(No Model.) 4 Sheets—Sheet 1.

A. PHILIPSBORN.

ELECTRIC LOCOMOTIVE.

No. 493,942. Patented Mar. 21, 1893.

Fig. 3.

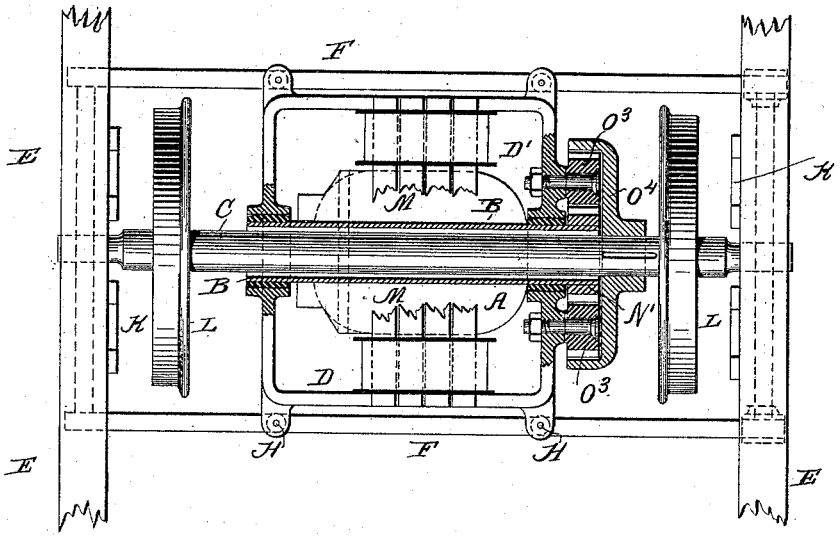
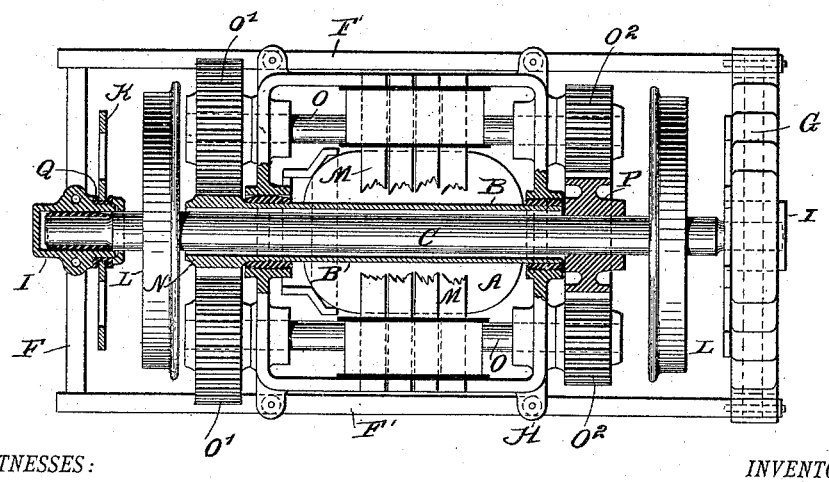


Fig. 1.



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(No Model.)

4 Sheets—Sheet 2.

A. PHILIPSBORN.

ELECTRIC LOCOMOTIVE.

No. 493,942. Patented Mar. 21, 1893.

Fig. 5.

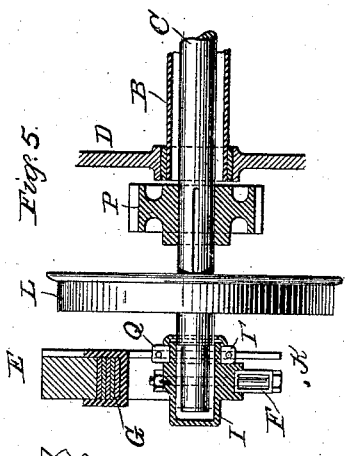


Fig. 4.

