(No Model.)

5 Sheets—Sheet 1.

# H. SCHWIEGER.

## ELECTRIC TRAMWAY.

No. 530,286. Patented Dec. 4, 1894.

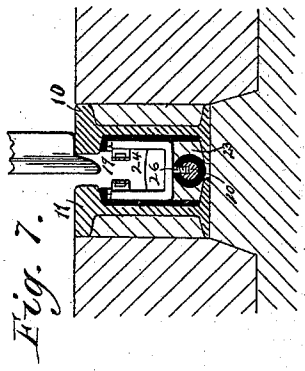


Fig. 7.

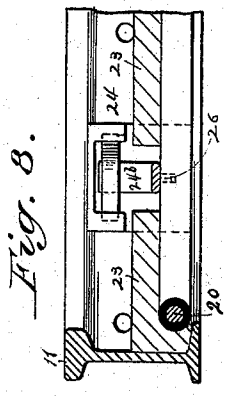


Fig. 8.

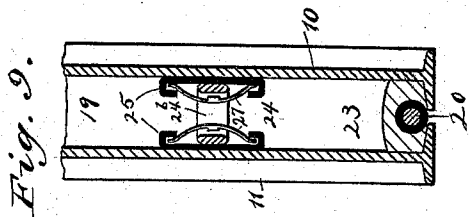


Fig. 9.

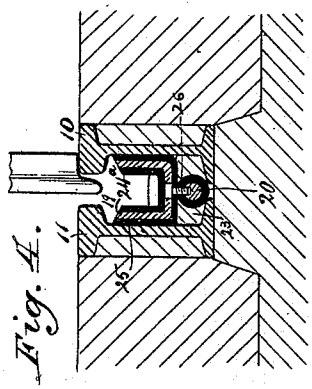


Fig. 4.

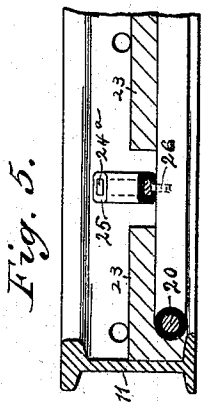


Fig. 5.

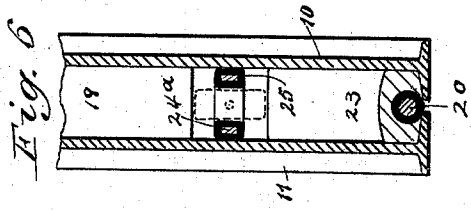


Fig. 6

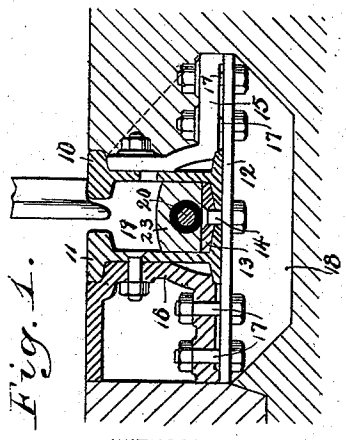


Fig. 1.

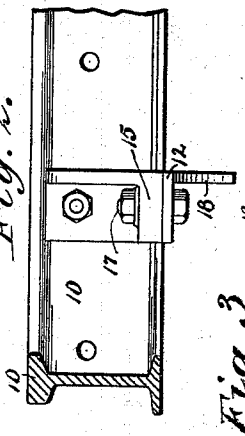


Fig. 2.

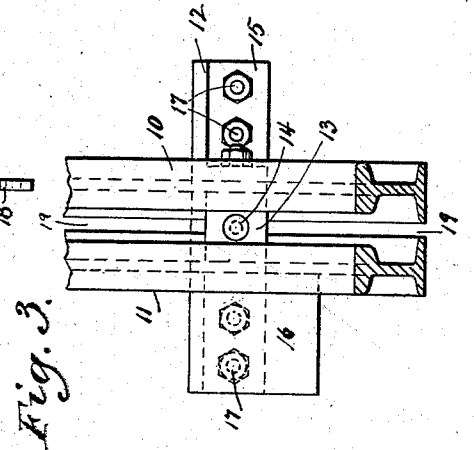


Fig. 3.

