(No Model.) 2 Sheets—Sheet 1.

G. RITTER.

CONDUCTOR FOR ELECTRIC RAILWAYS.

No. 598,184. Patented Feb. 1, 1898.

Fig. 1.

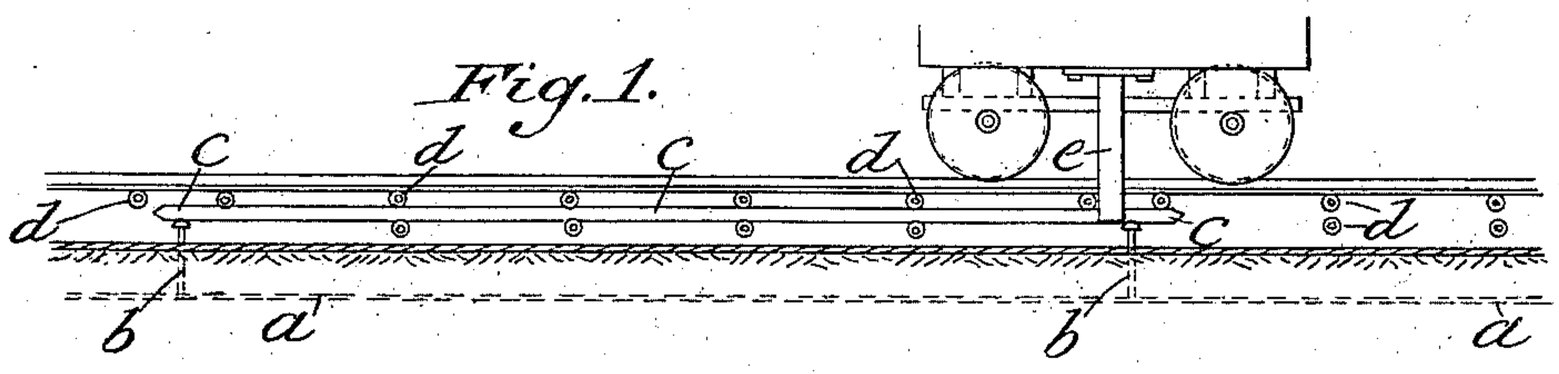


Fig. 2.

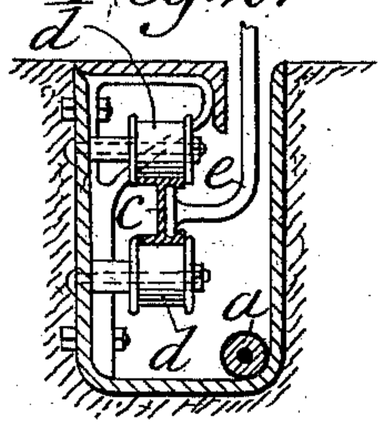


Fig. 3.

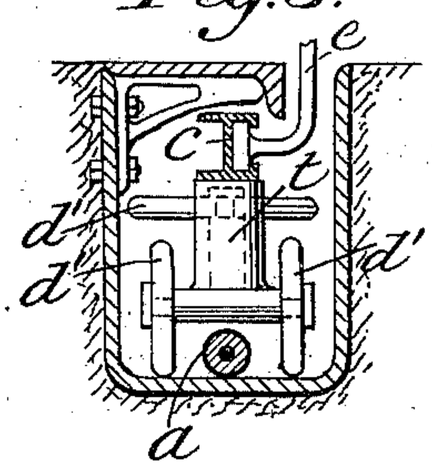


Fig. 4.

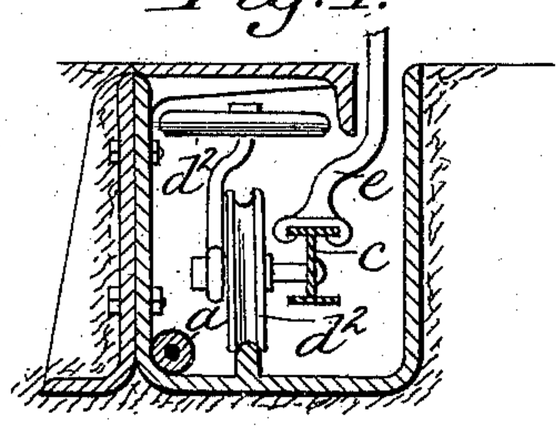


Fig. 5.

