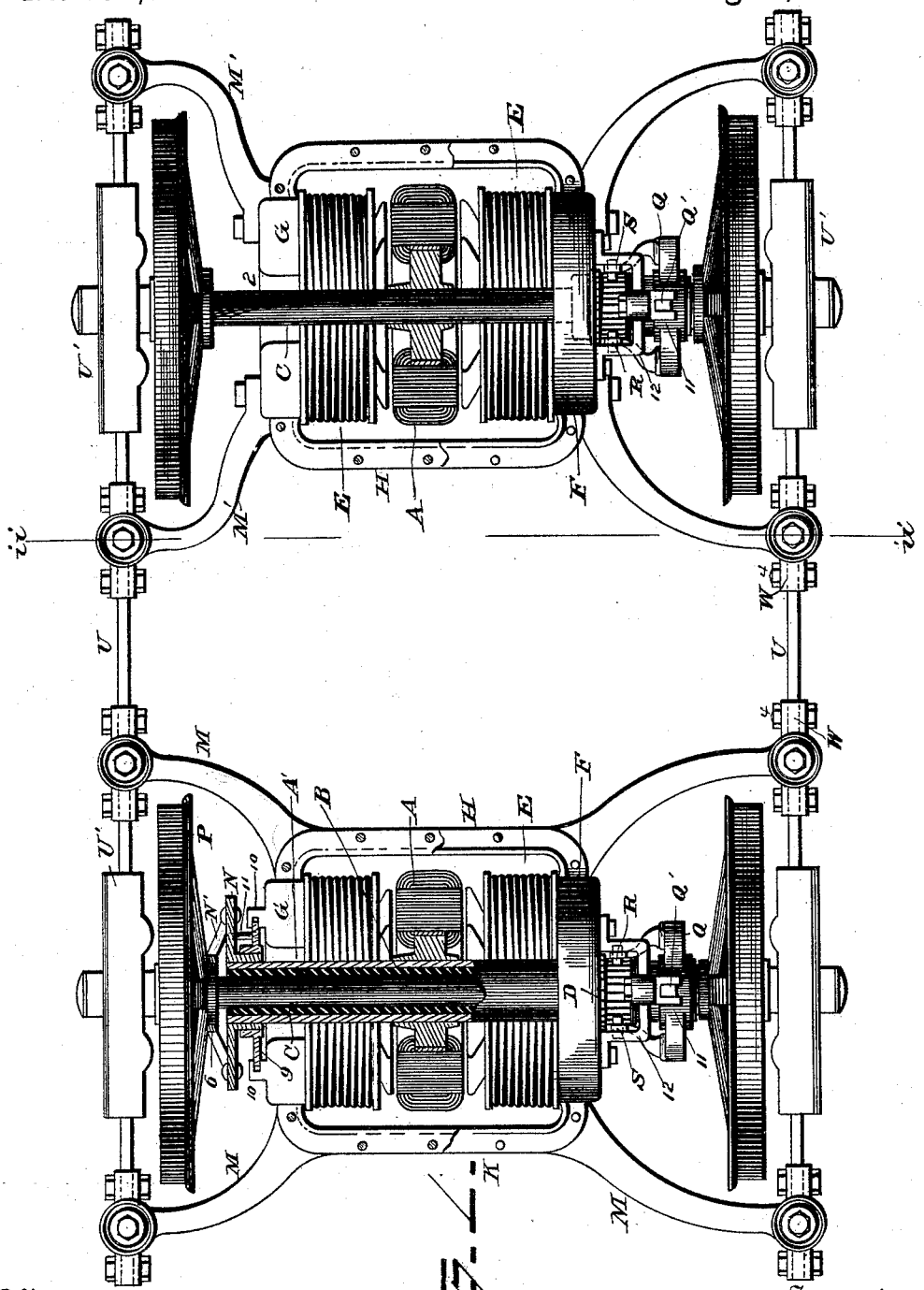
(No Model.) 3 Sheets—Sheet 1.

S. H. SHORT.

CAR PROPELLED BY ELECTRICITY.

No. 456,970. Patented Aug. 4, 1891.