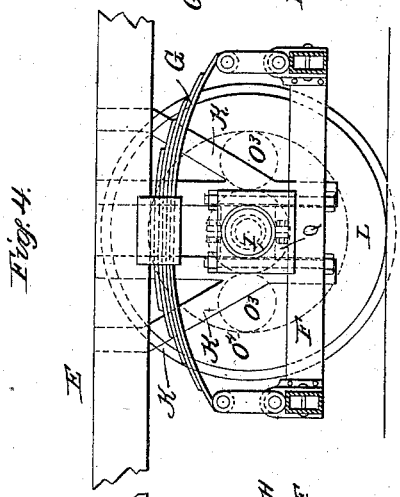


Fig. 7.

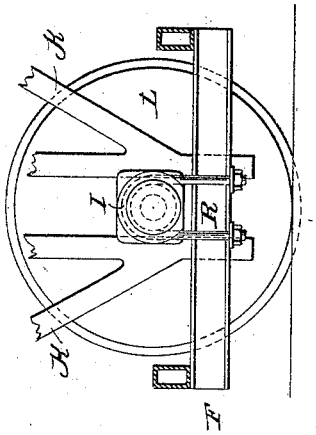


Fig. 2.

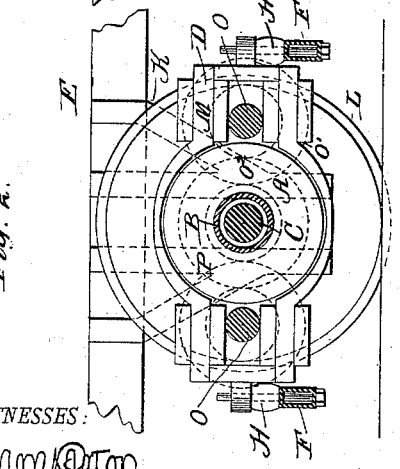
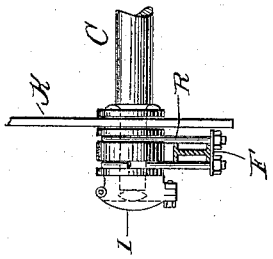


Fig. 6.



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(No Model.)

4 Sheets—Sheet 3.

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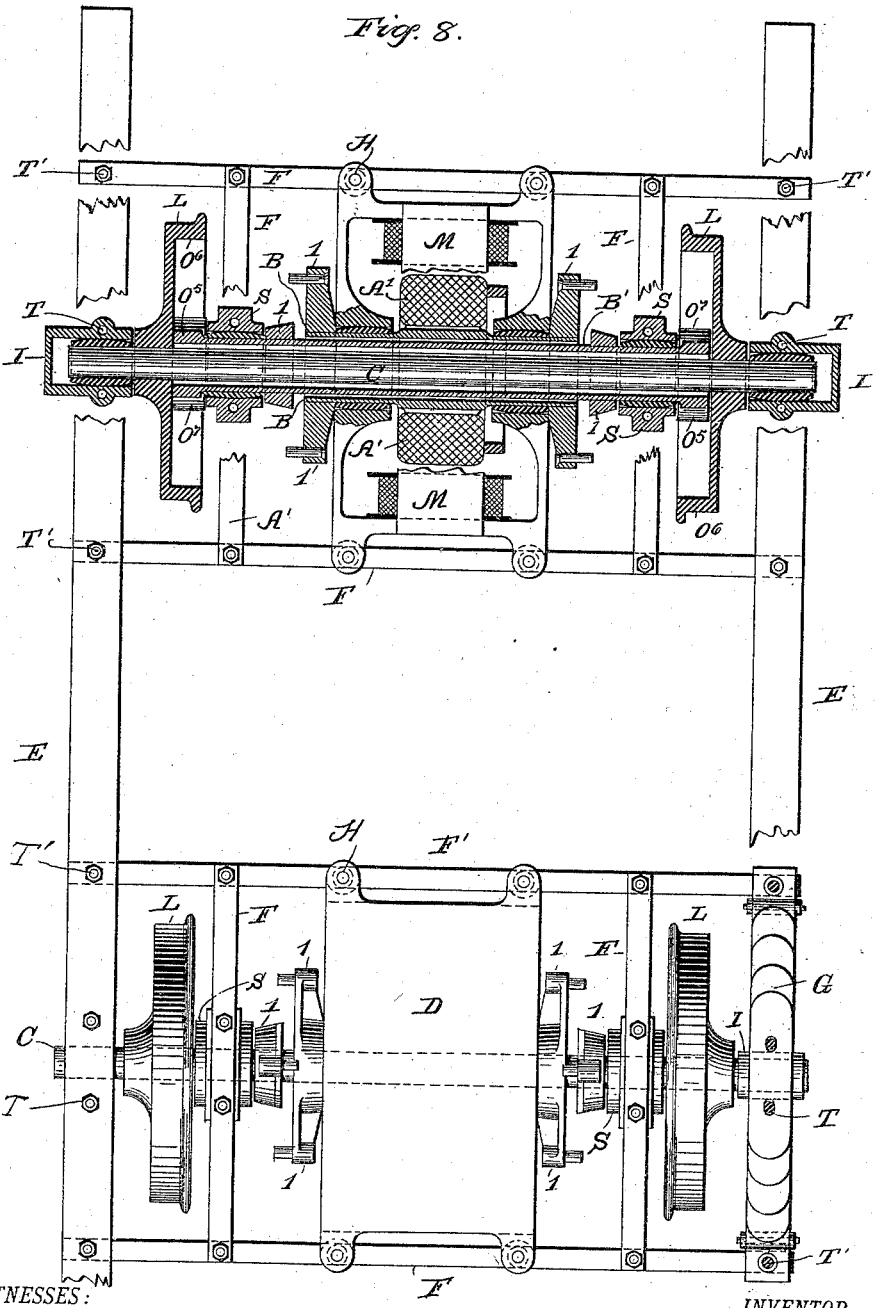
No. 493,942. Patented Mar. 21, 1893.

