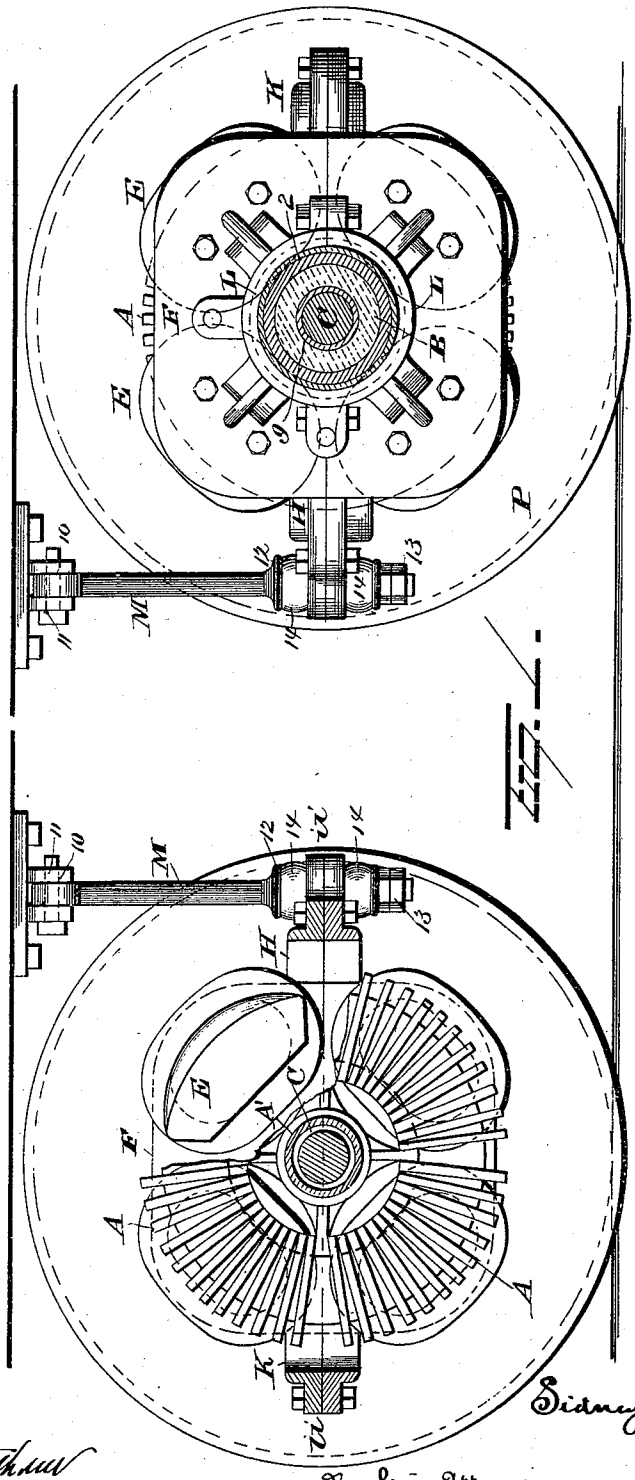
(No Model.) 3 Sheets—Sheet 1.

S. H. SHORT.

ELECTRIC LOCOMOTIVE.

No. 478,242. Patented July 5, 1892.



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(No Model.) 3 Sheets—Sheet 2.

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ELECTRIC LOCOMOTIVE.

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Fig. 2.