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(No Model.) 5 Sheets—Sheet 2.

# H. SCHWIEGER.

## ELECTRIC TRAMWAY.

No. 530,286. Patented Dec. 4, 1894.

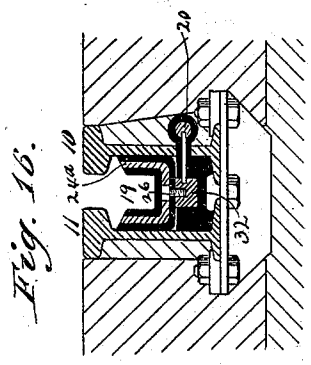



Fig. 16.

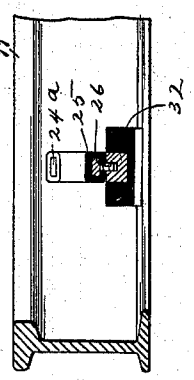



Fig. 17.

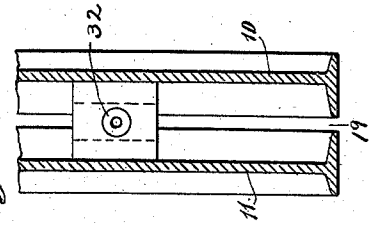



Fig. 18.

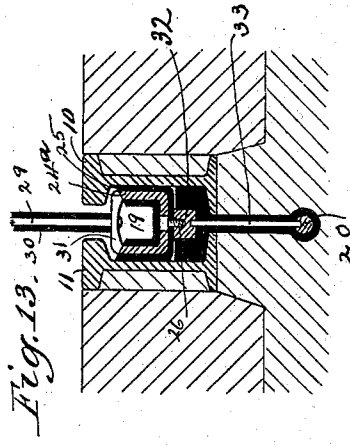



Fig. 13.

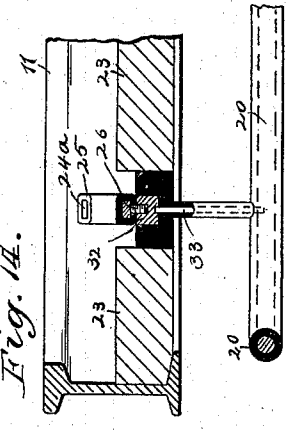



Fig. 14.

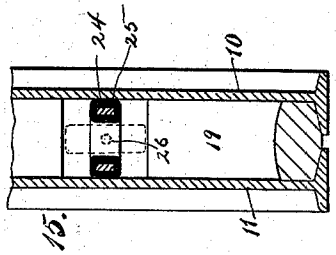



Fig. 15.

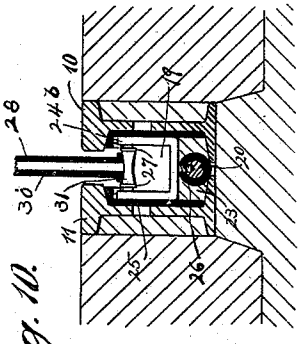



Fig. 10.

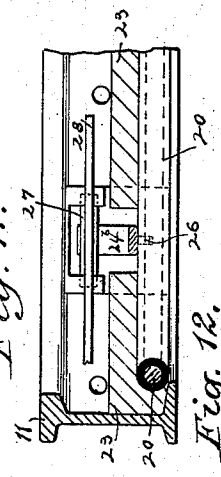



Fig. 11.

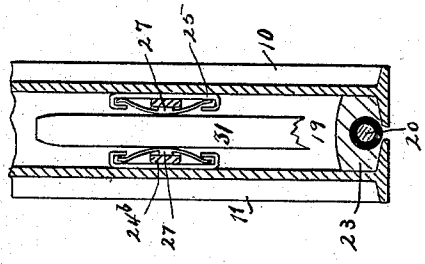



Fig. 12.

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(No Model.) 5 Sheets—Sheet 3.

# H. SCHWIEGER.

## ELECTRIC TRAMWAY.

No. 530,286. Patented Dec. 4, 1894.