Fig. 8.



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4 Sheets—Sheet 4.

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No. 493,942. Patented Mar. 21, 1893.

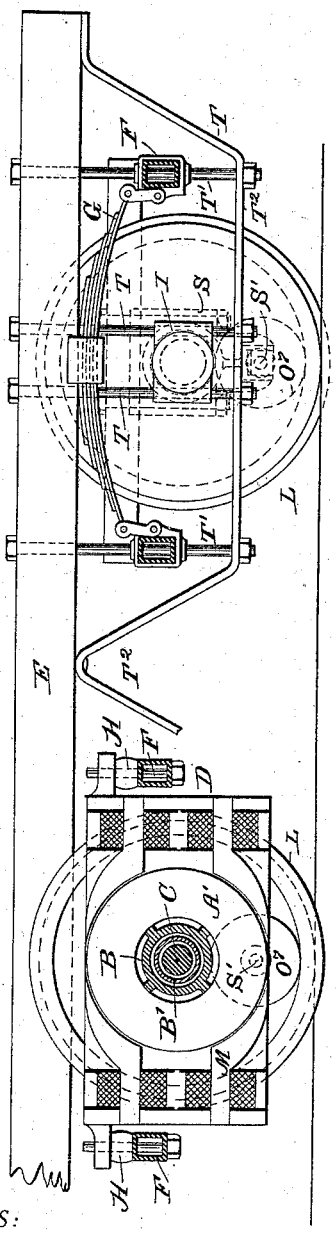

Fig. 9.

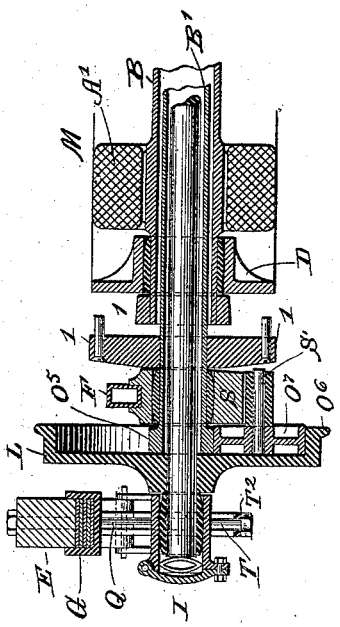

Fig. 10.

