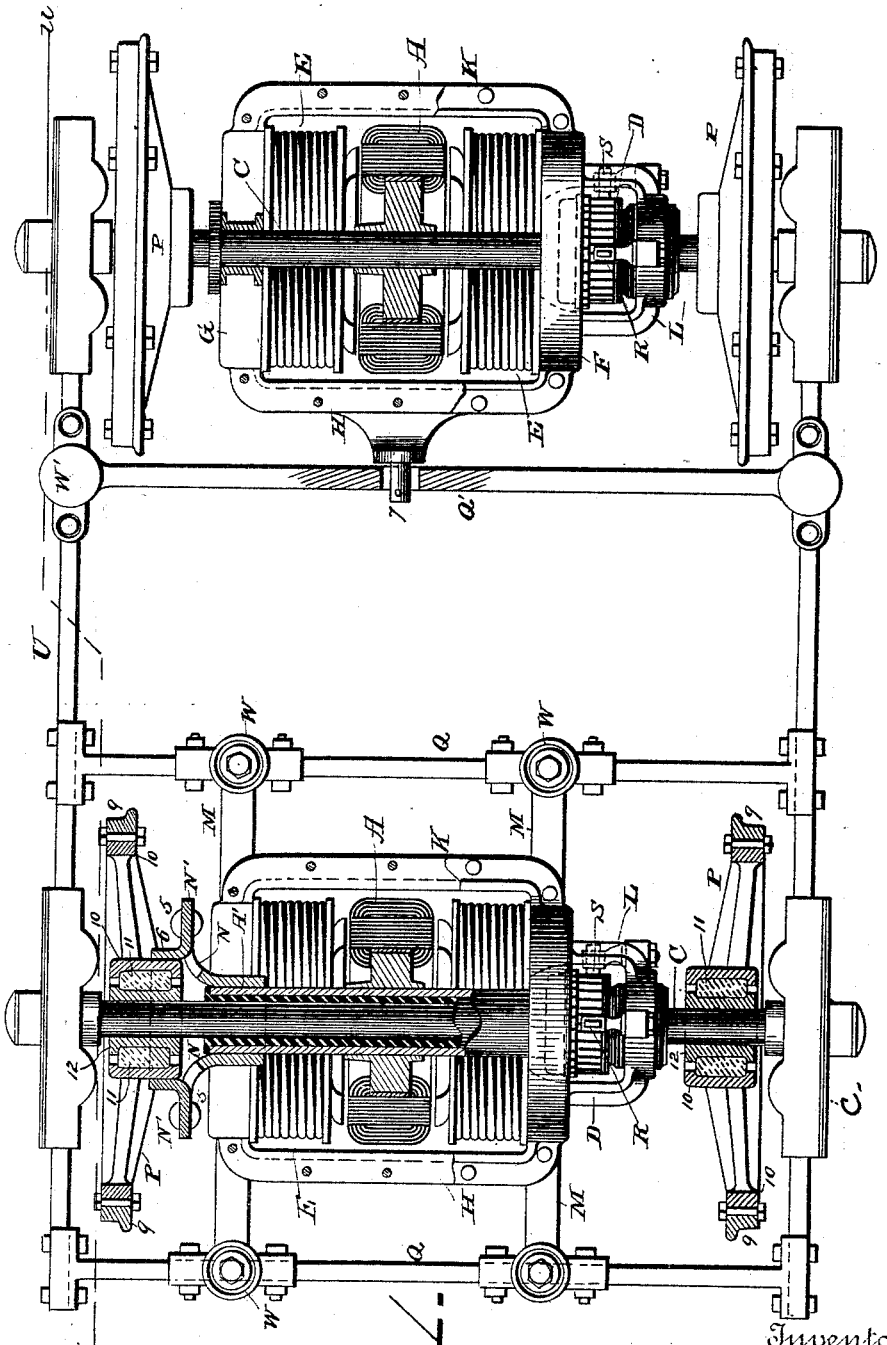
(No Model.)

2 Sheets—Sheet 1.

S. H. SHORT.

ELECTRIC LOCOMOTIVE.

No. 491,666. Patented Feb. 14, 1893.



Witnesses:
E. Mottinghaw
G. F. Downing

Inventor
Sidney H. Short
By H. A. Seymour
Attorney

(No Model.) 2 Sheets—Sheet 2.

S. H. SHORT.

ELECTRIC LOCOMOTIVE.

No. 491,666. Patented Feb. 14, 1893.

