

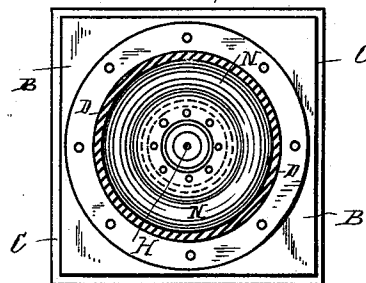
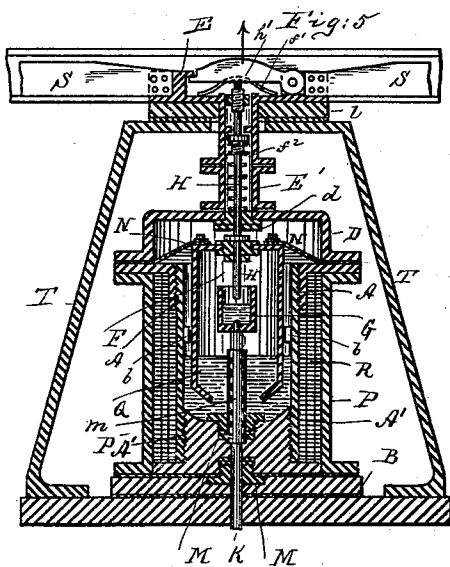
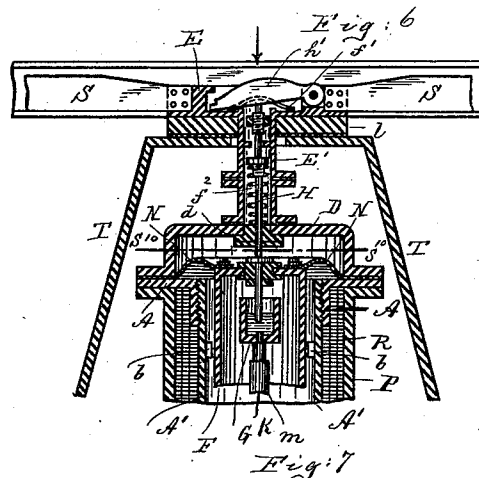
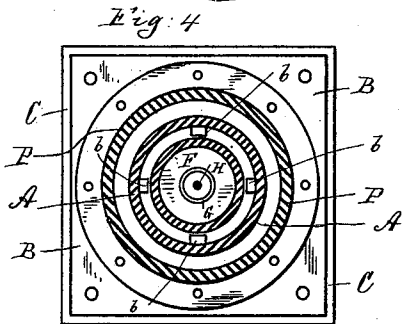
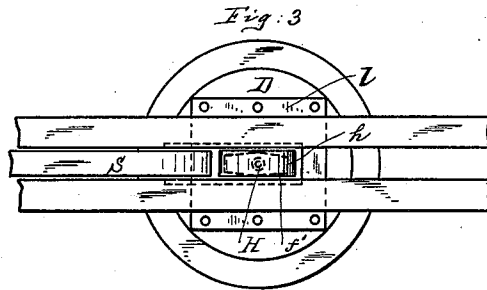
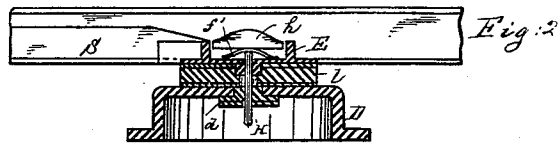
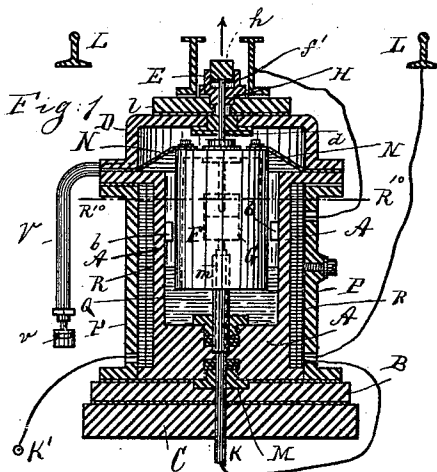
(No Model.)