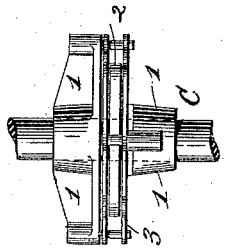

Fig. 11.

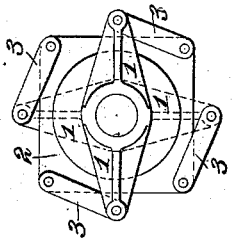

Fig. 12.

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UNITED STATES PATENT OFFICE.

ALEXANDER PHILIPSBORN, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 493,942, dated March 21, 1893.

Application filed April 21, 1892. Serial No. 430,034. (No model.) Patented in Switzerland May 4, 1891, No. 3,563; in Austria-Hungary May 6, 1891, No. 22,273 and No. 43,860; in England May 12, 1891, No. 8,153; in France May 15, 1891, No. 213,494; in Belgium May 15, 1891, No. 94,901, and in Germany August 11, 1891, No. 58,270, October 12, 1891, No. 59,200, and February 17, 1892, No. 61,177.

To all whom it may concern:

Be it known that I, ALEXANDER PHILIPSBORN, a subject of the King of Prussia, residing at the city of Berlin, Prussia, Germany, have invented certain new and useful Improvements in Elastic Suspension of the Motor in Electrically-Operated Vehicles, (for which Letters Patent have been obtained in the following-mentioned countries, viz: Germany, No. 58,270, dated August 11, 1891; No. 59,200, dated October 12, 1891, and No. 61,177, dated February 17, 1892; France, No. 213,494, dated May 15, 1891; Belgium, No. 94,901, dated May 15, 1891; England, No. 8,153, dated May 12, 1891; Switzerland, No. 3,563, dated May 4, 1891; and Austria-Hungary, No. 22,273, Tom. XLI, Fol. 3,200, and No. 43,860, Tom. XXV, Fol. 3,129, dated May 6, 1891;) 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 means for concentrating the arrangement of the electro-motor and its gearing about the car axle, and between the traction wheels, in an electro-motive car, and also establishing a certain elastic connection between the said electro-motor and the car, and also between certain parts of the gearing of the motor for the purposes which will hereinafter appear.

To these ends the invention consists in certain novel features of construction and modifications thereof in the motive apparatus of an electro-motive car such as hereinafter fully described and claimed.

Referring to the accompanying drawings, in which similar letters of reference indicate corresponding parts throughout the several views; Figure 1, is a plan view, partly in horizontal section; showing a construction of my invention wherein the motion is transmitted from the motor to the car axle through externally toothed gearing; and Fig. 2, a cross sectional elevation of Fig. 1. Fig. 3, is a plan view partly in horizontal section showing a modification of construction wherein the arrangement of the transmitting gearing is concentrated by the employment of an internally toothed gear upon the car axle; and Fig. 4, an end view partly in section of Fig. 3. Fig. 5, is a partial cross sectional elevation showing the journal box and the car axle; Fig. 6, a detail view showing the journal box in elevation; Fig. 7, a detail view showing an end view of the said journal box; the construction in Figs. 5, 6, and 7, applying to all of the preceding figures. Fig. 8, is a plan view partly in horizontal section showing a modification of the invention adapted to the employment of frictional power transmitting wheels for imparting motion from the motor to the traction wheels of the car. Fig. 9, is a side elevation partly in section of Fig. 8; and Fig. 10, a partial cross sectional elevation taken through one of the traction wheels and journal box, showing also the motor and its transmission wheels; and Figs. 11 and 12, are plan and end views respectively showing in detail a flexible coupling adapted to permit vertical play between the armature shaft and transmitting shaft in Figs. 8, 9, and 10.