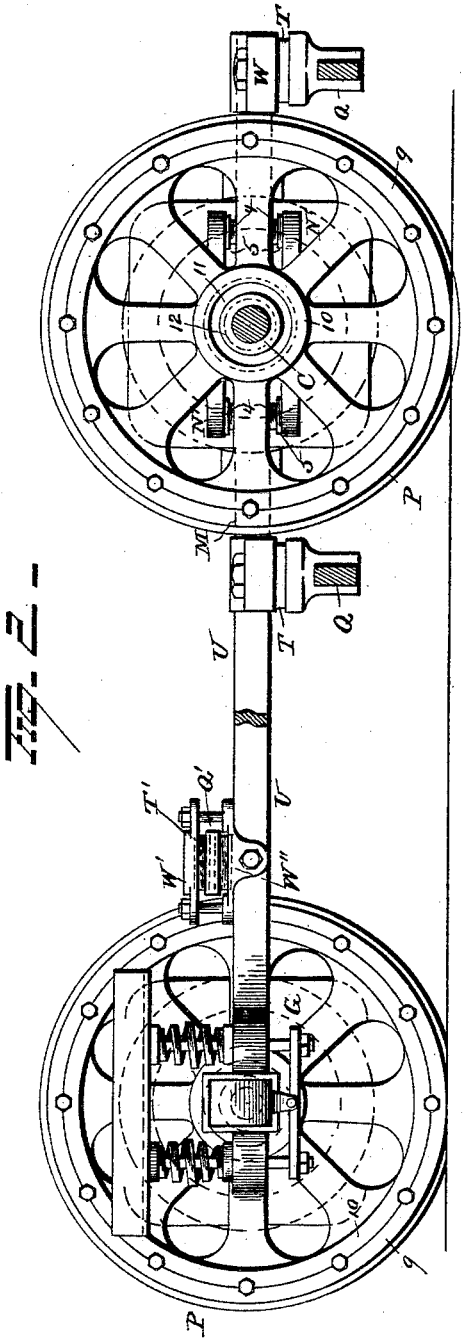


Fig. 2.

Witnesses
E. V. Mottinghaus
G. F. Downing

Inventor
Sidney H. Short
By H. A. Seymour
Attorney

UNITED STATES PATENT OFFICE.

SIDNEY H. SHORT, OF CLEVELAND, OHIO, ASSIGNOR TO THE SHORT ELECTRIC RAILWAY COMPANY, OF SAME PLACE.

ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 491,666, dated February 14, 1893.

Application filed January 16, 1891. Serial No. 377,984. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY H. SHORT, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electrically-Propelled Cars; and I 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.

This invention relates more particularly to electrically propelled cars in which a propelling motor has its armature axially placed with reference to a car axle and connected directly therewith; but each of the improvements constituting the invention is included for all the uses to which it may be adapted. By axially placed is to be understood that the axes of the armature and the car axle are coincident or nearly so. By directly connected is to be understood that the driving connection imparts one revolution to the car axle for each rotation of the armature.

In accordance with the present invention, the propelling motor, with its axially placed and directly connected armature, is upheld by one or more car axles which are supported on wheels having cushioning material or insulating material or both intermediate the car axle and tire at any suitable point. Insulating and cushioning material will be shown herein as interposed between two parts of the hub of the car wheel, but this part of the invention extends also to the combination mentioned with a wheel in which the cushioning or insulating material is elsewhere placed. For the cushioning material soft vulcanized rubber is preferred on account of its special yielding nature and its insulating capacity. Other materials having the same characteristics may be used. Further, in the present invention, the propelling motor is mounted, at least in part, on the car axle with which the armature is directly connected, and is or may be provided with a cushion, spring or buffer between itself and the said car axle, or between itself and another part of the car adapted to hold the field magnets from rotation with the car axle with or without supporting the motor. Insulating or cushioning or insulating and cushioning material or materials may be used in both places.

The foregoing improvements are included in the invention irrespective of the precise form of motor; the invention, however, covers special features in regard to this, that is to say—First:—The field magnets are arranged symmetrically with reference to the car axle. Second:—The field magnets are arranged horizontally. Third:—The field magnets are placed above (or not materially below) the lowest part of the armature. Fourth:—The field magnets are placed at the sides of the armature parallel with the said axle. Fifth:—Multipolar field magnets are employed, the armature being adapted to use with such a field as by means of cross connections at the commutator. Sixth:—The field magnets of the multipolar field are so arranged that the two lowest poles are equidistant from the lowest part of the armature, one in front and one in rear of same. In this position the field magnets may project somewhat beyond the periphery of the armature and still be above its lowest point. Although it is designed to use all these features in connection with one another, yet it is obvious that one or more of them may be used without the others, and the invention extends to such use.