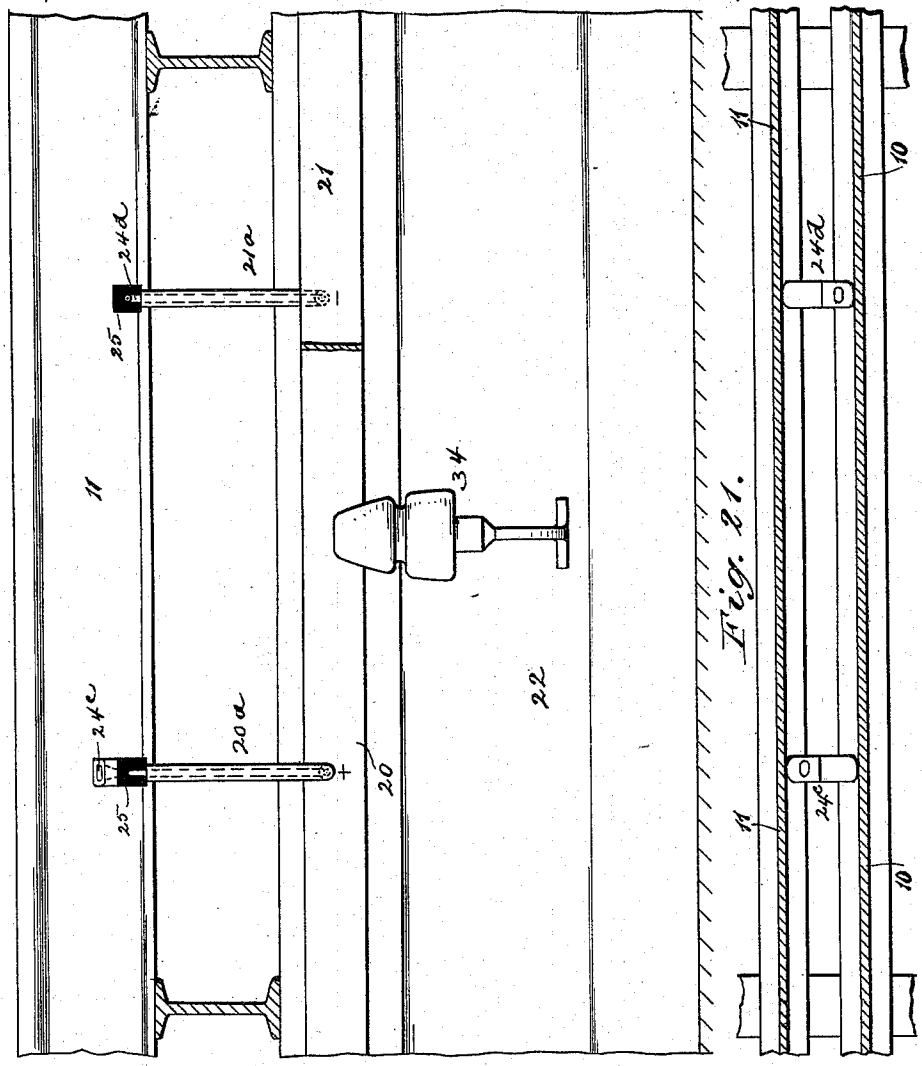



Fig. 20.

Fig. 21.

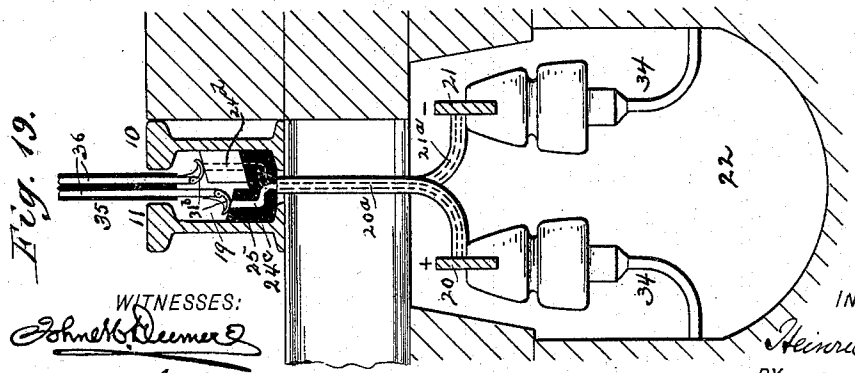



Fig. 19.