3 Sheets—Sheet 1.

C. F. P. STENDEBACH.
ELECTRIC RAILWAY.

No. 558,322.

Patented Apr. 14, 1896.



Witnesses:

William Schuf.
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UNITED STATES PATENT OFFICE.

CARL FRIEDRICH PHILIPP STENDEBACH, OF LEIPSIC, GERMANY.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 558,322, dated April 14, 1896.

Application filed March 7, 1895. Serial No. 540,869. (No model.)

To all whom it may concern:

Be it known that I, CARL FRIEDRICH PHILIPP STENDEBACH, of Leipsic-Plagwitz, in the Kingdom of Saxony, Germany, have invented an Improvement in Electric Railways, of which the following is a specification.

This invention relates to an electric railway having an underground conductor which is so constructed that the current enters the centrally or laterally placed contact-rail at the point where the car is supported and is conveyed to the motor by the contact-wheels. From these contact-wheels the current goes to the running-wheels of the car and thence back through the rails to the motor.

The main advantage connected with my construction is that at the contact-point where the circuit is closed there is no complicated mechanism whatever, while the parts are properly protected against moisture and external influences by being inclosed within a casing. Moreover, the movable circuit-closers have no stuffing-boxes, and access of water to the contacts is absolutely prevented by a mercury seal.

My improved system can be constructed at a reduced cost, as it requires no expensive insulating-subways; and it consists of the following general arrangement:

In the middle or at the side of the track there is placed between two properly arranged guard-rails a so-called "contact-rail." Under the ends of the contact-rail the novel contact apparati are placed, so that the circuit is closed by the contact-pressure rollers of the moving car and held closed until the car has left the section and reached the next section of the road.

The contact-point proper is in the apparatus inclosed within a special vertically-movable iron cylinder protected against all external influences and dipping with its lower open end into a mercury seal.

The operation of my improved electric railway and the coöperation of the contact-apparati cars and conductors are apparent from the accompanying drawings, in which—

Figure 1 is a vertical section of the contact device, showing it open. Fig. 2 is a vertical section through the upper part thereof. Fig. 3 is a plan thereof; Fig. 4, a horizontal section on line R¹⁰ R¹⁰, Fig. 1. Fig. 5 is a verti-

cal section through a modification, showing the contact open; Fig. 6, a similar section through the upper part thereof with the contact closed; Fig. 7, a horizontal section on line S¹⁰ S¹⁰, Fig. 6. Fig. 8 is a vertical section of one form of the guard-rail and the contact-slide with its insulator; Fig. 9, a plan of the contact-slide; Fig. 10, a side view of the contact-slide, showing its coöperation with the apparatus, which is shown in section; Fig. 11, a longitudinal section of the spring-contact g'; Fig. 12, a plan thereof; Fig. 13, a section on line a¹⁰ a¹⁰, Fig. 11; Fig. 14, a plan of the head h', showing it in the form of a one-armed lever; Fig. 15, a side view, and Fig. 16 a front view, thereof; Fig. 17, a longitudinal section through the valve v; Fig. 18, a cross-section through the guard-rails, the contact-rail, and one track-rail; Fig. 19, a vertical section, partly in side view, of the apparatus, showing it in operative position; and Fig. 20 a plan view thereof, showing the general plant.

The rails L of the road proper are laid in the customary manner. Between the rails lies, in the middle of the track or at the side thereof, the so-called "contact-rail" S, which is protected against injury from wagons, &c., by two guard-rails (see Figs. 18, 19, and 20) placed upon the wooden ties H'.

The contact-rail is U-shaped in cross-section and approaches the inner sharp edges of the guard-rail within about ten millimeters, Fig. 18, so that no dirt, stones, &c., can accumulate between the contact-rails and the guard-rails, and so that a cleaning from the street may be easily effected.

