No. 835,103. PATENTED NOV. 6, 1906.

J. DULAIT & L. ROSENFELD.

DEVICE FOR REVERSING AND AUTOMATICALLY BLOCKING TRAINS ON ELECTRODYNAMIC TRACTION RAILWAYS.

APPLICATION FILED FEB. 8, 1905.

3 SHEETS—SHEET 1.

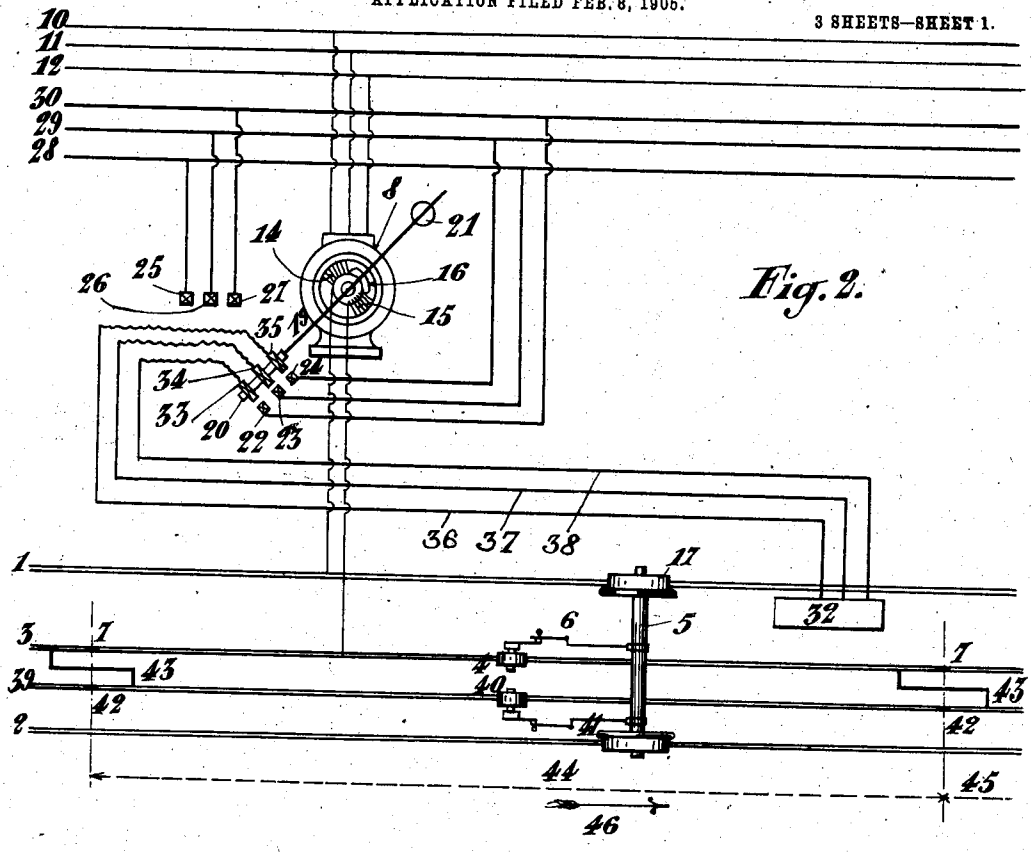

Fig. 2.