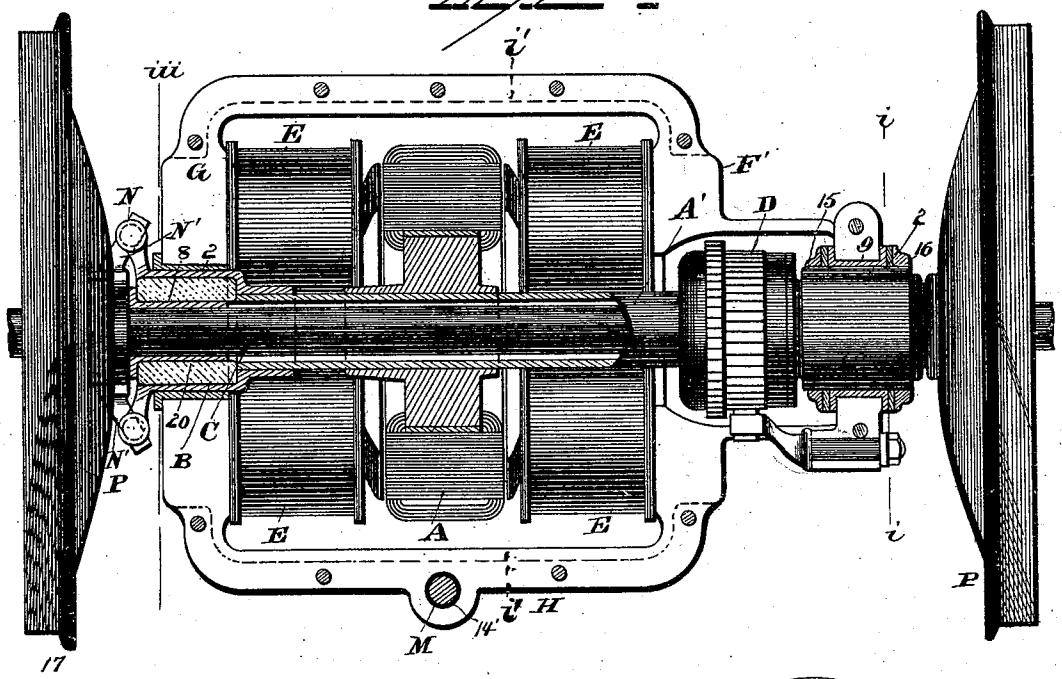


Fig. 3.

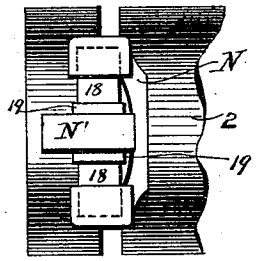


Fig. 4.

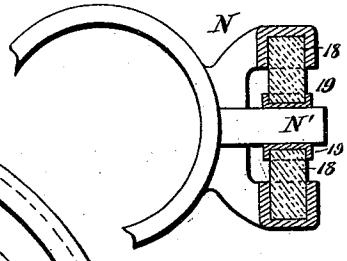
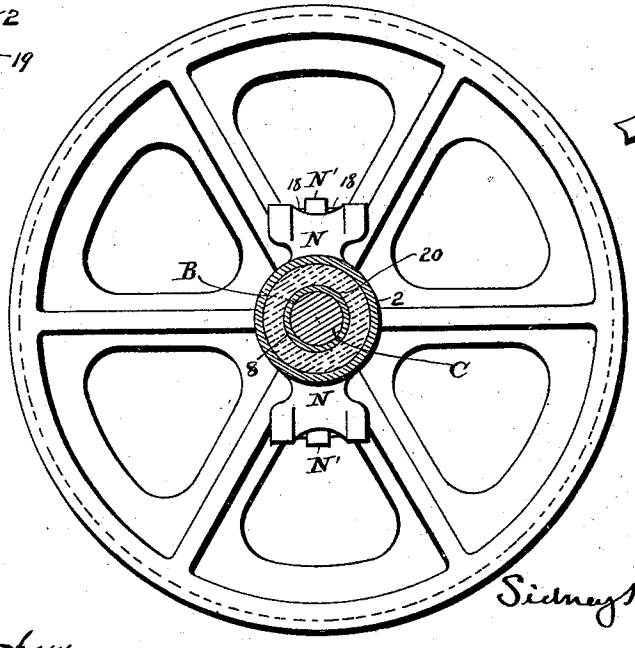


Fig. 5.



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(No Model.) 3 Sheets—Sheet 3.

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ELECTRIC LOCOMOTIVE.

No. 478,242. Patented July 5, 1892.

Fig. 6.