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(No Model.) 3 Sheets—Sheet 2.

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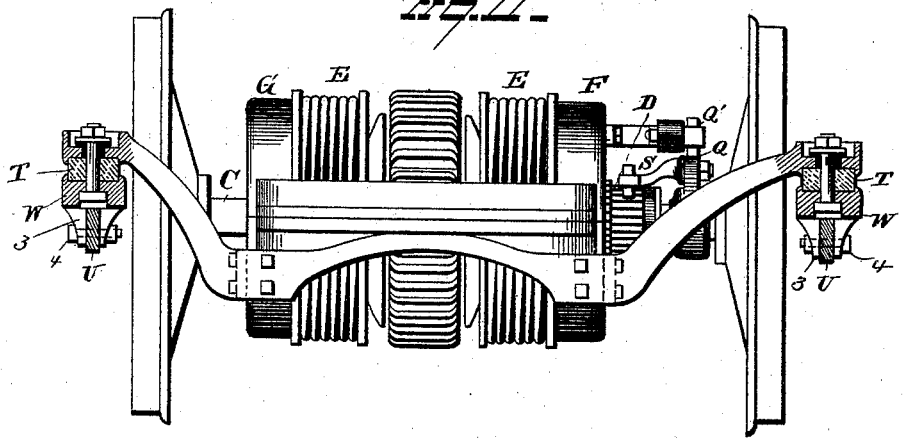
Fig. II.



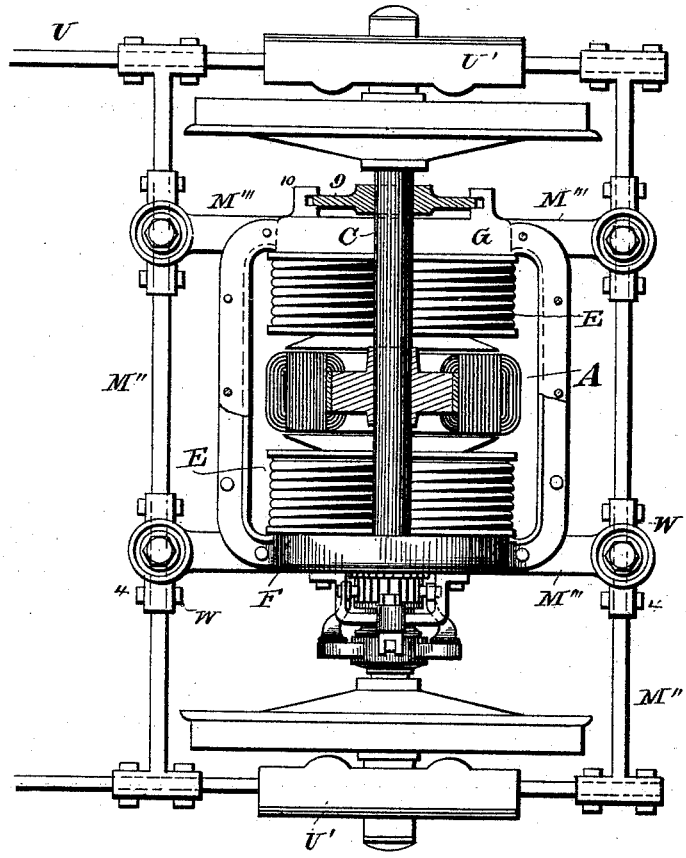


Fig. IV.

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(No Model.) 3 Sheets—Sheet 3.

