(No Model.) 2 Sheets—Sheet 1.

E. E. RIES.

DRIVING MECHANISM FOR ELECTRIC RAILWAY CARS.

No. 386,086. Patented July 10, 1888.

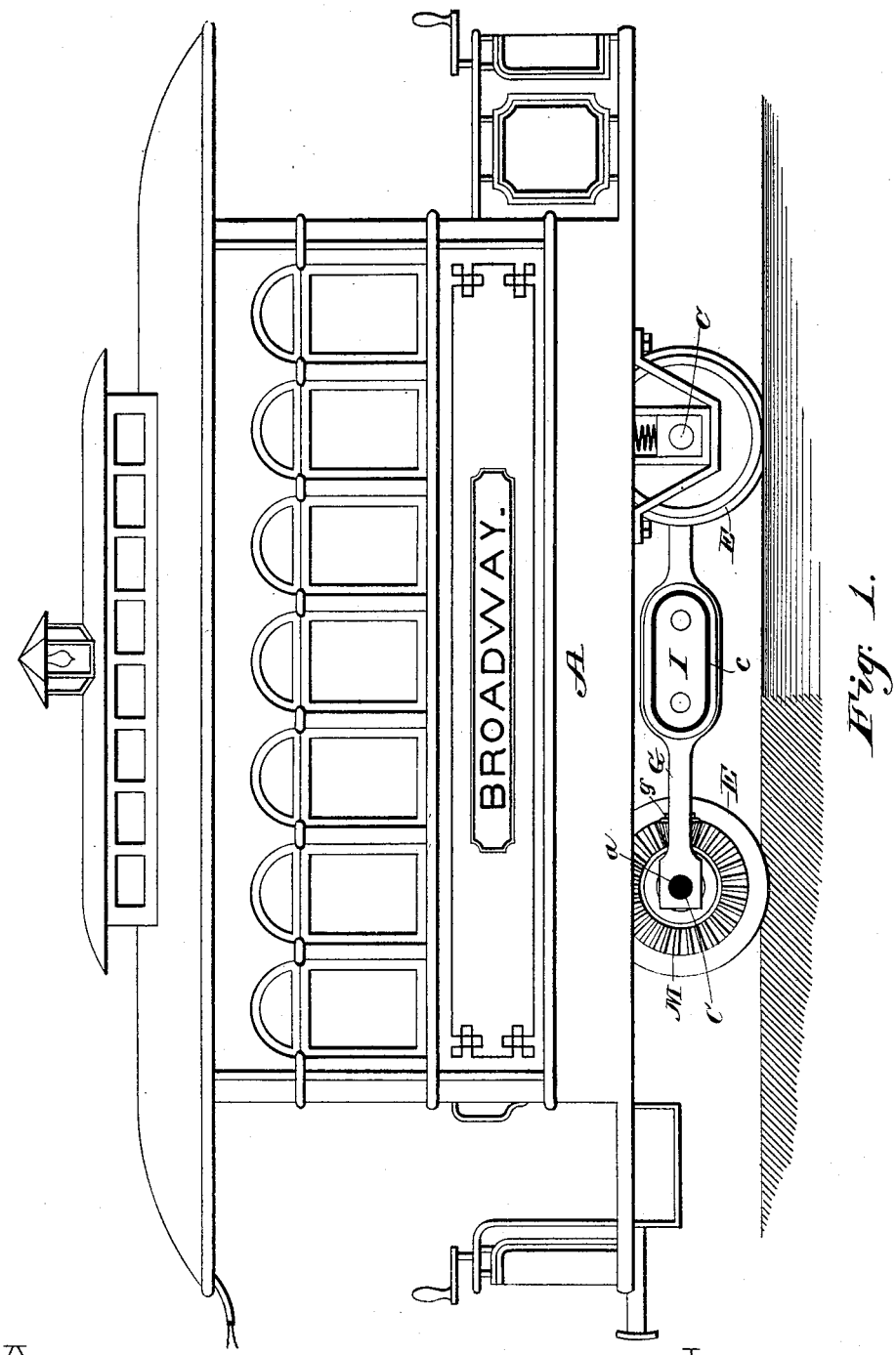

Fig. 1.