WITNESSES:

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(No Model.) 5 Sheets—Sheet 4.

# H. SCHWIEGER.

## ELECTRIC TRAMWAY.

No. 530,286. Patented Dec. 4, 1894.

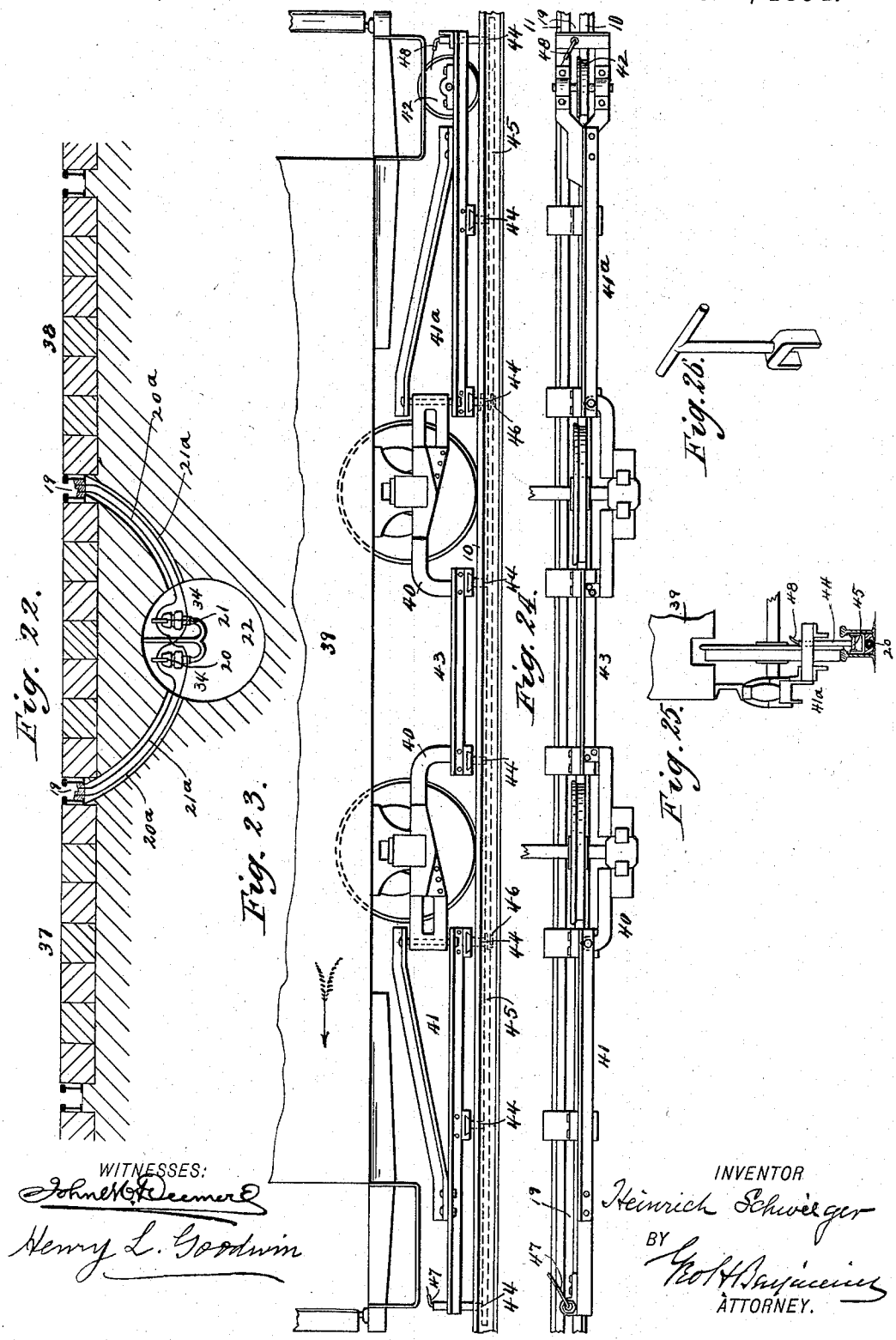


Fig. 22.