In the accompanying drawings which form part of this specification, Figure 1 is a partial plan view partly in horizontal section of the truck of an electrically propelled car containing the present invention, and Fig. 2, is a sectional elevation on line *i i* of Fig. 1.

In Figs. 1 and 2 somewhat different mountings are shown for the two motors. This is done for the purpose of saving illustration as practically the motors on both axles would be made as nearly identical as possible, although they might of course be different as shown.

In both motors the armature A is composed of a soft iron strip wound upon itself and provided with bobbins of insulated wire wrapped about the ring so made in notches in the edges thereof. The bobbins are connected in closed series and from the junctions wires are led to the strips of a commutator D. The armature A is not only axially placed with reference to the car axle C but is mounted there-

on. In the motor at the left hand of Fig. 1. the armature is fast on a hollow shaft A′ which surrounds the car axle C, a cushioning and insulating sleeve B, of say soft vulcanized rubber, being interposed between the shaft A′ and the car axle C. In the motor at the right of Fig. 1. the armature is shown as fast on the car axle C. The armature in both the motors is directly connected with the car axle. In the motor at the left of the figures the direct driving connection is made by forks N on the shaft A′ engaging arms N′ projecting from a collar 6 which is fast on the hub of a car wheel P. Spring pads 4 of say soft vulcanized rubber are interposed between forks N and the arms N′, the ends of the pads being protected by metal caps 5. In the other motors the driving connection is through the key or other mechanical means by which the armature is made fast on the car axle.

The field magnets E are in both the motors arranged symmetrically in a horizontal position above (or not materially below) the lowest point of the armature, at the sides of the armature parallel with the car axle. These are (as represented) eight in number to form a multipolar field of four poles, each pole being constituted by two magnets in line with each other on opposite sides of the armature. These field magnets are so arranged that the four lowermost magnets are equidistant from the lowest point of the armature, the magnets of one polarity being in front and those of the other sign in the rear of said lowest point. The magnets E project from yokes F G which are mounted on the car axle C through journal bearings formed in the yoke G and bracket L on the yoke F, said bearings embracing journals on car axle C, or on the hollow armature shaft A′. The yokes F G are connected together by arms H K. To facilitate the application to the car axle, the yokes F G, bracket L and arms H K are divided horizontally through the journal bearings.

The field magnets may be held from rotating by a connection with any part of the car adapted to that purpose. As shown at the left of the figures the lower half of yokes F G, have supporting arms M on opposite sides of the axle C, and these arms rest upon cross bars Q which are fastened to the side bars U of the truck frame. Springs or buffers T are interposed between the arms M and the heads W which are fastened to the cross bars Q. The arms M and cross bars Q not only hold the field magnets from rotating with the axle and armature, but also support or may support the weight of the motor in large part or almost entirely. In the motor at the right of Fig. 1. the lower half of the arm H is provided with a pivot pin 7 working in a horizontal slot in the cross bar Q′ whose ends are interposed between springs or buffers T′, of say soft vulcanized rubber which are confined between heads W′ and W″ which are bolted together, and of which the heads W″ are fastened to the side bars U of the truck frame. Of course there are other means of supporting the motor which could be adopted, as shown in my prior applications. The side bars U are shown as upheld by the car axle boxes U′, so that they do not partake of the motion of the car body on the main car springs, but other known or suitable arrangements of side bars, or more generally of a supporting frame, could be adopted.

The wheels P are shown as in four parts, namely, a tire 9 (of say steel) a web and outer hub 10 (of say cast iron), an insulating cushion 11 (of say soft vulcanized rubber or of wood) and an inner hub 12 (of say cast iron or steel). The web and tire could of course, be made in one piece, as in known forms of wheels. The inner hub 12 has outwardly projecting flanges and the outer hub 10 has inwardly projecting flanges which retain the cushion 11 in place. The flanges at one end of the cushion may be formed by upsetting the metal after the cushion has been inserted between the hubs. This insertion can be made under pressure so as to pack the cushion in tightly. The inner and outer hubs are separated from each other so as to insulate the web and tire from the inner hub and axle.