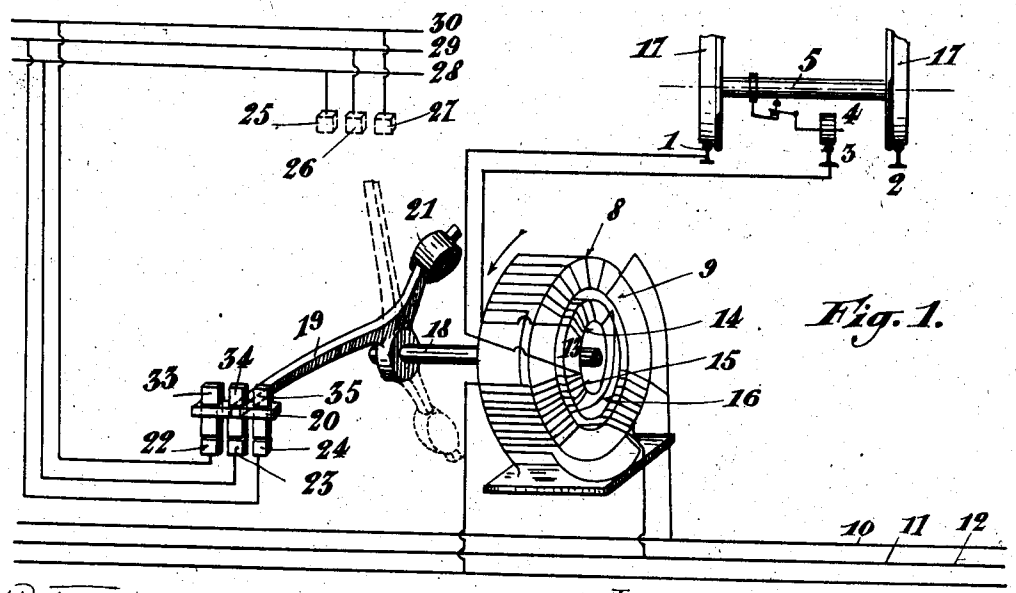

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 3

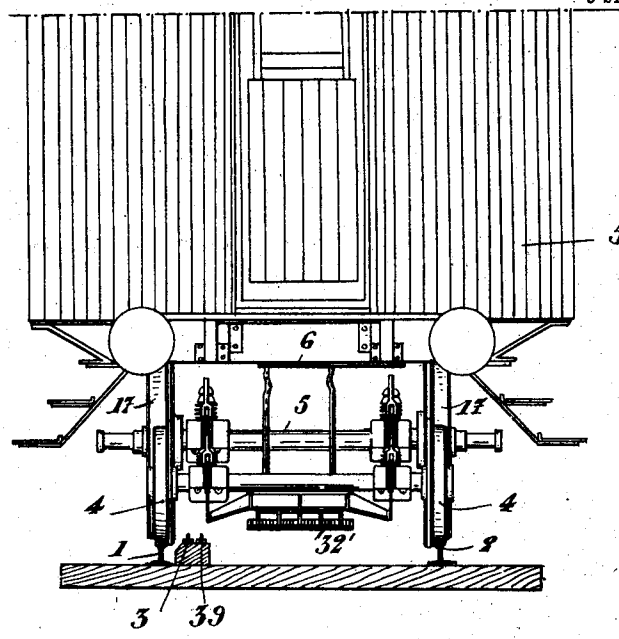
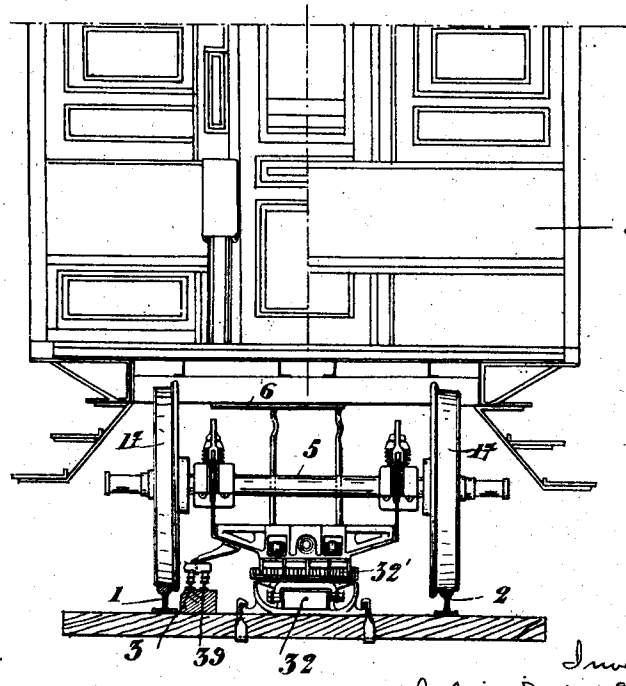


Fig. 4



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3 SHEETS—SHEET 3.