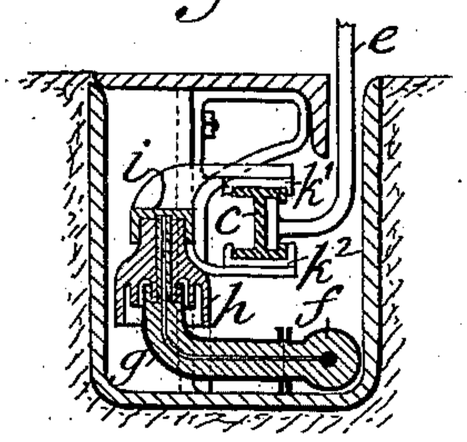


Fig. 6.

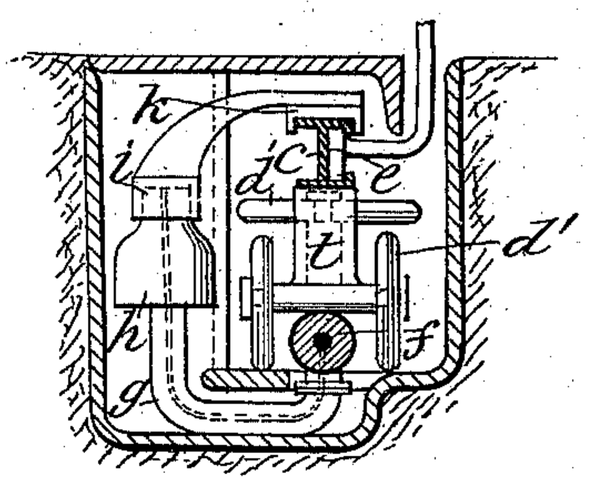


Fig. 7.

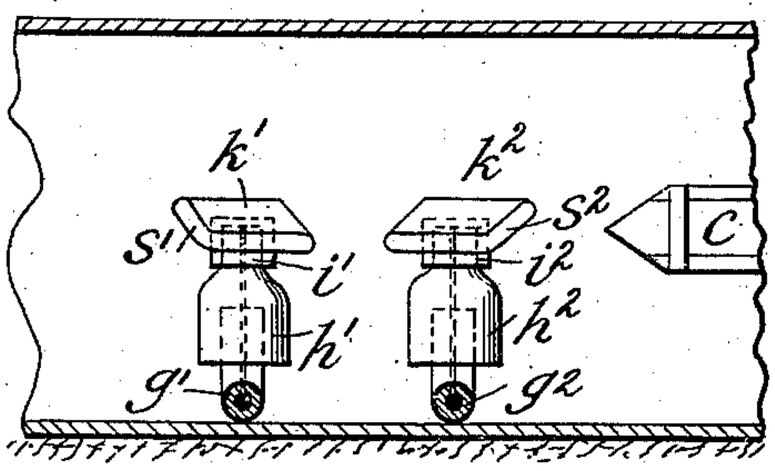


Fig. 8.