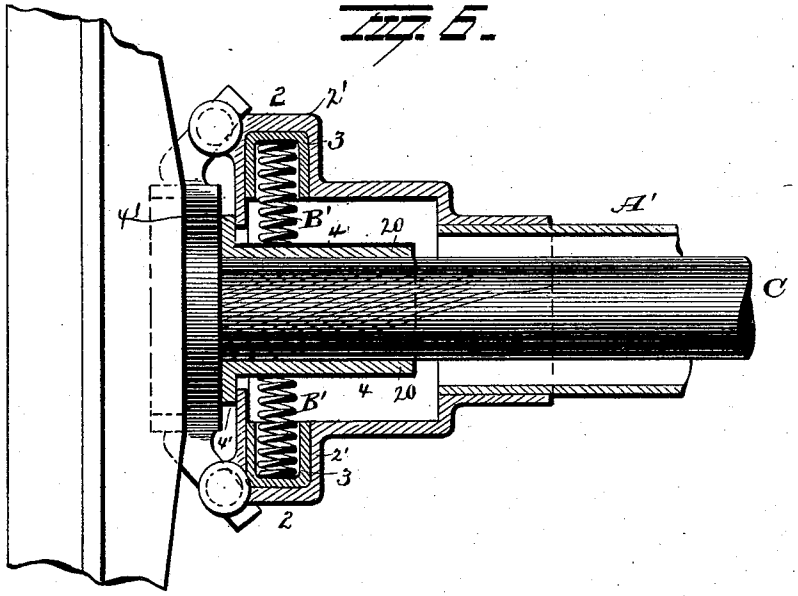
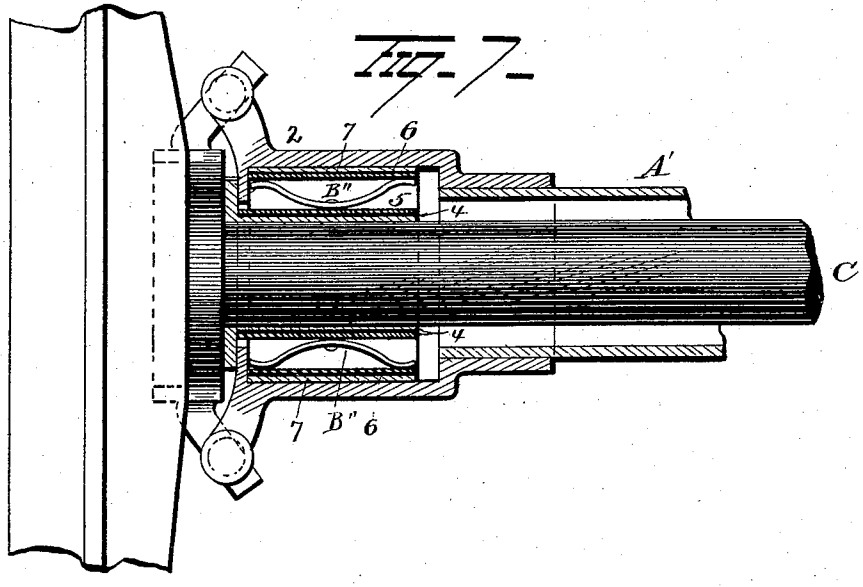


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 478,242, dated July 5, 1892.

Application filed November 6, 1890. Serial No. 370,539. (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 Electric-Motor 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 to electric-motor cars in which the armature of a propelling-motor is mounted axially with reference to a driving-axle and is directly connected therewith (or with a driving-wheel,) so as to make one revolution to each revolution of the driving-wheels. By "axial mounting of the armature" is to be understood that the axis of the armature and the driving-axle are coincident, or nearly so.

In accordance with the present invention the armature is mounted on springs or buffers, and is connected with the driving-axle by means of a self-adjusting coupling which adapts itself to the motion of the armature on its springs or buffers. The self-adjusting coupling might also be usefully employed even if there be no special spring-mounting, but only a want of absolute rigidity. These combinations are included generally in the invention irrespective of the precise means of supporting the non-rotative field-magnets or of the precise form of springs and of self-adjusting coupling. The invention, however, cover, also, special improvements in these respects. Thus a hollow armature-shaft is mounted on springs or buffers interposed between itself and the axle and turning with them. In this arrangement the armature is mounted on the driving-axle, no special journal-bearings being required therefor, while at the same time it is spring-mounted. Further, the field-magnets are also spring-mounted, preferably on the same springs which carry the armature, so that only one set of springs is necessary and preferably, also, with a rigid connection between the armature and field-magnets, so that their relative positions are maintained notwithstanding the movement on the springs. These conditions are best secured by mounting the field-magnets by means of journal-bearings on the hollow spring-held armature-shaft. The rotation of the field-magnets with the said hollow armature-shaft being prevented by an additional mechanical connection of the field-magnets with another part of the car, such connection being preferably elastic in itself and does by preference connect the field-magnets with a spring-supported portion of the car—as, for instance, with the car-body itself. By the use of a connection as last indicated springs are interposed between the field-magnets and the wheel-base by way of such connection as well as by way of the hollow armature-shaft. The springs may be of metal or of appropriate non-metallic substances, like soft vulcanized rubber or partly of both. The self-adjusting coupling may most conveniently be made by forks on the armature-shaft, engaging and sliding upon arms of the driving-axle or a driving-wheel, spring-pads being interposed between the forks and the arms. These spring-pads, moreover, constitute a direct elastic and yielding driving connection for communicating the motion to the driving-wheels, and may be usefully employed for that purpose, even if the mounting for the armature is rigid—as, for example, if the hollow armature had no springs between itself and the driving-axle.