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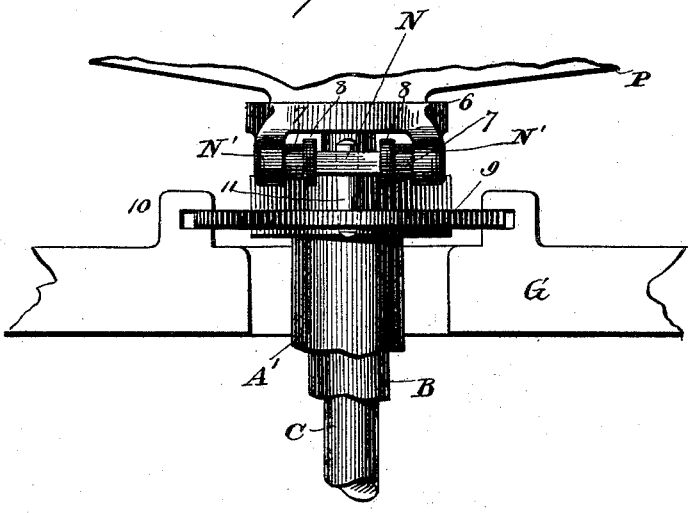
Fig. V.



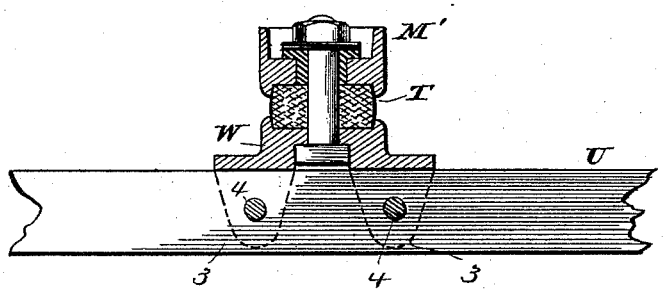


Fig. III.

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UNITED STATES PATENT OFFICE.

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CAR PROPELLED BY ELECTRICITY.

SPECIFICATION forming part of Letters Patent No. 456,970, dated August 4, 1891.

Application filed December 15, 1890. Serial No. 374,741. (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 Cars Propelled by Electricity; 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 cars propelled by electricity in which the armature of a propelling-motor is axially placed with reference to a driving-axle and is directly connected with the same; but each of the improvements constituting the said 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 driving-axle are coincident, or nearly so, the axial position being best secured by mounting the armature on the car-axle. By "directly connected" is to be understood that the driving connection between the armature and the car-axle is such as to impart one revolution to said axle for each revolution of the armature. It is most easily made by making the armature fast on the car-axle by a key or like means.

In accordance with the present invention the axially-placed and directly-connected armature is combined with field-magnets mounted on the truck-frame or frame supported by the ordinary journals of the car. With this arrangement, if the armature is mounted on the car-axle no special journal-bearings are required for the motor, the ordinary car-journals making the rotative connection between the armature and field-magnets. The invention extends to the support of the field-magnets on any suitable part of the truck-frame; but it is especially intended to make use for such support of side bars connecting the pedestals and journal-boxes of the car-axles. These side bars may be secured to the pedestals, so as to move up and down with the car-body, or they may be secured to the journal-boxes, so as to be independent of the vertical movement of the car-body. They may rest on springs or buffers separate from the car main springs. Side bars of any of these different forms or the like may serve for use in this part of the invention for the support of the field-magnets. Side bars secured to the axle-boxes, so as to be independent of the vertical movements of the cars, have, however, an advantage in diminishing the movements of the field-magnets relatively to the armature.

In accordance with a further improvement the field-magnets are eased of jolting by springs or buffers, which are separate from the main springs of the car and which may be interposed at any point or points between the field-magnets and the wheel-base, as between the field-magnets and their support or supporting-frame, or between the latter and the journal-boxes, or both. Such springs or buffers are included in the invention in connection with a frame in general under the car-body.

The invention also comprises additional improvements which are not restricted to the particular means of supporting the field-magnets, whether on a frame under the car-body, upheld by the ordinary journals of the car or otherwise, or on other suitable support, (as the car-body itself, for example.) These additional improvements include the following: (A) The spring-support of the armature is made independently of the field-magnets, and may be employed with or without a spring-mounting for said magnets. (B) The connection of the armature with the field-magnets, which are movable relatively thereto, is effected by means such as a collar working in a groove or fork or a grooved collar fitting over a projection, whereby the movements of the field-magnets transversely of the armature-axis are permitted and longitudinal movement prevented. This improvement may be employed with or without spring-mounting for either or both the armature and field-magnets. (C) The field-magnets are made adjustable lengthwise of the armature-axis. (D) The insulation from the wheel-base of the vehicle of the armature, as well as the field-magnets, is provided for.