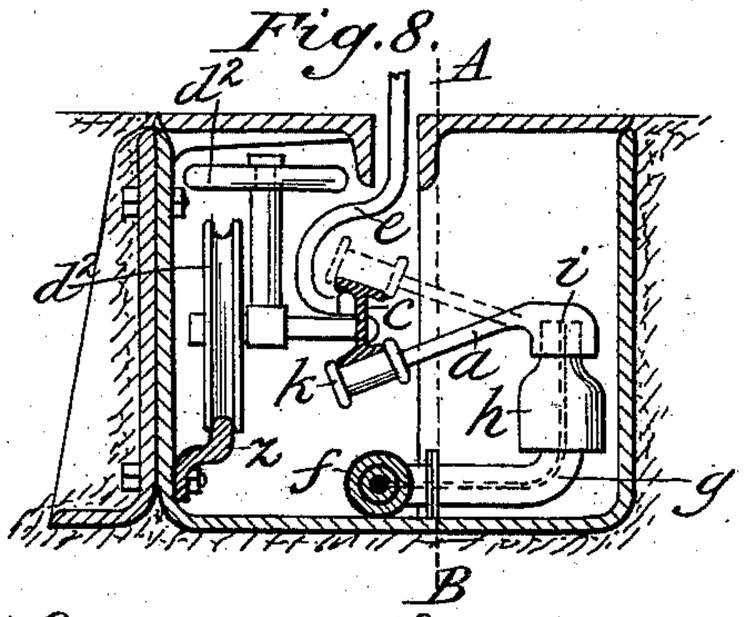
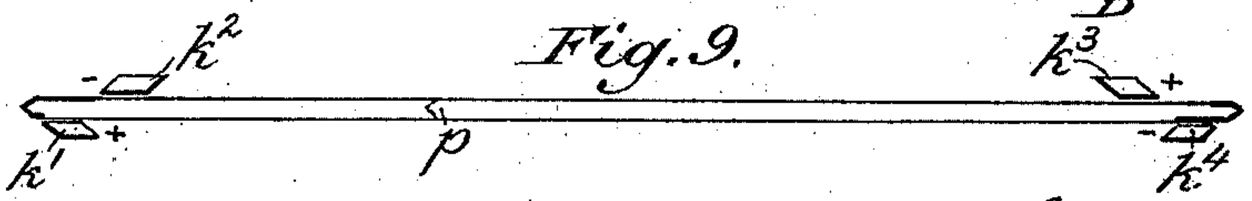


Fig. 9.



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(No Model.)

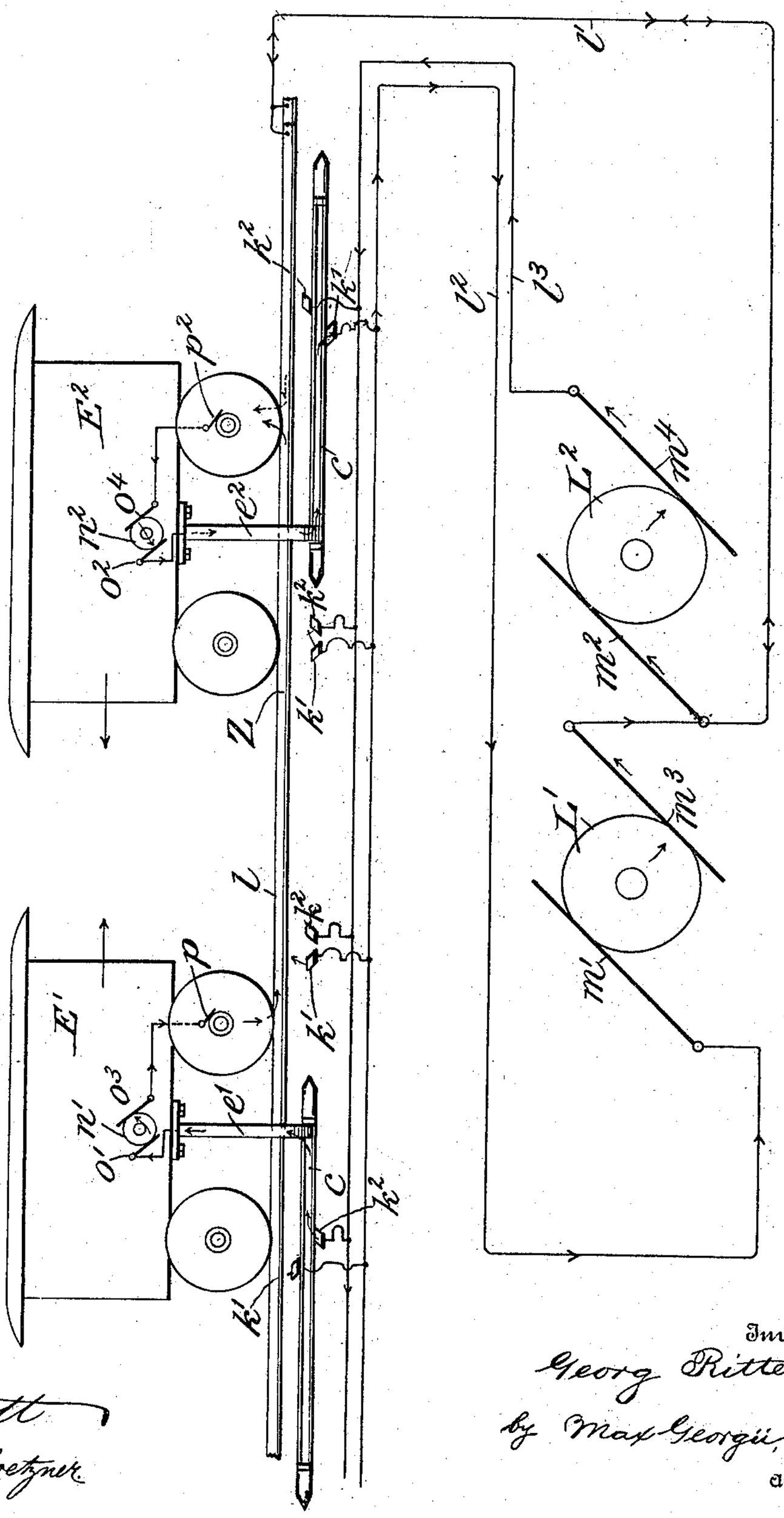
2 Sheets—Sheet 2.