A further object of the present invention consists in insulating the motor from the wheel-base of the vehicle. To effect this, insulation is interposed not only in the coupling or direct driving connection between the armature-shaft and the driving-axle or driving-wheel of the vehicle, but also in the supports of the armature and field magnets. Such insulation may evidently be used with or without spring-supports for the motor, and with spring-supports the springs may furnish the insulation by being made of insulating material like soft vulcanized rubber. In like manner with a coupling using spring-pads, as above explained, the pads may be of insulating material like soft rubber. It is not essential, however, that the springs should be of insulating material, as insulating-pieces can be used with metal springs.

Still another object of the invention consists in mounting the armature and commutator

on a hollow shaft, which can be slipped over the driving-axle of the car, this improvement being irrespective of the interposition of springs between said shaft and the driving-axle.

The invention also comprises certain particular constructions, combinations, and arrangements, as hereinafter set forth.

In the accompanying drawings, which form a part of this specification, Figure I is a partial view in sectional elevation of an electric-motor car constructed in accordance with the present invention, the left half of said figure being in section on line *i'* of Fig. II, a portion of the armature being broken away, and the right half of said figure in section in a plane corresponding to the line *i* of said figure. Fig. II is a partial view in horizontal section on line *i i* of Fig. I. Fig. III is a section on line *i i i* of Fig. II. Figs. IV and V are detail views of the coupling between the hollow armature-shaft and the driving-wheels and axle of the car, and Figs. VI and VII are detail views illustrating the use of metal springs.

The armature A of each propelling-motor is mounted on springs B and is connected directly with the car-axle C by means of a self-adjusting coupling N N'. As shown in Figs. I and II, the springs B are of soft vulcanized rubber and are in form of rings in the sockets or enlargements 2 on the ends of the hollow armature-shaft A' between the walls of said sockets or enlargements and the axle C. Thus the armature A is elastically supported on the car-axle and is also insulated therefrom by the springs B. The object of using the enlargements or sockets 2 is to enable the hollow shaft A' to be made smaller without diminishing to a like extent the space for the springs B.

In Fig. VI spiral compression-springs B' of metal are placed in the sockets or enlargements 2, soft rubber or other insulating material being placed at the ends. As shown, there are cup-like recesses 2', which receive the outer ends of the springs and their insulating-cups 3 and hold the same in place. At their inner ends the springs B' rest on a ring 4 of insulating material on the axle. This ring has an insulating-flange 4', which lies outside the end of the socket 2.

In Fig. VII leaf-springs B'' are shown fastened at their middle to a metal collar 5, around a ring 4 of insulating material, and at their outer ends bearing upon plates 6, which are fastened on the inner face of the insulating-ring 7. Other arrangements could of course be adopted.

The commutator D is placed on the hollow armature-shaft A' and can be adjusted properly with reference to the armature before the shaft is applied to the car-axle. The field-magnets E, as shown, are of the type in which the electric magnets at the sides of the armature project from yokes F and G. The yokes are connected by arms H and K, and the yoke F has a bracket L. The field-magnets are mounted on the hollow armature-shaft A', so that the springs B (or B' or B'') support it also, the armature-shaft A' making a rigid connection or a connection which maintains the relative position of the field-magnets and armature. The field-magnets E are provided with journal-bearings at 8 and 9, by which they are supported on said hollow shaft A'. The field-magnets E are held from rotation by a suitable connection with another part of the car, such as the car-body. As shown, this connection M consists of a rod connected by a flexible joint 10 with a hanger 11 under the car-floor and provided with a flange 12 and nuts 13. The jointed rod passes through an ear on the arm H and springs or buffers 14 are interposed between said arm and the flange and nuts. The springs or buffers are preferably of soft rubber, so as to insulate the magnet-frame F G H K L from the car-body. An insulating-sleeve 14', Fig. II, surrounds the rod M. The insulation of the magnet-frame from the ground may, however, be secured by insulating material on the car-body—as, for example, a wooden beam—to which the jointed rod M may be fastened.

At 15 and 16 are nuts for adjusting the magnets longitudinally of the shaft A', to place the poles at proper distances from the sides of the armature.

The coupling shown for connecting the armature directly with the driving-axle or driving-wheels consists of the forks N on the armature-shaft A' (these forks, as shown, being made in one piece with the sockets or enlargements 2) and of the arms N', fastened to the driving-axle, these arms, as shown, being formed on a collar 17, bolted on the hub of a driving-wheel P.

Between the arms N' and the forks N are the spring-pads 18, preferably of rubber, so as to insulate the forks from the arms, and thus complete the insulation of the motor from the ground. Of course other forms of spring-pads could be used and insulation could be provided independently of the elastic material composing the spring-pads.