The sharp edges o o of the contact-rail and the sharp edges p p of the guard-rails, Fig. 18, have for their object to present a minimum surface to the snow, so that the strength of the current is not impaired by moisture. The contact-rails are secured in position between the guard-rails by means of porcelain insulators J', Fig. 8, and at the end the contact-rails are supported by the porcelain blocks J, Fig. 19. The insulators J' are supported by the bolts S', that also serve to hold the guard-rails at the proper distance from each other, Fig. 18.

The entire arrangement lies on the street-level. The contact-rail S is divided into sections, Fig. 19, in such a manner that a car

traversing the sections will touch a new section before it leaves the old one. To these separate sections the current is led by means of the electromagnetic contact apparatus, which are located directly beneath the contact-rails, the current being conducted to any one section only as long as the car is propelled over such section.

The current is fed to the contact devices from an underground cable K', which is properly insulated and is made of proper cross-section, Fig. 19.

The contact devices are constructed and operated as follows:

The apparatus consists of a case A, made of soft cast-iron, which is mounted at its base by means of an insulating-packing (tarboard) upon the underlying iron plate B. The latter is in turn with its insulating-packing fastened to the underlying masonry C. At its upper end the case A is closed by the cover D, secured in place by means of brass screws. Above the apparatus the contact and guard rails are mounted either directly or upon a casting T, Figs. 5 and 6, that is provided with the insulating-layer *l* and bridges the apparatus. With the latter construction the contact-slide E is provided with the sleeve E', that passes through the insulator *l*, and is composed at its lower end of two connected and removable halves, which are provided with an intervening insulator and are screwed to the cover D, Figs. 5 and 6.

Another construction of the contact-slide E is illustrated in Figs. 8, 9, and 10. Here the slide is connected to the casting T by means of the intermediate hollow plates U and a number of porcelain insulators J'. The contact-slide itself is provided at its sides with integral guard-plates *e*, that form a right and left trough or longitudinal channel within the body of the slide. These channels prevent snow and water from entering between the contact-slide E and the guard-rail. (See Figs. 8, 9, and 10.) The water that may enter at this point from the street will flow along the channels of the slide and thus reach the excavations that contain the contact apparatus, from which it is drained in suitable manner. In this construction the contact-slide E should be provided with an oval aperture into which projects the insulated sleeve E', which is screwed to the apparatus, Fig. 10.

The conducting connection between slide E and sleeve E' is effected by means of a lead-wire *y*, as shown in Fig. 19. At the point where the sleeve E' is screwed to the cover D the latter is provided with a socket, which is filled with asphalt, so as to prevent the water that flows over the apparatus from forming a connection between the sleeve E' and the earth, Fig. 10. The loose connection between slide and apparatus has for its object to permit any suitable inclination of the former, while the latter may always be mounted in a vertical position.

The section K of cable K' is led insulated

through the bottom of the case A, and is clenched by means of the nuts M M, above which it is provided with a water-tight packing of leather and metal washers, Fig. 1. Above the nuts M the cable is surrounded by a metal covering *m*, which serves to impart greater stability to it.

The cable K extends to about the center of the case and carries at its upper end the quicksilver contact G, Figs. 5 and 6, or the spring-contact G', Figs. 10, 11, 12, and 13. The contact G or G' is in turn surrounded by the conical wrought-iron cylinder F, which reaches nearly to the bottom of the vessel. At its upper end, facing the cover of the apparatus, the cylinder F is closed by a disk, through which projects the insulated contact-point H, which is fastened to said disk. The point H extends through the center of the cover D and through a brass guide-piece *d*, which is insulated from and screwed into the cover. Thence the point H enters the bore of the contact-slide E and terminates in a head *h*, that is free to move vertically in a corresponding slit of the contact-slide E. The head *h*, and consequently the cylinder F, connected to the contact-point H, is supported by a spring *f'*, Fig. 2, which is located beneath the head. Within the case A the iron cylinder F has a second support, which is formed by four diametrically-arranged noses *b*, Figs. 1 and 4.