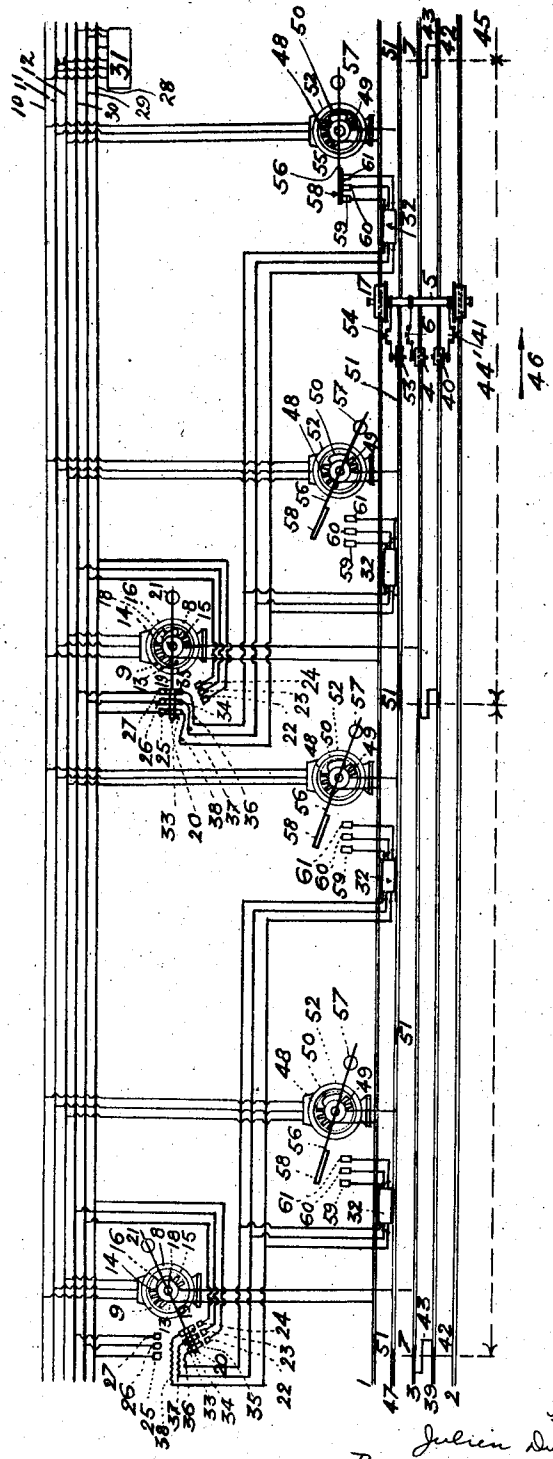

Fig. 5

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UNITED STATES PATENT OFFICE.

JULIEN DULAIT AND LEON ROSENFELD, OF CHARLEROI, BELGIUM.

DEVICE FOR REVERSING AND AUTOMATICALLY BLOCKING TRAINS ON ELECTRODYNAMIC TRACTION-RAILWAYS.

No. 835,103. Specification of Letters Patent. Patented Nov. 6, 1906.

Application filed February 8, 1905. Serial No. 244,787.

To all whom it may concern:

Be it known that we, JULIEN DULAIT, manufacturer, a subject of the King of Belgium, and LEON ROSENFELD, engineer, a subject of the Emperor of Russia, residing in Charleroi, in the Kingdom of Belgium, have invented certain new and useful Improvements in Devices for Reversing and Automatically Blocking Trains on Electrodynamic Traction-Railways; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to figures of reference marked thereon, which form a part of this specification.

The present invention relates to a device for reversing and automatically blocking trains on electrodynamic traction-railways.

Before describing our invention and in order to make it quite clear we shall briefly state the principles of the tangential or parallel traction.

This system is based upon the properties of alternating polyphased currents. As well known, a polyphase-current motor comprises a fixed part or "stator" and a running part or "rotor," which revolves under the action of the rotating field developed by the polyphased currents sent into the stator. Instead of circular-shaped stators and rotors we may conceive that the motor would be developed or straightened and that the stator would be placed on a track (between the rails, for instance) over which would run the elements of the rotor suitably fitted to one or more vehicles in such a manner that the rotating field would be substituted by a straight traveling field. In a system as above described the current should cross continuously the whole length of the stator even when no train is on the line, and the consumption of current would be high. Therefore it is obvious to provide the system with a device allowing the current only to be sent in the working parts of the stator—*i. e.*, in the parts in front of the train—this insuring the highest efficiency of the system by reducing the loss in the line. Further, it is necessary that a parallel traction system as above described be provided with devices allowing the running direction of the train to be reversed and also with blocking devices fitted in such a manner that two trains running on the same track and in the same direction can never catch each other. To obtain this, it was necessary to subdivide or section the stator in such a manner as to send automatically the current only in the parts of said stator in front of the train, the other parts remaining without current, the sections so determined being fitted with suitable devices in order to obtain the reversing of the traveling direction of the train and the automatic blocking of said train. These results have been obtained by the use of suitable switches operated by alternating-current motors the circuits of which are wired in a special manner—as described, for instance, in the British Patent No. 22,298 of 1891. In the said system the traveling direction of the train is reversed by the use of reversing-switches which are placed in each section and worked by motors, of which there are two on each section.