Referring now to Figs. 1 to 7 inclusive, the apparatus consists as follows: L, L, represent the traction wheels; C, the car axle; I, I, the journal boxes thereof; and K, the guard frame depending from the car body or bed sill E, adapted to guide the journal boxes I, vertically in the usual manner. Upon the journal boxes I, I, the truck frame F, is rigidly suspended by means of yokes R, R, as seen in Figs. 6 and 7, and as seen in Figs. 1 and 3, the transverse bars F′, F′ of the truck frame F, support the motor frame D, in which the armature shaft and the shafts of the gearing are journaled and supported. Between the truck frame F, and the bed sill E, of the car, suitable springs G, are interposed to neutralize the usual concussions incident to travel upon the roadway, and between said truck frame F, F′, and the frame D, of the motor there are interposed india rubber or other suitable springs H, having limited elasticity, adapted to relieve the gearing from vibration. The shaft B, bearing the armature A, of the motor M, is tubular, and is concentrically lo-

cated about the car axle C, giving suitable clearance such as to avoid contact therewith within the range of elastic motion of the springs H. The teeth of the gearing have sufficient clearance to allow for the said motion of the springs H without interference with the free transmission of motion.

The gearing in Figs. 1 and 2, consists as follows: N, is the pinion of the armature shaft B; O′, O′, are duplicate spur gears meshing with N; O, O, are the transmission shafts; and O^2, O^2, are transmission pinions mutually engaging with the central spur gear P fixed upon the car axle C.

In the modified construction of gearing in Fig. 3; N′ is the pinion on the armature shaft B; O^3, O^3, are duplicate transmission gears which rotate idly upon gudgeons D′, bolted to the frame D, and which mutually and directly engage with the surrounding internally toothed gear O^4, fixed to the car axle C. In the construction of gearing thus indicated, a suitable reduction of speed is obtained in the transmission of motion from the motor M, to the traction wheels L, while at the same time the location of the said motor is established concentrically with the car axle, thereby minimizing the space occupied by the same and its gearing without the necessity of employing a low speed motor attached directly to axle as adopted heretofore for the same purpose.

In Figs. 4, 5 6 and 7, the feature of permitting a certain degree of oscillatory motion of the frame F, about the car axle C, according to the degree of elasticity of the spring connection G is illustrated, the main difference in the constructions represented in Figs. 4 and 5 and Figs. 6 and 7 being the mode of connecting the truck frame to the journal box I, in Figs. 4 and 5, this being accomplished by bolts, while in Figs. 6 and 7 it is accomplished by the bent strips or ties R. The collar Q which is guided so as to play vertically but non-rotatively in the guard frame K, is made in halves and when united together forms a support wherein the journal box I may oscillate to a limited degree upon its own axis. To this purpose, the journal box I, is circumferentially grooved as seen in Fig. 5, to receive the collar Q, and turn loosely therein. In Fig. 6 the collar Q is dispensed with, the mode of support of the truck frame upon the axle permitting such oscillatory movement. The oscillatory play thereby derived is designed to check the transmission of the vibrations of the gearing to the car, and to impart an elastic impulse to the car in starting the same.

Referring to the construction in Figs. 8 to 12, inclusive, the truck frame F, in lieu of being rigidly and directly connected to the journal boxes I, is supported upon the traction wheels L L, through the agency of the transmitting shaft B′, which is journaled at S, S, in said truck frame F, and through the agency of the frictional power transmitting wheels O^5, O^7, which rest on the said traction wheels and impart rotation to them. The transmitting shaft B′, is rotated by the armature shaft B of the motor, and both of said shafts are tubular and concentrically arranged one within the other and about the car axle C. The frictional transmitting wheels O^5, O^5, upon the extremities of the shaft B′, have perfectly smooth peripheries, and the traction wheels L, L, are provided with internal rims also smoothly finished. The idle frictional transmitting wheels O^7, O^7, are interposed in a vertical line between the peripheries of the wheels O^5 and the said internal rims O^6 of the traction wheels L. One of said wheels O^7 appear more clearly in Fig. 10. The journal boxes I, in this construction are non-supporting, and serve merely as means for keeping the car axle in its proper relative position to the car, and said journal boxes are loosely connected to the vertical guide rods T, T. The truck frame F, is guided during its vertical play by means of depending rods T′, T′, projected from the bed sill E of the car and braced by a suitable yoke frame T^2. The car springs G, are interposed between the frame F, and the bed sill E, as indicated; the same being adapted to yield in the usual manner to the concussions of travel.