Fig. 23.

Fig. 24.

Fig. 25.

Fig. 26.

WITNESSES:

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(No Model.)

5 Sheets—Sheet 5.

# H. SCHWIEGER.

## ELECTRIC TRAMWAY.

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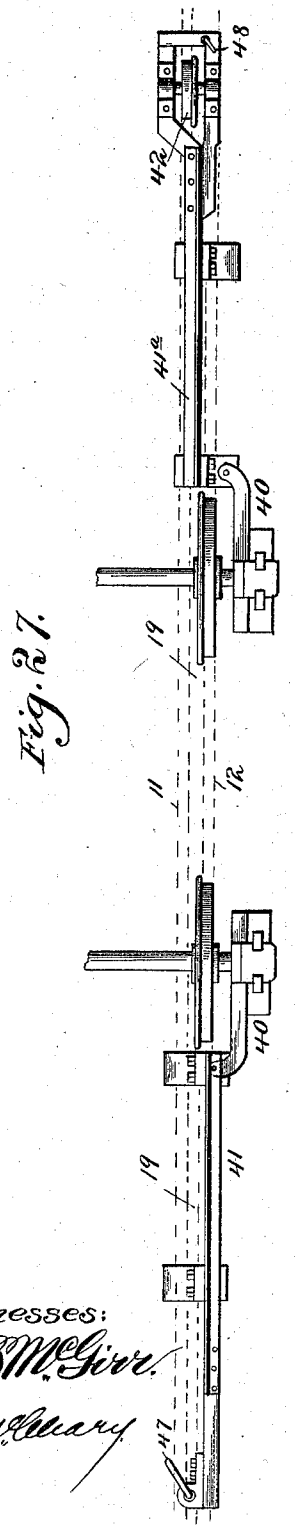



Fig. 27.

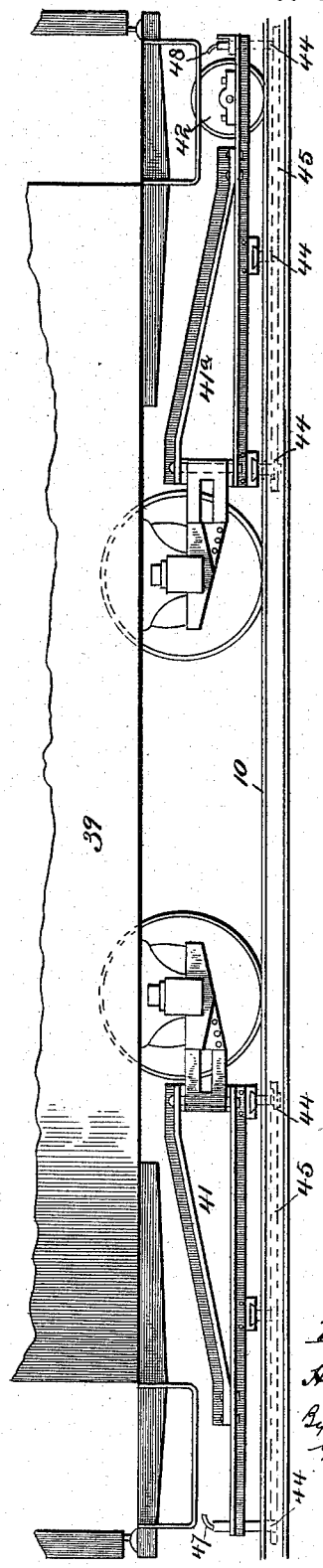



Fig. 28.

Witnesses:
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F. M. Keary

Inventor:
Heinrich Schwieger
By Geo. H. Benjamin
Attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

HEINRICH SCHWIEGER, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

## ELECTRIC TRAMWAY.

SPECIFICATION forming part of Letters Patent No. 530,286, dated December 4, 1894.