The object of the present invention is to provide a new device allowing to obtain the traveling of the train in both directions by using but one motor on each section and to block the train automatically without the aid of a second motor by simply adjoining a supplementary conductor-rail.

In accordance with the present invention we use on each section a reversing-switch worked by a single motor and interpolated by means of suitable connections between the section-stator and the feeders or line-wires and which according to the position of its movable contacts changes the direction of the magnetic field of the section-stator, and thus changes the traveling direction of the train.

As to the blocking, it is obtained by adjoining a supplementary conductor or rail divided in sections which are insulated from each other and connected to the reversing-rail, so that one section of the blocking-rail is electrically connected to the next preceding section of the reversing-rail.

In the annexed drawings, which represent one embodiment of the invention, Figure 1 is a detail view of the motor driving the reversing-switch. Fig. 2 is a diagram of the connections allowing to obtain, by means of the said motor, the running of the trains in both directions and also the automatic blocking. Figs. 3 and 4 are views showing the rotor as

carried by a car, and Fig. 5 is a diagrammatic view of the blocking system.

Before describing the object of the present invention we will, in order to make things quite clear, first explain the principle of sectioning.

The sectioning-motor 52 is of the same construction as the reversing-motor 8. Its stator is connected with the three feeders 10 11 12. Its rotor has two windings 48 49, electrically connected with each other by means of the conductor 50, the free ends of which are connected, on one hand, with the tread-rail 1 and, on the other hand, with a special conductor-rail 47. This conductor is formed by a series of portions which are insulated from each other by means of non-conducting joints 51. Each of these portions forms a section which corresponds to a group of stators. Each of these groups of stators, and consequently each section, is controlled by a sectioning-motor 52. On the rail 47 travels a roller 53, (or a brush,) which is electrically connected with the axle 5 of the vehicle by means of a switch 54, placed near the driver. It will therefore be noticed that if a vehicle is on any section (in Fig. 5 the last section to the right) and if the switch 54 is closed the following circuit is formed: windings 48 49 with the connections 50 of the rotor of the sectioning-motor, rail 1, wheel 17, axle 5, switch 54, brush 53, rail 47. The circuit of the rotor 52 being thus closed, this rotor rotates in the direction of the arrow 55 and brings thus the lever 56, with its balance-weight 57, fixed on the shaft of the motor, in its horizontal position. The piece 58 on the end of the lever 56 makes the contact between the three contacts 59 60 61 and closes the circuit of the stators 32, which allows the vehicle to move on. To stop the vehicle, the driver will simply have to open the switch 54. The circuit of the rotor 52 is thus interrupted and the balance-weight 57 of the lever 56 and the member 58 are lifted and interrupt the circuit of the stators.

From the above explanation it will be seen that the sections are not put out of circuit by the reversing-motors, but by the sectioning-motors.

In our present invention the plant comprises, as in the ordinary electrodynamic traction system, a track formed by means of two rails 1 2, on which the train runs; but in the present case this track is completed by a supplementary rail or conductor 3, on which travels a brush or roller 4, fitted on the propelling-vehicle 5′. This roller is electrically connected to one of the axles of the vehicle by means of a switch 6, which allows to make or to break at will the electric connections between 4 and 5′. This track is, furthermore, divided in successive sections electrically insulated from each other by means of joints 7, placed in the intermediary rail 3.

In order to assure the possibility of reversing the traveling direction, each section is provided with a reversing device, which as contradistinct from the known reversing devices necessitates only one motor 8. This motor 8 comprises a stator 9, with three windings or phases connected to the three conductors or feeders 10 11 12 of a main which runs along the whole track, and a rotor 13, which only possesses two coils 14 15, two ends of which are connected with each other by means of a conductor 16. The two free ends of the coils 14 15 are connected with a tread-rail 1 and with the intermediary rail 3. Through the three windings or coils of the stator the current of the mains 10 11 12 flows constantly.