ATTEST:
Percy C. Bowen.
Carl B. Waller

INVENTOR:
Elias E. Ries:
By Harding & Richmond
his Attorneys.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

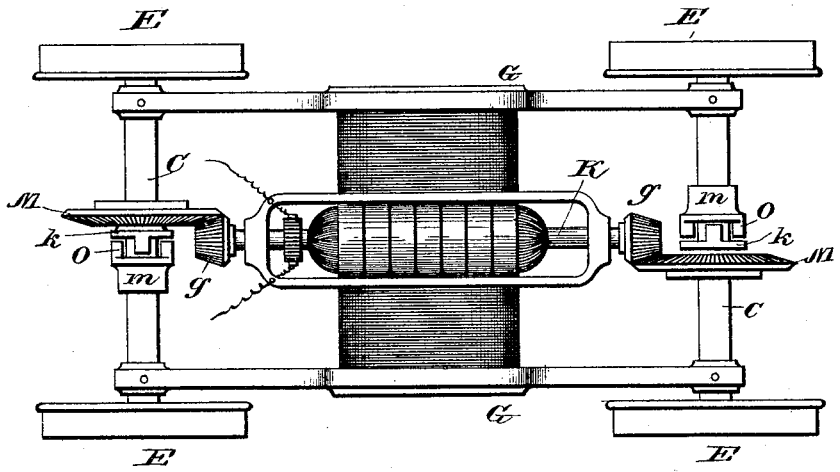


Fig. 3.

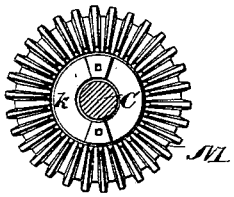


Fig. 4.

Fig. 5.

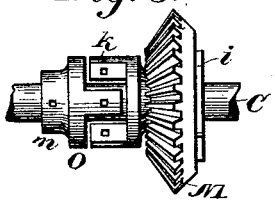


Fig. 6

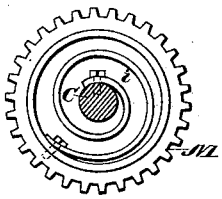


Fig. 7.

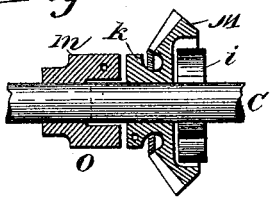


Fig. 8.

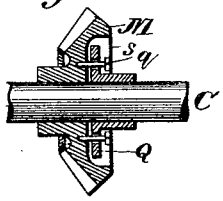
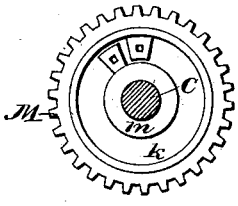


Fig. 9.



ATTEST:

Percy C. Bowen.
Carl B. Waller.

INVENTOR:

Elias E. Ries:—
By Harding & Richmond
his Attorneys.

UNITED STATES PATENT OFFICE.

ELIAS E. RIES, OF BALTIMORE, MARYLAND, ASSIGNOR OF ONE-HALF TO ALBERT H. HENDERSON, OF SAME PLACE.

DRIVING MECHANISM FOR ELECTRIC-RAILWAY CARS.

SPECIFICATION forming part of Letters Patent No. 386,086, dated July 10, 1888.

Application filed October 19, 1886. Serial No. 216,610. (No model.)

To all whom it may concern:

Be it known that I, ELIAS E. RIES, of the city of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Driving Mechanism for Electric and other Railway Cars, of which the following is a specification.

This invention relates to certain improvements in the driving mechanism of electric and other self-propelling railway-cars, and in means for supporting the motor and for connecting it with the driving-axles of such cars, as will hereinafter fully appear.

The objects sought to be attained by the present invention are, first, to so support and connect an electro-dynamic or other motor upon a railway-car that it will not be thrown out of alignment with the driving-axle mechanism by reason of the vibration or swaying motion of the car-body or its distance from the axles under varying loads; second, that the motor and the driving mechanism connected therewith will not be injuriously affected or strained by the vibration of the motor-car when running on an uneven roadway; third, that the power of the motor may be directly and simultaneously exerted upon both axles of the car-truck without the employment of connecting-rods, chain belts, gearing, or other complicated mechanism, and thereby gain the greatest amount of tractive force with the least waste of power; fourth, to provide means whereby the power of the motor is gradually communicated to the driving-axles in order to prevent sudden strains in starting and stopping and consequent wear of the motor and the driving mechanism, and, fifth, to so dispose the weight of the motor upon the driving-axles that it will materially increase the effective tractive force of the driving-wheels and enable them to more readily overcome the inertia of the car and propel it on ascending grades.

In the drawings the invention has been shown as applied to a street-car in which electricity is the motive power, the propelling-current being derived either from conductors extending along the line of way, from secondary batteries carried on the car, or from both, as shown, for example, in several of my previous applications for Letters Patent, or in any other well-known or desirable manner. It is to be understood, however, that I do not limit myself to the application of this invention to electric street-cars, but may apply it also to other kinds of railway-cars and adapt it to other forms of motive power, more especially rotary power, without departing from the scope of this invention.