The foregoing constructions, arrangements, and combinations are included in the invention irrespective of the precise form of the motor. The invention, however, covers special

features in regard to this—that is to say, first, the field-magnets are arranged horizontally; second, the field-magnets are placed above (or not materially below) the lowest part of the armature; third, the field-magnets are placed at the sides of the armature parallel with the car-axle; fourth, multipolar field-magnets are employed, the armature being adapted to use with such a field, as by means of cross connections at the commutator; fifth, the field-magnets of the multipolar field are so arranged that the four lowest are equidistant from the lowest point of the armature, two in front and two in rear of the said point. 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 these several 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 I is a partial plan view, partly in horizontal section, of the truck of an electrically-propelled car containing the improvements of the present invention. Fig. II is a section on line *i i* of Fig. I. Fig. III is a detail view. Fig. IV is a partial plan view, partly in horizontal section, of a somewhat different arrangement of frame; and Fig. V is a detail view.

In Fig. I somewhat different mountings are shown for the two motors. This is done for the purpose of saving illustration, as practically the two motors on both axles would be mounted alike, although of course they might 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 in notches in the edges thereof. The armature A is not only axially placed with reference to the car-axle C, but it is mounted thereon, so as to turn therewith without requiring any journal-bearings.

In the motor at the left of Fig. I the armature is fast on a hollow shaft A′, which surrounds the car-axle C, an insulating-sleeve B being interposed. This sleeve B is or may be of soft vulcanized rubber, so as to constitute a spring support or buffer as well as an insulator. In the other motor the armature is mounted directly on the car-axle C. The armature in all the motors is directly connected with the car-axle.

In the motor at the left of Fig. I the direct driving connection is made by forks N on the shaft A′, engaging forks N′, projecting from a collar 6, fast on the hub of a car-wheel P. Spring-pads 7, of, say, soft vulcanized rubber, are interposed between the arms N and the forks N′, the ends of the pads being protected by metal caps 8. The spring-pads of rubber insulate the armature-shaft A′ from the forks N′, and at the same time furnish a yielding connection for driving. The construction of the driver permits the movement of the armature A and shaft A′ relatively to the car-axle by reason of the springiness or yielding nature of the sleeve B. In the motor at the right of Fig. I and in Fig. IV the direct driving connection is through the mechanical means by which the armature is made fast on the car-axle.

The field-magnets E are arranged symmetrically in a horizontal position above (or not materially below) the lowest point of the armature parallel with the car-axle. They are (as represented) eight in number, and form a multipolar field of four poles, each pole being constituted by the 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 part of the armature, those of one polarity in front and those of the opposite side in the rear of said lowest part of the armature. The field-magnets E project from yokes F G, which are mounted on side bars U of the truck-frame, which is a frame supported by the ordinary journals of the car. As shown, the side bars U are secured to the journal-boxes U′, so that they do not partake of the vertical movements of the car-body. They could be secured to pedestals, as in known forms of trucks. The yokes have openings 2 in the middle for the passage of the car-axle C, and they are joined together by connecting-arms H and K. To facilitate the placing of the field-magnets in position, the frame F G H K is made in two parts. The supports by which the field-magnets are mounted on the side bars U are attached to the lower half of the frame. They may be made integral with the motor-frame, as indicated at M on the left-hand motor of Fig. I, or they may be fastened thereto in any suitable way. In the right-hand motor of Fig. I they are formed by cross-bars M′, bolted to the yokes F G and underlying the arms H and K. The middle part under the said arms might be omitted. The supports M or M′ might rest directly on the side bars U; but to relieve the jar, springs or buffers T are interposed. Heads or plates W are fastened to the bars U, as by the forks 3 and bolts 4. Thus the field-magnets are supported from the ordinary journals of the car by a frame below the car-body. They are further spring-mounted on their individual springs or buffers separate from the main springs which support the car-body. The same springs or buffers could be interposed between the field-magnets and any supporting-frame below the car-body without necessarily having said frame upheld by the ordinary journals of the car.