Application filed December 22, 1891. Serial No. 415,933. (No model.) Patented in Germany December 30, 1885, No. 37,255; in Austria-Hungary August 7, 1886, No. 31,294/36, and No. 2,759, and No. 63,587, XX, 2,733, and in England August 20, 1886, No. 11,003.

*To all whom it may concern:*

Be it known that I, HEINRICH SCHWIEGER, a subject of the Emperor of Germany, residing at Berlin, in the Empire of Germany, have invented certain new and useful Improvements in Electrical Railways, (for which Letters Patent were granted to me as follows: In Great Britain, No. 11,003, dated August 20, 1886; in German Empire, No. 37,255, dated December 30, 1885; in Austria, No. 31,294/36, 2,759, dated August 7, 1886, and in Hungary, No. 63,587, XX, 2,733, dated August 7, 1886,) of which the following is a specification.

My invention relates to electrical railways, in which the current is conveyed through an insulated conductor located below the level of the roadway.

Generally, my invention consists in forming a channel between a pair of rails so arranged as to form a compound rail, and within which channel are located a number of contacts in communication with one or more insulated electrical conductors situated within or external to the channel.

The object of my invention is to provide means for establishing electrical communication between an insulated electrical conductor or conductors located below the street surface and a motor or motors upon a vehicle or vehicles moving upon the trackway, and without requiring any considerable change in the street surface, or disfigurement of the street by overhead wires, supports, &c.

In the accompanying drawings which illustrate my invention, the same reference numerals indicate like parts.

Figures 1, 2 and 3 represent respectively a cross section, side view and plan view of one embodiment of my invention. Figs. 4, 5 and 6 are respectively a cross section, a longitudinal vertical section, and a horizontal section of the same construction,—the views being so taken as to show the contact devices within the channel. Figs. 7 to 12 represent similar views of a modified embodiment of my invention,—the modification consisting in the employment of a spring contact device within the channel. Figs. 13 to 15 represent similar views and show a construction like that shown in Figs. 4, 5 and 6, with the exception that the contact making device carried by the vehicle is illustrated in its relation to the contact devices in the channel. The views also show the main conductor located external to and below the channel. Figs. 16 to 18 are similar views and show a similar construction, with the exception that the electrical conductor is situated at the side of the channel containing the contact devices. Figs. 19, 20 and 21 represent respectively a cross section, a longitudinal vertical section and a horizontal section, illustrating a further modification of my invention, in which a subway is formed beneath the traction rail, and in the channel of the traction rail, two sets of contacts are located. Figs. 22, 23 and 24 represent a further modification, in cross section, elevation and plan, showing two compound rails having contacts arranged in the channels thereof, communicating with conductors in a subway located beneath the space intervening between the trackways. Figs. 23 and 24 show the contact making device carried by the car. Fig. 25 is a partial end view of one compound rail, showing the relation of the contact making device carried by the car to the contacts within the channel. Fig. 26 represents such a key as I may use to remove the contact pieces from connection with the electrical conductors for the purpose of repair, &c. Figs. 27 and 28 illustrate respectively a plan view and a side view of a modified construction of contact strip and supporting devices adapted for use when double contacts are required.

Referring to Figs. 1 to 6, 10 indicates a traction rail; 11, a guard rail arranged parallel therewith. These rails are mounted upon a metallic cross-tie 12, and are secured thereto by means of the plate 13 and bolt 14. The width of the channel between the rails 10 and 11 is determined by the width of the plate 13,—thus, by using a larger or smaller plate, the width of the channel may be increased or diminished, as desired.

15 and 16 represent angle iron brackets connected respectively to the rails 10 and 11.

These brackets serve to secure the rails to the cross-ties 12 through the bolts 17, and also to prevent the rails being pressed inward or outward when subjected to lateral pressure,—as by heavy traffic passing over them. The bracket 16 may be made box-shaped so as to take the place of a Belgian block,—where the railway is laid in a street furnished with Belgian pavement—and as a key for the cross-ties 12. The cross-ties 12 are provided with a dependent web 18 (Figs. 1 and 2) which serves to prevent any longitudinal movement of the rails. Located in the channel 19, between the rails 10 and 11, (Figs. 1 to 12 inclusive) is a suitably insulated electrical conductor 20.