G. RITTER.

CONDUCTOR FOR ELECTRIC RAILWAYS.

No. 598,184. Patented Feb. 1, 1898.

Fig. 10.



Witnesses

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UNITED STATES PATENT OFFICE.

GEORG RITTER, OF STUTTGART, GERMANY.

CONDUCTOR FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 598,184, dated February 1, 1898.

Application filed October 16, 1896. Serial No. 609,104. (No model.)

To all whom it may concern:

Be it known that I, GEORG RITTER, residing at Stuttgart, Germany, have invented a new and useful Improvement in Electric Railways, of which the following is a specification.

My invention relates to an improvement in electric railways, and particularly to a current-collecting device for the same.

The object of my invention is to provide means for conveying current from a bus-conductor or lead-conductor to a car in such a manner that the said conductor may be kept well insulated except at certain points.

My invention consists in the features, details of construction, and combinations of parts which will first be described in connection with the accompanying drawings, and then particularly pointed out in the claims.

In the drawings, Figure 1 is a diagrammatical longitudinal view of a portion of a system embodying one form of my invention. Fig. 2 is a cross-section of a conduit, showing a shoe for collecting the current guided on rollers in the manner illustrated in Fig. 1. Figs. 3 and 4 are similar views illustrating other means for guiding and supporting the collecting-shoe. Fig. 5 is a cross-section of a conduit, showing the manner of supplying current from a single lead-conductor to a shoe carried as shown in Fig. 1. Fig. 6 is a similar view showing a modified form of mechanism for distributing the current to the shoe carried as shown in Fig. 3. Figs. 7, 8, and 9 are detailed views of the construction employed in connection with a three-wire system. Fig. 10 is a diagrammatic view of a section of single-track three-wire system in which the cars are intended to run in both directions, two cars (illustrated in a conventional form) being shown as approaching each other, it being understood that in such a system turnouts are employed to permit the cars to pass each other.

In Fig. 1 the arrangement is represented for underground conductors. *a a* represent a cable serving as a feeding-conductor, which is provided at determined intervals, depending upon the particular local conditions, with devices *b b* for distributing the current. The latter are so arranged within a conduit that a device *c c* for collecting the current, made in the form of a drag-rod or shoe attached to the car, drags over the same, thereby enabling the current to pass into the electric motor of the car, of which only the wheels and the carrying-arm of the drag-rod or shoe are shown in Fig. 1. The current-collector or shoe is somewhat longer than the distance between the two current-distributing devices, so that at least one of them is always in contact with the movable current-collector or shoe. To diminish the resistance of the drag-rod or shoe against the forward movement and to prevent its contacting with the conduit-walls, whereby loss in current would occur, the same is provided with roller-guides which do not conduct the current. This guide may be obtained either by journaling the rollers *d* to the conduit-walls, Figs. 1 and 2, or by so securing the rollers to the shoe or drag-rod as to form, in a certain sense, a truck with the same, *d' d²*, Figs. 3 and 4, in which case horizontal rollers may be applied to prevent contact with the conduit-walls.