At its open lower end the cylinder F dips into a mercury seal Q, Fig. 1, for twenty to thirty millimeters similar to a diver's bell, which protects it hermetically against all the influences of moisture, while a thin rubber disk N at the top of the cylinder serves at the same time as a packing between the case A and the cover D. Above this packing are arranged one or more outlets in the form of a downwardly-curved pipe V, Fig. 1, which at one end is screwed directly into the cover and at its other end is provided with a relief-valve *v*, Fig. 17. This valve will open by the pressure of the water that may be collected in the pipe V, while it closes by spring *f*⁸ against any water that may attempt to enter from without, Fig. 17. Thus during flooding of the track water cannot penetrate into the apparatus.

The hollow space of the case A contains a compound winding R in such a manner that a coil of fine wire in shunt with the contact-slide E and the return-conductor L is wound upon the case A with a resistance corresponding to the working potential. The winding is connected at its beginning with the contact-slide E and at its end with the return-conductor or track-rail, and is inclosed water-tight where it passes through the outer case P. The outer case P is composed of soft cast-iron and serves to protect the winding against external influences.

Upon the above-described wick-winding is placed the main-current winding, which allows only a current of such intensity to pass as is necessary to move the car. This coil

connects with the cable K, encircles the case the same as the wick-winding, and is conducted through the case P to the contact G or G'.

5 The shunt-circuit is so calculated that with an empty car on a level stretch it exercises three-fourths of the magnetizing power which is necessary to draw the iron cylinder F, counter-influenced by spring f' , into or retain it
10 within the hollow of the case, while the rest of this magnetizing power is to be taken from the main-current winding. If the car has not yet touched the contact point or bolt H or its projecting head h , no current at all circulates
15 in the shunt-circuit, because there is no difference of potential between contact-slide E and the return-rail L. Only on the closing of the contact G or the depression of head h or h' by the contact pressure-wheels r of the car do
20 the contact-slide E and the metallicallly-connected rails S become positively electrified. Thus the shunt-circuit will at once begin to work, and will, in conjunction with the main current, hold the iron cylinder F down until
25 the car has passed the section. As in this case the main-current winding becomes immediately currentless, the shunt-circuit is not able alone to resist the spring f' working against it, and this results in the breaking of
30 the contact and the consequent interruption of the entire current flow to this section.

As shown in Figs. 9 and 10, the contact-point H may be loosely arranged with relation to the head h' . In this case the head h'
35 may be made in the form of a one-armed lever pivotally connected to the contact-slide E.

The spring f' may, within certain limits, be made of suitable tension, as the breaking of the contacts is effected independently of such
40 spring by a spiral spring f^2 , inclosed by sleeve E'. This spring has only to counteract the weight of the cylinder F and the resistance of the shunt-circuit, while no frictional resistance, owing to dirt or dust accumulating be-

tween head h and slide E, which would cause 45 an uneven working of the spring f' , is to be overcome. Thus an easy and uniform operation during the opening or closing of the circuit is effected.

In Figs. 5, 6, and 10 the case A is provided 50 with a brass center A', by which the induced action of the compound winding upon the cylinder F is considerably increased. This result is obtained because the magnetic current is compelled to pass almost entirely through 55 the iron cylinder, from the bottom toward the top, and to close through the outer case P, whereby the iron part of the case A may be regarded as a field-magnet. By this arrangement the dimensions of the apparatus may be 60 considerably reduced and its cost diminished.

What I claim is—

1. An electric railroad with underground conductor, composed of a pair of guard-rails, a contact-rail, a case A, cover D, inner cylinder F, a mercury seal at the bottom of such 65 cylinder, an insulated contact-pin H, and a contact G within the cylinder, all being so constructed that contact is made between the underground conductor and the contact-rail 70 by a depression of the latter, substantially as specified.

2. An electric railroad with underground conductor, composed of a pair of guard-rails, a contact-rail, a slide E, cases A, P, cover D, 75 an inner cylinder F, a mercury seal at the bottom of such cylinder, a disk N, at the top of the cylinder, an insulated contact-pin H, a compound winding R, and a contact G, within the cylinder, substantially as specified. 80

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

CARL FRIEDRICH PHILIPP STENDEBACH.

Witnesses:

MAX MATTHÄI,
RUDOLPH FRICKE.