When the propelling-vehicle enters the section and the switch 6 of the vehicle is closed, a circuit is formed comprising the roller 4, the axle 5, the wheel 17, the rails 1 and 3, and the windings 14 and 15 of the rotor 13. The rotor thus short-circuited in the rotating field rotates in the direction of the arrow, Fig. 1. The rotor 13 is mounted on a shaft 18, which carries the swinging lever 19 of the reversing-switch, said lever carrying at one of its ends a piece 20, having three contacts 33 34 35, and at its other end a counterweight 21, which when the circuit of the rotor is opened throws the lever back into the position indicated by dotted lines in Fig. 1. According to the position occupied by the lever 19 of the reversing-switch—viz., according to the circuit of the rotor 13 being closed or open—the piece 20 contacts with the contacts 22 23 24 (rotor-circuit closed) or 25 26 27, (rotor-circuit opened.) When no vehicle is on the section, the balance-weight tends to draw the lever 19 back into the dotted position, which will be the case, too, when the propelling-vehicle is on the section and the switch 6 of the vehicle is open. When, however, the propelling-vehicle is on the section, its switch being closed, the motor 8 starts in order to bring the piece 20 in contact with the contacts 22 23 24. A second main of three wires or feeders 28 29 30 provides a three-phased current coming from the central station to the several principal stators 32, placed within the track and designed to assure the propulsion of the propelling-vehicles through the medium of the rotors 32′. The contacts 25, 26, and 27 of the reversing-switch are respectively connected with the conductors 28, 29, and 30, while the contacts 22, 23, and 24 are respectively connected with the conductors 30, 28, and 29. Furthermore, the contact-carrying member 20 carries itself three contacts 33 34 35, connected with the three windings of the main stators 32 by means of connections 36, 37, and 38.

It will be seen that the connections between the conductors 28 29 30 and the con-

tacts 25 26 27, on one hand, and 22 23 24, on the other hand, are made in a different order of succession, so as to change the sequence of the phases in the track or main stators 32 according to the lever of the reversing-switch being in one of the other of its two positions. Consequently the vehicle will be propelled forward (from the left to the right) when the switch 6 is open, and in order to make the vehicle run backward—viz., from the right to the left—the driver will only have to throw in the switch 6.

An automatic block system is obtained by adding in the track a supplementary conductor or rail 39 and by fitting on the propelling-vehicle a roller or brush 40, which travels on the rail 39 and which is electrically connected with the axle 5 by means of a switch 41. The rail 39 is divided in sections which are electrically insulated from each other by means of joints 42 at the location of the joints 7, which separate the sections of the rail 3. Furthermore, there is at each joint a connection 43 between the rails 3 and the rail 39 which connects electrically one section of the rail 3 to the next following section of the rail 39. The blocking-sections 44 45 (shown in Fig. 2) are connected in this way.

Obviously the device shown in Fig. 2 may simultaneously control a series of stators 32, arranged along the line and grouped according to known principles.

Supposing now that a train traveling in the direction of the arrow 46 is on the section 45 and that the switch 41 of its propelling-vehicle is closed, which is its normal position, it will be seen that owing to connection 43 the rotor of the motor 8 of the section 44 will be short-circuited and the lever 19 will close the circuit by means of the contacts 22 23 24, so that every train traveling on the section 44 will move backward—viz., in a direction opposite to that of the arrow 46. Consequently a train arriving on the section 44 will be blocked as long as the section 45 is occupied by another train.

Having described our invention, what we claim as new is—

1. In an electrodynamic system, the combination of a track divided in sections insulated from one another, line-wires, a section-stator on each section, and means for changing the rotating field in said stator, comprising a switch inserted between the stator and the line-wires and adapted to reverse the current conducted from the line-wires to the stator, and a single motor for operating said switch.

2. In an electrodynamic traction system, the combination of a track divided in sections, a single reversing-switch on each section, a single motor for operating said switch and a switch arranged on the train and controlling said motor.

3. In an electrodynamic traction system, the combination of a track divided in sections, a supplementary rail divided in sections insulated from one another, a single reversing-switch on each section, a single motor for operating said switch, and electrically connected to said rail, and a second switch for controlling said motor, said second switch being electrically connected to the supplementary rail.

4. In an electrodynamic traction system, the combination of a track divided in sections, a supplementary rail divided in sections insulated from one another, a single reversing-switch on each section, a single motor for operating said switch and electrically connected to said rail, a blocking-rail divided in sections insulated from one another, each section of the blocking-rail being electrically connected to the preceding section of the supplementary rail, and means on the train completing the circuit through a section of the blocking-rail, the preceding section of the supplementary rail and the motor of the preceding section to operate the switch of the preceding section.

In testimony that we claim the foregoing as our invention we have signed our names in presence of two subscribing witnesses.

JULIEN DULAIT.
LEON ROSENFELD.

Witnesses:
E. MEYER,
GREGORY PHELAN.