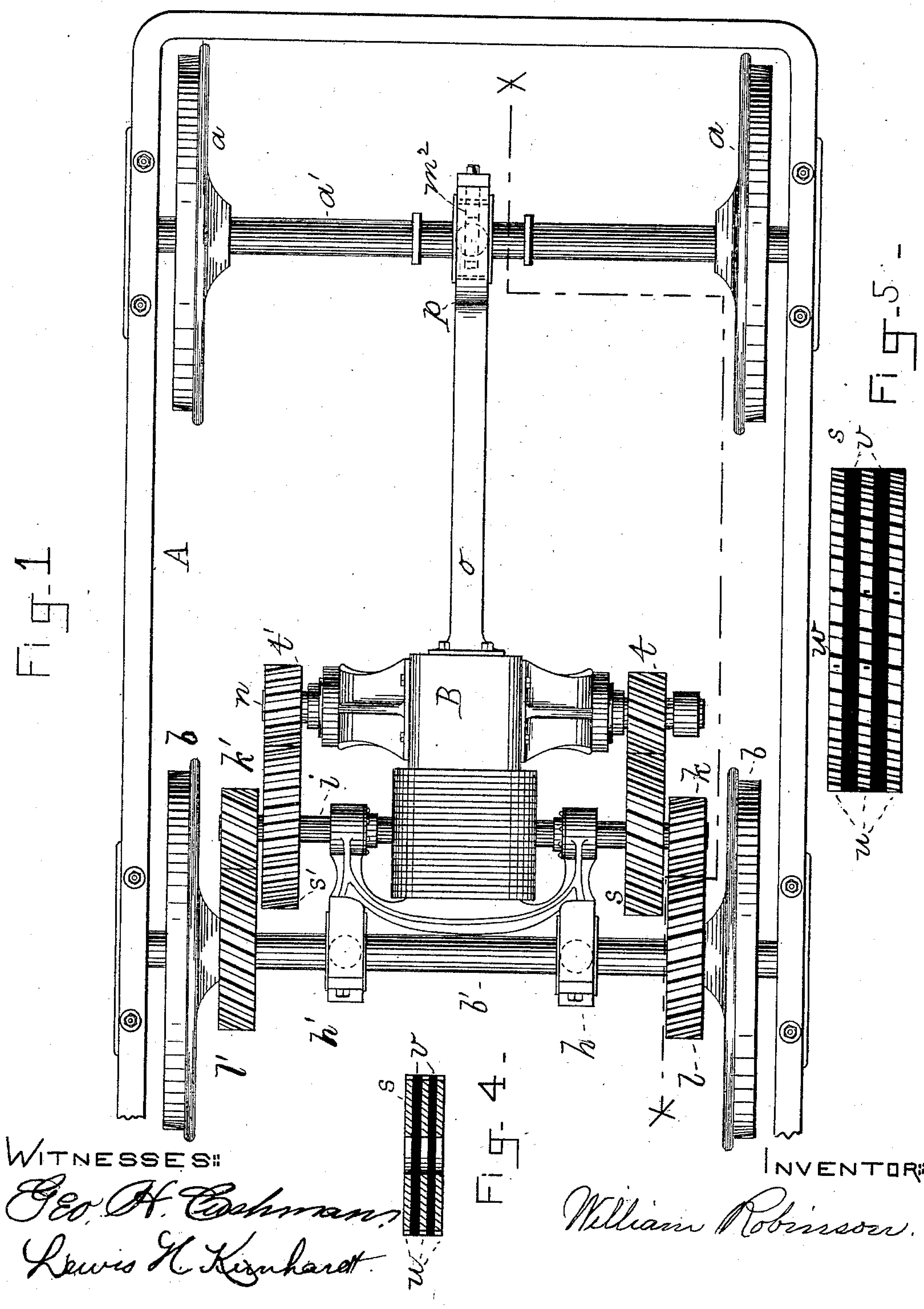
(No Model.)

3 Sheets—Sheet 1.

W. ROBINSON.

ELECTRIC MOTOR CAR.

No. 436,440. Patented Sept. 16, 1890.



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(No Model.)