The required insulation of the drag-rod or shoe may be obtained by guide-rollers of insulating material, as in Figs. 2 and 4, or by insulating these rollers with respect to the conduit-walls by suitable insulating material or with respect to the drag-rod, as in the arrangement according to Fig. 3.

In order to reduce the friction due to the guide-rolls *d*, as well as the unavoidable losses of current, to a minimum, these rolls are arranged at as large distances apart as practicable. This is attained by making the current-collector or shoe of such a cross-section as will produce the greatest rigidity. In the present case, for example, the drag-rod is made I-shaped in cross-section. To enable the car to change from one direction of travel to the opposite direction, the carrying-arm *e* of the car is not fixed to the drag-rod or shoe, but only grasps the same in such a manner that it may, if necessary, be shifted lengthwise of the same without breaking the electric contact between the two, the drag-rod or shoe being provided at each end with suitable shoulders against which the carrying-arm bears. When it is desired to reverse the direction of travel of the car, the drag-rod will remain at rest until the carrying-arm of the car has been shifted from one end of the drag-rod to the other; only then the latter is

taken along in the new direction of travel. This may be attained by making the friction between the carrying-arm *e* and the drag-rod *c c* less than that between the latter and the current-distributing devices *b*, as well as the guide-rolls *d*.

The feeding or bus conductor *a a* may be arranged in the ground alongside the conduit or within the same. The first arrangement is assumed in Fig. 1 and the latter in Figs. 2 to 6 and 8.

The current-distributing devices are represented in Figs. 5 and 6, as well as Figs. 7 and 8.

In the current-distributing device represented in Fig. 5 the shunting or branching off from the feed or bus cable takes place within a so-called "cable-muff" *f*, to which is joined a tube *g*, bent at right angles. An insulator *h*, provided with a bore for the passage of the shunt or branch conductor, is mounted on the upper open end of tube *g*. After putting the insulator *h* in place the tube and bore of the insulator have a suitable insulating mass poured into them, and a cap *i* of conducting material is mounted water-tight upon the insulator, the contact devices k' k^2, between which the drag-rod or shoe *c c* is drawn along, being secured to two arms formed on the said cap *i*.

In Fig. 6 the above-described current-distributing device is represented for the case where the guide-rolls d' are connected with the current-collecting device (drag-rod or shoe) in the manner represented in Fig. 3. It is distinguished from that represented in Fig. 5 by the fact that the current-distributing devices are provided with only one contact device *k*, and that the branch conductors from the feed or bus cable are arranged below the conduit-floor. The insulation of the drag-rod or shoe *c* with respect to the earth is effected by insulators, as in Fig. 3, by which the drag-rod is rigidly connected with the rollers.

In Figs. 7 and 8, the former of which represents a section through Fig. 8 on line A B, is shown the arrangement for taking off the current for a three-conductor system employing one track for both directions of travel, (illustrated diagrammatically in Fig. 10,) from which it will be seen that the track *l* constitutes the middle conductor, and that the cars when going in one direction receive the current only from one of the outer conductors, while when going in the opposite direction they receive current from the other conductor, so that the current between two meeting cars is equalized by the track forming the middle conductor.

The dynamo-commutators are shown at L′ and L^2, their brushes being indicated at *m* m^3 and m^2 m^4, respectively, the said dynamos being connected in series with the two outer conductors or bus-wires l^2 l^3, which are laid adjacent to the railway-track in such a manner that they can be conveniently connected at intervals to their respective contact-pieces k' k^2 in a manner more fully described hereinafter.

The rails *l*, which form the middle conductor of the system, are connected by a conductor l' to the intermediate brushes m^3 m^2 of the dynamos, whereby the rails *l* and the wire l' form the neutral conductor of the system, as will be well understood by those skilled in the art.