To prevent the motion of the field-magnets relatively to the armature lengthwise of the axis of the latter and at the same time permit transverse movements, a collar 9 is shown on the hollow shaft A′, engaging the grooved or forked ears 10 on the yoke G. A similar collar could of course be used on the car-axle in

the other motors whether the field-magnets are or are not spring-mounted. The collar 9 is shown as screwed on its support and may be turned to regulate the position of the field-magnets relatively to the armature by adjusting said magnets lengthwise of the armature-axis. A pin 11 is shown for preventing the accidental turning of the collar after an adjustment has been made.

The commutator D is fast on the hollow shaft A′ or on the car-axle C and rotates in contact with brushes R and S, which are placed ninety degrees apart for the four-pole field shown. The brushes R and S are mounted on a collar Q, which is journaled on the hollow shaft A′ or on the car-axle C, and has an arm Q′, which works in a slot in a wrist-pin 11, pivoted in the bracket 12 on the yoke F. The current is supplied to and cut off from the motor in any known or suitable way.

In Fig. IV the cross-bars M″ are fastened at the ends to the side bars of the truck-frame, and the motor-frame has projections M‴, which rest on said cross-bars, springs or buffers being interposed, as between the supports M or M′ and the cross-bars U in prior figures. The armature and field-magnets only are shown in this view in addition to the motor-frame and its supporting means, the commutator and brushes being omitted. They are or may be the same as previously described.

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 therewith 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, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle, and field-magnets mounted on side bars connecting the pedestals and journal-boxes of the car and upheld by said journal-boxes independently of the car-body and the main car-springs, substantially as described.

2. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and directly connected with said axle, and field-magnets spring-mounted on a frame below the car-body, substantially as described.

3. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and directly connected with said axle, and field-magnets spring-mounted on side bars connecting the pedestals and journal-boxes of the car-axle below the car-body, substantially as described.

4. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and directly connected with said axle, and field-magnets spring-mounted on a truck-frame upheld by the journal-boxes of the car independently of the car-body and the main car-springs, substantially as described.

5. The combination, with a car, of a propelling-motor comprising an armature upheld by springs or buffers independently of the field-magnets, said armature being mounted on or axially placed with reference to a driving-axle and connected directly with said axle, substantially as described.

6. An electric motor having the armature upheld by springs or buffers independently of the field-magnets, substantially as described.

7. An electric motor having the armature and field-magnets upheld independently on springs or buffers, substantially as described.

8. The combination, with a car, of a propelling-motor having its armature and field-magnets upheld independently on springs or buffers, the said armature being mounted on or axially placed with reference to a car-axle and directly connected with said axle, substantially as described.

9. The combination, with a car, of a propelling-motor whose field-magnets are movable transversely to the armature-axis and whose armature is mounted on or axially placed with reference to a car-axle and directly connected with said axle, and means, such as a collar working in grooved or forked ears, whereby transverse movements are permitted and longitudinal movements prevented, substantially as described.

10. The combination, with a car, of a propelling-motor whose field-magnets are movable transversely to the armature-axis and whose armature is mounted on or axially placed with reference to a car-axle and is directly connected with said axle, and means, such as an adjustable collar working in grooved or forked ears, whereby the said field-magnets may be adjusted relatively to the armature while transverse movements are permitted, substantially as described.

11. The combination, with a car, of a propelling-motor insulated from the wheel-base by way of its mounting and driving connection and comprising field-magnets and armature movable relatively to each other transversely to the armature-axis, said armature being mounted on or axially placed with reference to a driving-axle and directly connected with said axle, substantially as described.

12. The combination, with a car, of an armature axially and elastically mounted on and insulated from the car-axle and having a

direct insulating connection with said axle for driving the same, and field-magnets independently mounted, substantially as described.

13. The combination, with a car, of a propelling-motor comprising a spring-held armature axially mounted on a driving-axle and connected directly with said axle, and field-magnets mounted on a truck-frame or frame supported by the ordinary journals of the car, substantially as described.