At 19 are metal caps, between which the arms N' may play without rubbing against the spring-pads 18.

The coupling N N' 18 it will be observed is self-adjusting for all movements of the armature-shaft A', the play of the arms N' between the caps 19 permitting movements of the armature in the direction of said arms and the yielding of the spring-pads 18 permitting transverse movements.

If it be desired, the movement of the shaft A' endwise on the driving-axle may be prevented by suitable collars. It is preferred, however, to hold the said shaft through the intermediary of springs, as B, so as to permit longitudinal spring movements as well as those transversely on the axle. As shown, there are sleeves 20 with flanged ends between the springs B and the axle C, and these sleeves

may be fastened to the axle or they may be held from endwise motion by the hubs of the driving-wheels P.

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

1. The combination, with a car, of an electric propelling-motor comprising an axially-mounted armature and non-rotative field-magnets, and a self-adjusting coupling connecting the said armature directly with a driving-axle and comprising the arms, the forks, and the spring-pads, substantially as described.

2. The combination, with the driving-axle of an electric-motor car, of an armature mounted upon a driving-shaft encircling the axle, field-magnets journaled upon and supported by said hollow driving-shaft, a yielding support interposed between the driving-axle and the hollow driving-shaft, and an elastic self-adjustable driving connection interposed between the driving-shaft and driving-axle, whereby power is transmitted from the armature to the driving-axle, substantially as set forth.

3. The combination, with a car, of an electric propelling-motor comprising a spring-mounted armature placed axially with reference to the driving-axle and non-rotative field-magnets, and a coupling connecting the said armature directly with the driving-axle and comprising the arms, the forks, and the spring-pads, substantially as described.

4. The combination, with a car, of an electric propelling-motor comprising an armature with a hollow shaft, springs interposed between and turning with said shaft and a driving-axle, and a coupling connecting the said armature directly with the driving-axle and comprising the arms, the forks, and the spring-pads, substantially as described.

5. The combination, with a car, of an electric propelling-motor comprising an armature with a hollow shaft, and non-rotative field-magnets mounted by journal-bearings on said shaft, springs interposed between the said shaft and the driving-axle, and a coupling connecting the armature directly with the driving-axle and comprising the forks, the arms, and the spring-pads, substantially as described.

6. The hollow shaft provided with sockets or enlargements at the ends, and the springs in the said sockets or enlargements, in combination with the driving-axle in said shaft, and the armature thereon, substantially as described.

7. The combination, with an electric car, of a propelling-motor with an axially-mounted armature insulated from the wheel-base of the car by way of the mounting and provided, also, with a direct insulating driving connection between the armature and driving-axle, substantially as described.

8. The combination, with an armature having a hollow shaft and the field-magnets mounted thereon by means of journal-bearings, of an insulating-mounting for said shaft, an insulating connection adapted to prevent the rotation of the field-magnets, and an insulating direct driving connection between said armature and a driving-axle of the vehicle, substantially as described.

9. The combination, with a car, of an electric propelling-motor comprising an axially-mounted armature and non-rotative field-magnets, insulating spring-mountings for the armature and field-magnets, and an insulating self-adjusting coupling or driving connection between the armature and a driving-axle, substantially as described.

10. The combination, with a car, of an electric propelling-motor comprising an armature with hollow shaft and field-magnets mounted by means of journal-bearings on said shaft, insulating spring-bearings interposed between the armature and a driving-axle, an insulating self-adjusting coupling connecting the armature directly with a driving-axle, and an insulating spring connection adapted to hold the said field-magnets from rotation, substantially as described.

11. The combination, with a hollow shaft, an armature, and a driving-axle, of the coupling comprising the forks, the arms, and the insulating spring-pads, substantially as described.

12. The combination, with a driving-axle, a hollow shaft encircling the axle, an armature rigidly secured to said hollow shaft, and field-magnet yokes journaled upon and supported by the hollow shaft, of a yielding support interposed between the axle and hollow shaft, and a self-adjustable coupling for transmitting power from the hollow armature-shaft to the driving-axle, substantially as set forth.

13. The combination, with the driving-axle of an electric-motor car, of an armature mounted upon a driving-shaft, non-rotative field-magnets located on opposite sides of the armature and mounted upon the armature-shaft, and means for adjusting the field-magnets longitudinally on the armature-shaft and with reference to the armature, substantially as set forth.

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

SIDNEY H. SHORT.

Witnesses:
A. B. CALHOUN,
C. J. LEEPHART.