Other means for retaining the cushion in place and at the same time maintaining insulation may be employed. The cushion 11 gives a spring mounting to the motor notwithstanding that the latter may be in whole or in part mounted solidly on the car axle. In case the motor is cushioned by springs or buffers at B, and T or T′, the cushion 11 co-operates with said springs or buffers to give increased ease of riding. It will now be seen that the cushion 11, has special utility in electric locomotives, where either the armature or the whole motor is axially mounted with reference to or on the car-axle; for in such cases, the cushion between the armature and the car-axle, if such cushion is used at all, cannot practically be made so elastic as to permit of a wide range of oscillation of the armature or of the whole motor, independently of the car-axle. In such case, the cushion 11, intercepting, in a great measure, the shocks received by the wheels and which would otherwise be transmitted to the car-axle, reduces the tendency of the latter to rise and fall with the violence with which it would do so if the cushion 11 were absent; so that the elastic cushion interposed between the armature or whole motor and the car-axle although permitting only a limited range of independent rise and fall of the two, will be all-sufficient when the cushion 11, is used. If there is no elastic cushion between the car-axle and the motor, as indicated on the right-hand side of the drawings, the cushion 11, becomes the sole means for rendering the axially mounted motor independent, or partly independent, of the rise and fall of the wheels, due to the inequalities of the road. Thus, it is seen that in all cases where the armature or the whole motor is mounted axially with

reference to or on the driving-axle, the elastic cushion interposed between the driving axle and the wheel, has special utility.

The cushion 11, is preferably made of insulating material, as above stated, and since, in electric locomotives where the motor is mounted axially with reference to or on the car-axle, it is desirable not only to have the motor insulated from the car, but also the latter from the track, so as to effectually prevent leakage to the rails; the insulating cushion 11, therefore, co-operates with the insulating cushion between the armature and the axle (if such is used) to effect this result, and in a case where there is no insulating cushion between the axially mounted motor and the car-axle, the elastic insulation 11, becomes the sole means for insulating the car from the rails. As an insulating medium, therefore, the cushion 11, is specially adapted to and has particular advantages in electric motors which are axially mounted with reference to or on the car-axle. The commutator D is fast on the car axle C or the armature shaft A', and rotates in contact with the brushes R and S which are placed ninety degrees apart for the four pole field shown. The current is supplied to and cut off from the motor in any known or suitable way.

In the foregoing description the armature has been described as rotating with the car axle and the field magnets as non-rotative; it is evident that this might be reversed, the field magnets being allowed to rotate and being connected directly with the car axle to turn the same and the armature being held from rotation. It will be understood that this reversed arrangement is included in the invention as a substitute for that particularly described, without further specification herein.

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

1. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and the field magnets mounted in part at least on said axle by means of journal bearings with springs or buffers interposed, substantially as described.

2. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having both armature and field magnets mounted, in part at least, on said car axle, with springs or buffers interposed, the armature being connected directly with said axle, substantially as described.

3. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor mounted in part at least on said car axle by means of journal bearings and held from rotation by a cushioned connection with another part of the car, said motor having the armature axially placed and directly connected with said axle, substantially as described.

4. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor mounted in part at least on said car axle by means of journal bearings and held from rotation and supported by cushioned connections with another part of the car, said motor having an axially placed armature connected directly with said axle, substantially as described.

5. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and field magnets placed above or not materially below the lowest point of the said armature, substantially as described.

6. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and field magnets at the sides of the armature, substantially as described.

7. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and multipolar field magnets, substantially as described.

8. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature directly connected with said axle and multipolar field magnets arranged with the magnets of the two lowest poles equidistant from the lowest point of the armature in front and rear of the same respectively, substantially as described.

9. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and field magnets projecting from yokes perforated for the passage of the car axle, substantially as described.

10. The combination with a car axle, and wheels provided with cushioning material intermediate said axle and the tires, of a propelling motor having an axially placed armature connected directly with said axle and field magnets projecting from yokes perforated for the passage of the car axle and provided with journal bearings, substantially as described.

11. In an electrically propelled car, a car wheel comprising a bearing hub provided at its opposite ends with outwardly projecting flanges, and an outer hub provided at its outer ends with inwardly projecting flanges,

in combination with a rubber cushion interposed between the two hubs, said cushion being of such thickness as to retain the adjacent flanges on the inner and outer hubs out of contact and prevented against displacement by said end flanges and serving to insulate the outer hub and wheel from the inner hub and axle, substantially as set forth.

12. The combination with a propelling motor having an axially placed and directly connected armature, of the car axles, and the car wheels having two part hubs with insulating cushions between, substantially as described.

13. The combination with a car axle and wheels provided with cushioning material intermediate said axle and the tires, of the armature and field magnets of a propelling motor encircling the axle, the armature being connected with the axle so as to rotate therewith, and yielding supports connecting the field-magnets with the truck-frame, substantially as set forth.

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

S. H. SHORT.

Witnesses:
A. B. CALHOUN,
L. S. NOLD.