The cars are shown at E′ and E^2, their supposed direction of travel being indicated by the respective arrows. The commutators of the car-motors are illustrated at n' and n^2 and their brushes at o' o^3 and o^2 o^4, respectively.

Each motor has one pole connected to its respective shoe-support e' e^2, while the other pole of each motor is in circuit with the car-wheels, two brushes p' p^2 being shown as bearing on the car-wheel hubs for the purpose of making an electrical connection between the motors and the car-wheel. The circuits are illustrated by arrows, and will be fully understood from the drawings. It is to be understood that on a single-track railway of this kind the cars pass each other on turnouts, and at Z, I have indicated the point of switch for the car E^2, going in the direction indicated by its accompanying arrow.

In Fig. 8, *f* is the branching-off muff of a cable containing two conductors, which form the outer conductors of a three-conductor system and from which two current-distributing conductors branch off in two tubes g' g^2, which are passed through the insulators h' and h^2 in the manner shown in Fig. 5 and connected conductively with the contact-pieces k' and k^2 by spring-arms a' and a^2, which in turn are attached to the insulators by caps i' and i^2. The front faces of these contact-pieces k' and k^2 are beveled, so that for each direction of travel the piece which is struck first by the current-receiving conductor or shoe *c* is pressed upward and the other downward. The contact-pieces are coated on their lower surfaces and on the beveled surfaces which face downward with non-conducting material s' s^2, from which it follows that for each direction of travel only the second contact-piece will come into circuit with the shoe *c*, so that the car is at all times connected only with that branch conductor of the cable l^2 or l^3 which corresponds to the particular direction of travel. It may be added, in explanation of Figs. 7 and 8, that in the latter the current-collector or shoe *c* is not in contact with the current-distributing device, while Fig. 7 is drawn in illustration of the case where the drag-rod is in connection with said current-distributing device.

In changing from one direction of travel to the other it occurs in the three-conductor system that the current-collector or shoe *c* will be in contact with the positive outer conductor at one end, but at the other end with the negative outer conductor, so that a

short circuit would be established between the two outer conductors through the shoe *c*. To prevent the latter, the ends of the shoe *c* must be coated with non-conducting material in the manner represented in Fig. 9. In the latter the heavy lines at the ends of the conductor represent non-conducting material. In traveling from left to right all the contact devices k' bear against the upper face of the conductor *c*, while the contact devices k^2 lie against the under side of *c*, whereby the latter is evidently maintained in unbroken conductive contact with the positive feeding-conductor.

If the direction of travel of the car is changed when the shoe is in contact with the two pairs of contact devices, the contact device k' at one end will bear against the under side of the shoe *c*, while at the other end the opposite contact device k^2 also bears against the under side of the shoe *c*, which would result in the aforementioned short-circuiting if the insulators represented in Fig. 9 were not applied to the ends of the current-receiving conductor *c*.

The conduit is drained by locating sinks at suitable points and connecting them with the sewers.

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

1. In a three-wire electric-railway system, the combination, with a series of pairs of contact devices, the corresponding contact devices of all the pairs being connected to one bus-conductor, and the remaining contact devices to the other bus-conductor, of a car, and a shoe carried by the car and arranged to make electric contact with one series of corresponding contact devices when traveling in one direction, and with the other series of corresponding contact devices when traveling in the opposite direction.

2. In a three-wire electric-railway system, the combination, with a series of pairs of contact devices, the corresponding contact devices of all the pairs being connected to one bus-conductor, and the remaining contact devices to the other bus-conductor, of a car, and a shoe carried by the car and arranged to depress the corresponding contact devices of the series of pairs and to raise the other contact devices of said pairs when going in one direction and vice versa when going in the other direction, substantially as set forth.

3. In a three-wire electric-railway system, the combination with a series of pairs of contact devices capable of vertical movement, said contact devices being beveled on their lateral faces in opposite directions, of a car, and a shoe carried by the car and provided with a beveled end, whereby the contact devices will be alternately raised or depressed.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GEORG RITTER.

Witnesses:
AUGUST B. DRAUTZ,
CHRISTIAN BAUER.