In the accompanying drawings, in which similar letters of reference indicate corresponding parts, Figure I is a side view of a street-car provided with my improvements, with certain parts thereof shown in section. Fig. II is a top or plan view of the car-axles, wheels, motor, and their immediate connections, showing the general arrangement of the various parts and their position when the car is about to start. Figs. III, IV, V, VI, and VII are details of a portion of the invention, on an enlarged scale. Figs. VIII and IX illustrate modifications of a part of the said invention, which will hereinafter be fully described.

Referring now to the drawings, A is a street-car of ordinary construction.

C C are the car-axles, and E E the car-wheels secured to the said axles in the ordinary manner. The axles are supported from the car-body by means of hangers and boxes, as is usual in street-cars.

G G are bars which support the motor I, which in the present case is an electro-dynamic motor of the usual construction. These supporting-bars are provided with eyes or bearings *a a* at their ends, (see Fig. I,) in which the axles C C freely revolve, and are also furnished at the center with an opening, *c*, of the proper size and shape to receive and hold the field-magnet ends of the motor I, which latter is so placed, with respect to the car, that its armature-shaft K extends in a direction parallel with the sides of said car or at right angles to the axles C C.

The bars G G may, if desired, be slightly flexible, and the ends of the motor, resting within the openings *c c* of these bars, are preferably encircled with a gasket or ring, *c'*, as indicated in Fig. I of the drawings, of rubber or other flexible material, in order to deaden the vibrations communicated to the motor and at the same time permit of a certain degree of

elasticity on the part of the motor in starting the car or in increasing the speed of the same while under headway.

The armature or driving shaft K of the motor is provided at each extremity with a bevel or miter pinion, *g*, which pinion engages with miter-gears M M, that are placed on the axles C C at relatively-opposite sides of the shaft K and its pinions *g g*, the object of this arrangement being to permit both axles C C to revolve in the same direction when the armature-shaft K is in motion. By this construction the motor-shaft is caused to exert its power directly upon both axles of the motor-car, thereby gaining the positive tractive force of all the wheels E without the intervention of chain belts, reversing-pulleys, or other gearing.

By referring to Figs. I and II, it will be seen that the motor I is so supported by the bars G G that the driving-shaft K is directly in line with the center of both axles. This not only places the motor-shaft in the best position for effective action by permitting a certain amount of vertical motion or play on either side of the normal or central line without injury to the teeth and without affecting the smooth operation of the driving mechanism, but by this arrangement of the driving mechanism the center of gravity of the motor is placed so low and its weight so distributed that it will materially augment the transmission of rotary motion to the axles by the armature-shaft. Moreover, this method of supporting the motor from the car-axles not only secures the primary object of preventing the swaying motion of the car-body from affecting the relative positions of the various parts of the driving mechanism, but it permits the employment of a comparatively large size of electro-motor and its application to cars of ordinary construction without the necessity of making any material change in their present rolling-stock and without taking up any available passenger-space.

As it is advisable in most cases that the motion of the electric motor be communicated gradually to the driving-axles in starting the car from a position of rest, I prefer, in carrying out my invention, to make use of some intermediate arrangement between the motor-shaft and the driving-axles, whereby the power of the former is gradually applied to the latter under these conditions. The devices preferably employed by me for this purpose will now be described.

The gear-wheels M M, instead of being firmly secured to the axles C C, are loosely placed thereon, as shown in Figs. II to VII, and the means of communication between the said gears and their respective axles consist of coiled springs *i i*, which are placed within a hollow or recessed portion of the gears M, as shown in the sectional view, Fig. VIII. One end of the springs *i i* is secured to their respective axles and the other is fastened to the miter-gears, as shown in the rear view, Fig. VI. These springs, which need not make more than two or three convolutions, are of such a tension that it requires but a slight additional winding—say that imparted by a one-third revolution of the gears M—to overcome the inertia of the car under ordinary conditions, as will be hereinafter explained.

The axles C C are each provided with a clutch, O, formed in two parts or sections, one of which, *m*, is firmly secured to the axle, and the other, *k*, constructed so as to form a part of the gears M. Each section of the clutches O is provided with two projecting ears, *o o*, which interlock after the manner of ordinary clutches, except that in this case there is a clearance of about one hundred and twenty degrees, or one-third of a revolution, between the fixed and the movable ears of the clutches. When the car is at rest, and also when it is running under normal conditions of speed on a level track, the springs are partially distended and hold back the movable ears against and in contact with the fixed ears. When, however, the car is to be started from a position of rest, and the gears M are for this purpose put in motion by the motor, the portions *k k* and *m m* of the clutches are separated and the tension of the springs *i i* is gradually increased until the inertia of the car has been overcome and the car is brought under headway by the now revolving axles, whereupon the movable portions *k k* of the clutches O O again gradually recede as the car gains headway, until they are once more in contact with the "back-stops" of the clutches, which position they maintain, as before stated, while the car is running under ordinary conditions. Should the speed of the motor be suddenly increased for any reason while the car is under headway, the excess of power will not be suddenly communicated to the driving-axles, but such energy will be expended in increasing the tension of the coiled springs until the car has had time to accommodate itself to the increased rate of speed, the action being substantially the same as that gone through in starting the car. In this manner the motor and driving mechanism, as well as the car itself, are relieved from injurious shocks and strains that would otherwise seriously interfere with their operation. A similar compression of the coiled springs takes place when the motor is called upon to propel the car uphill, the amount depending upon the steepness of the grade and the weight of the car, which latter, it will be seen, is, under these conditions, flexibly connected with its propelling mechanism. The front stops of the clutches serve in either case to prevent overwinding of the springs, whose tension or flexibility in both directions is limited, as has been shown, by the clutches O O.