In Figs. 13 to 15, the conductor 20 is shown as located below the channel 19; in Figs. 16 to 18, as at the side of the channel 19.

In Figs. 19, 20 and 22, two conductors 20 and 21 are shown located in a subway 22, situated beneath the roadway. The conductor 20, which is situated in the channel 19, is shown as covered with a body of asphalt or other suitable moisture proof material 23. Located at suitable distances apart within the channel 19 are contacts 24, through which communication is made with the insulated electrical conductor 20. Different forms of these contacts may be employed, for instance in Figs. 4, 5, 6, 13 to 18, one form is shown which consists of a U-shaped piece $24^a$ of conducting material, such as copper, provided with an insulating covering 25, which completely envelops the U-shaped piece, except at its upper ends and the point where the screw 26 is carried through it.

In Figs. 7 to 12, a different form of contact 24 is shown. In this form, the U-shaped contact piece $24^b$ is not covered with insulating material. The insulating material 25 in this form is located between the contact pieces $24^b$ and the sides of the channel 19. This insulating material 25 is given the shape shown in Fig. 12; that is the ends are turned over, and between these ends are located springs 27 on each side of the channel. These springs are so arranged as to be normally out of contact with the ends of the U-shaped piece $24^b$, and are adapted to be pushed into contact therewith when the contact making device 28, carried by the vehicle, passes between them. The object of this arrangement is to protect the ends of the U-shaped pieces $24^b$ from contact with, for instance, a carriage wheel, should it drop into the channel 19. In such case, it will be observed that no contact would be made with the ends of the contact pieces $24^b$, unless the tire of the wheel was sufficiently wide to push the springs 27 into contact with the ends of the contact pieces.

Contact is made between the ends of the contact pieces $24^a$ and the motor upon the vehicle, in the form previously described, by means of the contact 29, shown in Fig. 13. The contacts 28 and 29 are substantially similar. Each consists of an arm 30, dependent from the vehicle, and a contact making device 31, attached to its lower end. In the device 28, the contact piece consists of a horizontally disposed bar 31, which is partially shown in Fig. 12. In the device 29, the contact portion 31 makes a rubbing contact over the exposed ends of the contact pieces $24^a$.

I wish it understood that I do not in any wise limit myself to any particular form of contact making device. Any that will answer the purpose of establishing electrical connection between the contacts in the channel 19 and the motors upon the vehicle, will be within the intent of my invention.

The contact pieces $24^a$ and $24^b$ are shown as connected to and in electrical contact with the conductor 20 by being screwed directly thereto, in Figs. 1 to 12, through the screw 26. In Figs. 13 to 18, an intermediate insulated plate 32 is connected through the insulated conductor 33 to the main conductor 20 and, as I have previously described, these contact pieces $24^a$ and $24^b$ are located at equally distant points along the channel 19.

It is necessary, in order to insure the successful operation of a road of this kind, to provide means for removing and repairing these contacts in case of injury. This is accomplished by means of the fork, shown in Fig. 26. This fork is introduced into the channel and over the contact piece, which is then rotated until brought into the position shown in the dotted lines in Figs. 6 and 15, when the contact piece can be lifted out of the channel and a new and perfect one introduced in its place. Fig. 18 shows the channel with the contact piece removed.

Referring to Figs. 19, 20 and 21,—these figures illustrate a modification of my invention and show a conduit 22 provided with insulators 34, carrying the plate-like conductors 20 and 21, respectively connected to the two terminals of the source of electricity. Located within the channel 19 are the contacts $24^c$ and $24^d$ respectively connected to the conductors 20 and 21 through the conductors $20^a$ and $21^a$. The free ends of the conductors $20^a$ and $21^a$ are separated from each other and carried through the insulating material 25.

35 represents a contact making device carried by the car; 36, conductors carried therein and connected at one end to the motor upon the vehicle and at their opposite end to the contact pieces $31^b$. The position of the contact pieces $24^c$ and $24^d$ is shown in Fig. 21.