The armature shaft B, Figs. 8 to 10 inclusive, gives clearance to the inner tubular shaft B′, sufficient to avoid contact therewith within the range of motion of the springs H, of limited elasticity. Rotative connection is established between the armature shaft B, and the transmission shaft B′, through a flexible coupling more fully illustrated in Figs. 11 and 12. This coupling is adapted to yield to the vertical motions between the said respective shafts according to the play of the springs H. The said coupling consists in two pairs of arms or cranks 1, 1, attached to adjacent portions of each shaft; the arms of one shaft projecting about at right angles to the arms of the other shaft. Between the arms so located there is a disk 2, which is commonly connected to the extremities of all the said arms through links 3, 3, 3, 3, pivoted as indicated. The disk 2, is omitted in Figs. 8 to 10, for the sake of clearness of illustration.

The operation referring to Figs. 1 to 7 inclusive, is as follows: The tubular armature shaft B, journaled in the motor frame D, is maintained in an approximately concentric relation to the axle C; the said position, however, being variable within the limitations of motion of the springs H, interposed between the said motor frame, to which the said axle and the frame F, F′ is journaled in a fixed relation. Such motion of the said armature shaft B, with reference to the axle C, as may be admitted, becomes neutralized through the double meshing points of the gearing, when constructed as in Fig. 1, or as in Fig. 3, to such an extent as to cause non-interference with the rotary transmission.

In operation, referring to Figs. 8 to 12 in-

clusive, the tubular transmission shaft B′, journaled in the truck frame F, will be maintained during travel, in its concentric relation to the car axle C, vertically by means of the transmission wheels O^7, O^7, and horizontally by reason of the horizontal retention of the truck frame F, with reference to the keepers T, T, of the journal boxes I, I, through the agency of guides T′, T′, and yoke T^2. The concentric relation between the shafts B and B′, is variable according to the limited action of the springs H, and such variation is admitted without interference with rotary transmission, by means of the flexible coupling 1, 2, 3, hereinbefore described.

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

1. In an electro-motor car, the combination with the traction wheels, axles, and journal boxes therefor, of a truck frame supported by the traction wheels of the car, an electro-motor, the field-magnets of which are elastically supported upon said truck frame, and the armature shaft of which is concentrically mounted on the car axle but revoluble independently of the same, a car body also elastically supported upon said truck frame and vertically guiding the journal boxes of the axle, and suitable means for transmitting motion from the armature to the traction wheels of the car, substantially as described.

2. The combination in an electro-motor car with the traction wheels, axle, and journal boxes therefor, of a truck frame supported by the traction wheels of the car, an electro-motor, the armature of which is arranged concentric with the car axle and capable of eccentric play relative to the same, and the field magnets of which are elastically supported upon said truck frame, a car body also elastically supported upon said truck frame and vertically guiding the journal boxes of the axle, and suitable means for transmitting motion from the armature to the traction wheels of the car, substantially as described.

3. The combination in an electro-motor car with the traction wheels, axle, and journal boxes therefor, of a truck frame supported by the traction wheels of the car, an electro-motor, the armature of which is arranged concentric with the car axle, and capable of eccentric play relative to the same, and the fixed portion of which is elastically supported upon said truck frame at opposite sides of said axle, a car-body also elastically supported upon said truck frame and vertically guiding the journal boxes of the axle, and suitable means for transmitting motion from said armature to the traction wheels of the car, substantially as described.

4. The combination in an electro-motor car with the traction wheels, axle, journal bearings therefor, and body sills carrying guards by which said journal bearings are vertically guided, of a truck frame elastically connected to the sills, a motor having its field magnets elastically mounted on said truck, and a tubular armature shaft concentric with but revoluble independently of the axle, and suitable means for transmitting motion from the armature to the traction wheels of the car, substantially as described.