It will be readily understood that in the arrangement just described the springs serve to take up, and equalize or regulate its application to the car, all excess of power beyond that which is necessary to keep the car in mo-

tion at the normal or required rate of speed on a level track. Now, as the power required to keep a car in motion at a given rate of speed is considerably smaller than the additional amount necessary to overcome its inertia, the plan above described will in most cases be found sufficient to give the needed torsional movement or flexibility between the motor-shaft and the driving-wheels. It may sometimes be desirable, however, that the total initial power of the motor should be gradually transmitted to the driving-axles in starting. This may obviously be accomplished by employing the arrangement shown partially in Fig. IX. In this figure, which represents a rear view of one of the gears M, with the spring removed, the clutch consists of a sleeve, *m*, fixed to the axle C and provided with a single projecting ear, *o*, which, when the car is at rest, is in contact with and acts as a back-stop to a similar projection, *o'*, forming part of the gear M, as shown. The spring employed in this modification is not shown in Fig. IX, since it is of substantially the same construction as in Fig. VI, its inner extremity being fastened to the hub or sleeve *m*. When the gear M is revolved in the direction of the arrow, by sending an electric current through the motor I the said gear will make nearly a full revolution before its projection *o* will come in contact with the opposite side of the fixed projection *o* and the spring will have been compressed to a corresponding extent before the car is brought under headway. In this construction the tension of the springs is so adjusted that they serve merely to take up the initial motion of the armature-shaft in starting the motor, thereby relieving it and the bevel-gears from the strain to which they would be subjected if the energy of the motor were suddenly expended in overcoming the resistance or inertia of the car itself. It will be understood that in the present case the projections *o* on the gears M remain in operative contact with the fixed projections *o* after the car has been started and while it continues in motion under the influence of the motor I. When the current flowing through the motor is interrupted, however, as would be the case when the car is running on downgrades, or when it is desired to stop, the projection on the gear will retrace its motion until it again rests in front of the projection on the sleeve *m*, whereupon the gears M M and the armature-shaft K are rotated by the momentum of the car, which momentum can thus be utilized, as specified in another application for Letters Patent pending herewith and bearing the Serial No. 205,941, to generate an electrical current which can be stored in a suitable secondary battery carried on said car.

Fig. VIII shows a modified form of clutch in which the fixed portion consists of a disk, Q, provided with curved slots *s* and firmly secured to the axle C, the driving gear M having pins or studs *q*, which pass through the said slots. The spring, which is not shown, is attached as already described, and the operation of this clutch is practically the same as that shown in Fig. V.

What I claim is—

1. The combination, in a railway-car, of parallel supporting bars or frames extending between and sustained by the driving-axles thereof, said bars being provided with openings provided with gaskets or rings for holding the electro-dynamic motor, substantially as set forth.

2. The combination, in a railway-car, of parallel supporting bars or frames extending between the driving-axles of said car, a gear-wheel on each driving-axle for revolving the same, and an electro-dynamic motor centrally mounted upon said supporting bars or frames, and having its armature-shaft provided with driving-pinions for engaging with said gears, the armature-shaft of said motor being in line with the diametrical center of both gear-wheels, substantially as and for the purpose set forth.

3. The combination, in a railway-car, of parallel supporting-bars extending between and sustained by the driving-axles of said car, said bars being provided with bearings for the motor, and a motor journaled in the bearings of said bars centrally between the driving-axles, substantially as specified.

4. In a railway-car, the combination, with an electric motor having its armature mounted centrally and longitudinally of the vehicle-truck and having its field-coils extending transversely and centrally of said truck, of the armature-shaft of said motor geared to each axle and extending longitudinally and centrally between the sides of said truck, and a flexible supporting-frame for said motor.

5. In a traveling vehicle, the combination, with an electric motor, of supporting-bars therefor having enlarged flexible bearings for said motor.

ELIAS E. RIES.

Witnesses:
ALBERT H. HENDERSON,
H. D. NASH.