The construction shown in Fig. 22 is applicable to a double track railway: the two parallel tracks being represented respectively at 37 and 38. The construction shown in this figure is substantially that shown in Fig. 19, except that the connections are in duplicate.

Referring to Figs. 23, 24 and 25, 39 represents a railway car or similar vehicle, which is supposed to be moving in the direction of the arrow. Located at one side of the vehicle, and so as to correspond with the position of channel 19 in the compound traction rail, is a contact making device by which communi-

cation is made between the insulated conductor from the source of energy and the motor upon the vehicle (not shown). The contact making device consists of the supporting plates 40, carried by the axle boxes, upon which are pivoted, at each end, the frames 41 and 41ª. The frame 41ª carries, at its outer end, a wheel 42. The frames on their inner ends carry the horizontal plate 43. Dependent from the frames 41 and 41ª and plate 43, are the arms 44, and connected to these arms, and located within the channel 19, is a strip of conducting material 45, which may be a strip of flexible material or formed of a rigid material, jointed at the points 46. By pivoting the frames 41 in the arms 40, provision is made whereby the vehicle may turn a single or reverse curve.

In the case where a double contact is included in the channel 19, as shown in Figs. 19 and 20, the strip of conducting material is divided into two parts as shown in Fig. 28; one part adapted to bear upon one contact and the other, upon the other. In this arrangement of the contact strip, the horizontal plate 43 shown in Figs. 24 and 25 is omitted, and the frames 41 and 41ª depend from the plates 40 disconnected from each other as shown in Figs. 27 and 28. The current from one set of contacts is conveyed through the conductor 47 to the motor, and thence through the conductor 48 to the opposite contacts in the compound rail. Connected to the ends of the conducting contact strip 45 are the insulated conductors 47 and 48.

When the conducting strip is made in one piece and a single contact is in the channel 19, both of the conductors 47 and 48 are connected to one terminal of the motor upon the vehicle. In the case where two contacts are included in the channel 19, the conductor 47 is connected to one terminal and the conductor 48 to the opposite terminal of the motor.

The operation of the contact device is simple and will be readily understood by reference to Fig. 12. The horizontal strip, marked as 31 in this figure, corresponds to the strip 45 in Fig. 23. As the vehicle moves along, the springs 27 are pushed into contact with the ends of the contact pieces 24ᵇ and the current picked up by the strip is conveyed to the vehicle, and motion of the vehicle results in the desired direction. The wheel 42, shown at the end of the frame 41ª, may be used also in connection with the frame 41, or it may be dispensed with.

I claim—

1. In an electrical railway, the combination with a channel or conduit, and means for conveying current from a source of electricity; of contacts arranged within the conduit and in electrical relation with said means; and a series of oppositely arranged yielding guards or protectors within the conduit, between which a traveling device from the car is arranged to pass, substantially as described.

2. In an electrical railway, the combination with a traction rail and an adjacent guard rail, conjointly forming a channel between their respective webs; of means for conveying current from a source of electricity; electrical contacts located in the said channel and in electrical relation with the said means; the said contacts consisting of upwardly turned pieces of conducting material; and horizontally disposed springs normally insulated from the electrical contacts, substantially as set forth.

3. The combination with an electrically propelled car, of a channel in the roadway, provided at suitable intervals with electrical contacts in electrical relation with a source of electricity; an elongated device carried by the car, extending below the slot of the channel, for making contact with the said contacts in the channel; a carrying frame suspended on the journal boxes of the car provided with longitudinal extension flexibly jointed thereto, the same being located above the slot in the roadway; and a laterally movable series of suspension rods depending through the slot, forming a mechanical and electrical connection between the said frame and contact making device, substantially as described.

4. In an electrical railway, the combination with a compound rail composed of a traction rail and an adjacent guard rail conjointly forming a channel between their respective webs; of insulated contacts arranged within said channel and in electrical relation with a source of electricity; and means carried by the car for making contact within the conduit; said means consisting of stationary plates depending from the car, laterally movable frames pivotally secured to said plates, arms depending from said frames, and yielding contact means secured to said arms, substantially as described.

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

HEINRICH SCHWIEGER.

Witnesses:

CHAPMAN COLEMAN,

MAX WAGNER.