14. The combination, with a car, of a propelling-motor comprising a spring-held armature axially mounted on a driving-axle and connected directly with said axle, and field-magnets mounted on a frame under the car-body, substantially as described.

15. The combination, with a car, of a propelling-motor comprising a spring-held armature mounted on or axially placed with reference to a driving-axle and directly connected with said axle, and field-magnets spring-mounted on a frame below the car-body, substantially as described.

16. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle and field-magnets mounted on a frame under the car-body, and a collar working in grooved ears for preventing motion of said field-magnets lengthwise of the armature-axis, substantially as described.

17. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle and field-magnets mounted on a truck-frame or frame supported by the ordinary journals of the car, and a collar working in grooved ears for preventing motion of said field-magnets lengthwise of the armature-axis, substantially as described.

18. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle and field-magnets mounted on a truck-frame or frame supported by the ordinary journals of the car, and means—such as an adjustable collar worked in grooved ears—whereby the said field-magnets may be adjusted lengthwise of the armature-axis, substantially as described.

19. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle and field-magnets mounted on a frame under the car-body, and means—such as an adjustable collar working in grooved ears—whereby said field-magnets may be adjusted lengthwise of the armature-axis, substantially as described.

20. The combination, with an armature and field-magnets independently mounted on springs or buffers, of means—such as a collar working in grooved ears—whereby the transverse movements of the field-magnets are permitted and their movements longitudinally of the armature-axis is prevented, substantially as described.

21. The combination, with the armature and field-magnets independently mounted on springs, of means—such as an adjustable collar working in grooved ears—whereby the said field-magnets may be adjusted lengthwise of the armature-axis and transverse movements of said field-magnets at the same time permitted, substantially as described.

22. The combination, with a car, of a propelling-motor comprising an armature axially mounted on a driving-axle and connected directly with said axle and field-magnets placed at the sides of the armature and mounted on a truck-frame or frame supported by the ordinary journals of the car, substantially as described.

23. The combination, with a car, of a propelling-motor comprising an armature axially mounted on a driving-axle and connected directly with said axle and multipolar field-magnets mounted on a truck-frame or frame supported by the ordinary journals of the car, substantially as described.

24. The combination, with a car, of a propelling-motor comprising an armature axially mounted on a driving-axle and connected directly with said axle and multipolar field-magnets placed at the sides of said armature and mounted on a truck-frame or frame supported by the ordinary journals of the car, substantially as described.

25. The combination, with a car, of a propelling-motor comprising an armature axially mounted on a driving-axle and connected directly with said axle and multipolar field-magnets arranged with the magnets of the lowermost pair of poles equidistant from the lowest point of the armature in front and rear of said point and mounted on a truck-frame or frame upheld by the ordinary journals of the car, substantially as described.

26. The combination, with a car, of a propelling-motor comprising an armature axially mounted on a driving-axle and connected directly with said axle and field-magnets projecting from yokes at the sides of the armature, which yokes are perforated for the passage of the car-axle and mounted on a truck-frame or frame supported by the ordinary journals of the car, substantially as described.

27. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle, field-magnets mounted on a truck-frame or frame supported by the ordinary journals of the car, and a commutator and commutator-brushes mounted on the car-axle by a collar, substantially as described.

28. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said

axle and field-magnets mounted on cross-bars on opposite sides of said axle, said cross-bars being supported at the ends by side bars upheld by the journal-boxes independently of the car-body and the main car-spring, substantially as described.

29. The combination, with a car, of a propelling-motor comprising an armature mounted on or axially placed with reference to a driving-axle and connected directly with said axle and field-magnets spring-mounted on cross-bars on opposite sides of said axle, said cross-bars being supported at the ends by side bars upheld by the journal-boxes independently of the car-body and the main car-springs, substantially as described.

30. In a car propelled by electricity, a truck comprising side bars, which are upheld by the journal-boxes independently of the car-body and the main car-springs, which extend beyond the car-wheels at each end of the truck, and which are provided with motor-holding cross-bars on opposite sides of the corresponding car-axle, substantially as described.

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

S. H. SHORT.

Witnesses:
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JOHN C. DOLPH.