5. The combination in an electro-motor car with the traction wheels, axle, journal bearings therefor, and body sills carrying guards by which said journal bearings are vertically guided, of a truck frame elastically connected to the sills, a motor having its field magnets elastically mounted on said truck, and a tubular armature shaft embracing the axle but capable of eccentric play and independent rotation relative to the same, and suitable means for transmitting motion from the armature to the traction wheels of the car, substantially as described.

6. The combination in an electro-motor car with the traction wheels and axle thereof, of a motor provided with a tubular armature shaft concentric with said axle, suitable means for transmitting motion therefrom to the traction wheels, a truck frame supporting said motor and capable of a limited oscillatory motion relative to the axle, and body sills elastically connected to said frame, substantially as described.

7. The combination in an electro-motor car with the traction wheels and axle thereof, of a motor provided with a tubular armature shaft concentric with said axle, gearing for transmitting motion from the motor to the traction wheels, an oscillatory truck frame secured to the journal boxes of the said axle for supporting the said motor and its gearings, and an elastic connection substantially as described between the said truck frame and the body of the car.

8. The combination in an electro-motor car with the traction wheels and axle thereof, of an electro-motor, a tubular transmission shaft surrounding said axle, a tubular armature shaft of the motor surrounding said transmission shaft, and means whereby rotation is imparted from said armature shaft to the transmission shaft, and thence to the traction wheels, substantially as described.

9. The combination in an electro-motor car with the traction wheels and axle thereof, of an electro-motor, a tubular transmission shaft surrounding said axle, a tubular armature shaft surrounding said transmission shaft and capable of eccentric play relative to the same, a yielding flexible coupling for said armature and transmission shaft, radially variable as described, and means whereby motion is imparted to the traction wheels from the transmission shaft, substantially as described.

10. The combination in an electro-motor car with the traction wheels, axle thereof and a tubular transmission shaft surrounding said axle, of a motor having its field magnets elastically supported on a truck supported by the traction wheels of the car, and a tubular armature shaft surrounding said transmission shaft

and capable of eccentric play relative to the same, a yielding flexible coupling between said armature shaft and transmission shaft, radially variable as described, and means whereby motion is imparted to the traction wheels from the transmission shaft, substantially as described.

11. The combination in an electro-motor car with the traction wheels, axle, journal bearings therefor, and a tubular transmission shaft surrounding said axle, of a motor provided with a tubular armature shaft surrounding said transmission shaft, a yielding flexible coupling between said armature shaft and transmission shaft, means whereby motion is imparted to the traction wheels from the transmission shaft, a truck frame elastically supporting said motor, and body sills elastically connected to said frame, substantially as described.

12. The combination in an electro-motor car with the traction wheels, axle, journal bearings therefor, and a tubular transmission shaft surrounding said axle, of a motor provided with a tubular armature shaft surrounding said transmission shaft, a yielding flexible coupling between said armature shaft and transmission shaft, means whereby motion is imparted to the traction wheels from the transmission shaft, a truck frame elastically supporting said motor, and a car body also elastically supported on said truck frame and vertically guiding the journal bearings of the axle in their upward movement, substantially as described.

13. The combination in an electro-motor car with the traction wheels, axle, non-supporting journal boxes therefor, and a tubular transmission shaft surrounding said axle and having frictional transmitting wheels on its ends, connected through transmission wheels with the rim of the said traction wheels, of a truck elastically connected to the car and having journals rigidly supporting the said transmission shaft, a motor having its field magnets elastically mounted on said truck, and having a tubular armature shaft, supported by journals in the said motor frame, and concentric with said axle and power transmission shaft, providing clearance according to the play of the said elastic connection between the said respective frames and between the two tubular shafts thus movable with reference to one another, and a flexible coupling between the armature shaft and the transmission shaft, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

ALEXANDER PHILIPSBORN.

Witnesses:
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MAX WAGNER.