3 Sheets—Sheet 2.

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Fig-2-

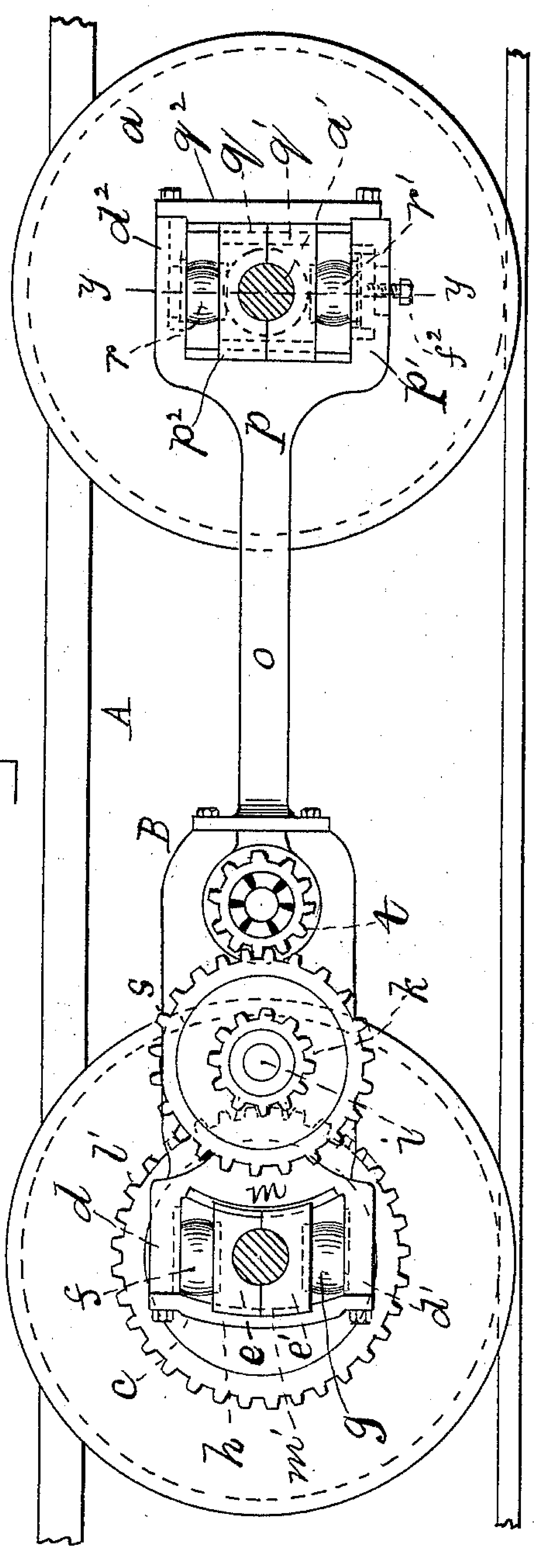
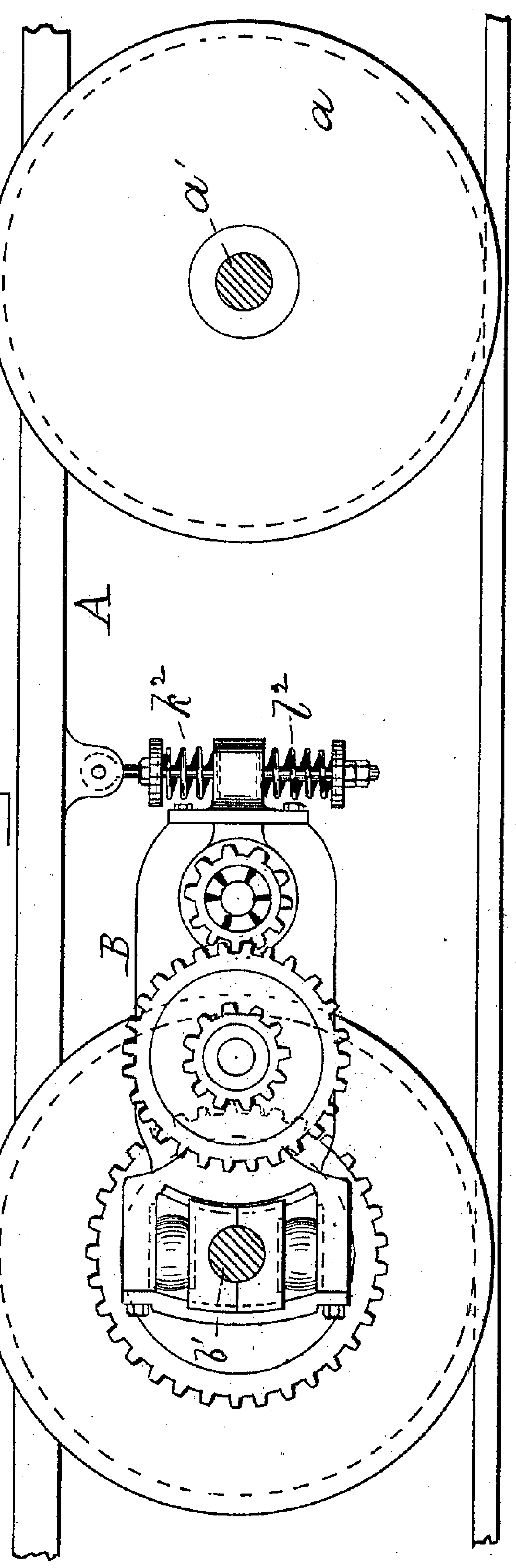


Fig-3-



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(No Model.)

3 Sheets—Sheet 3.

W. ROBINSON.

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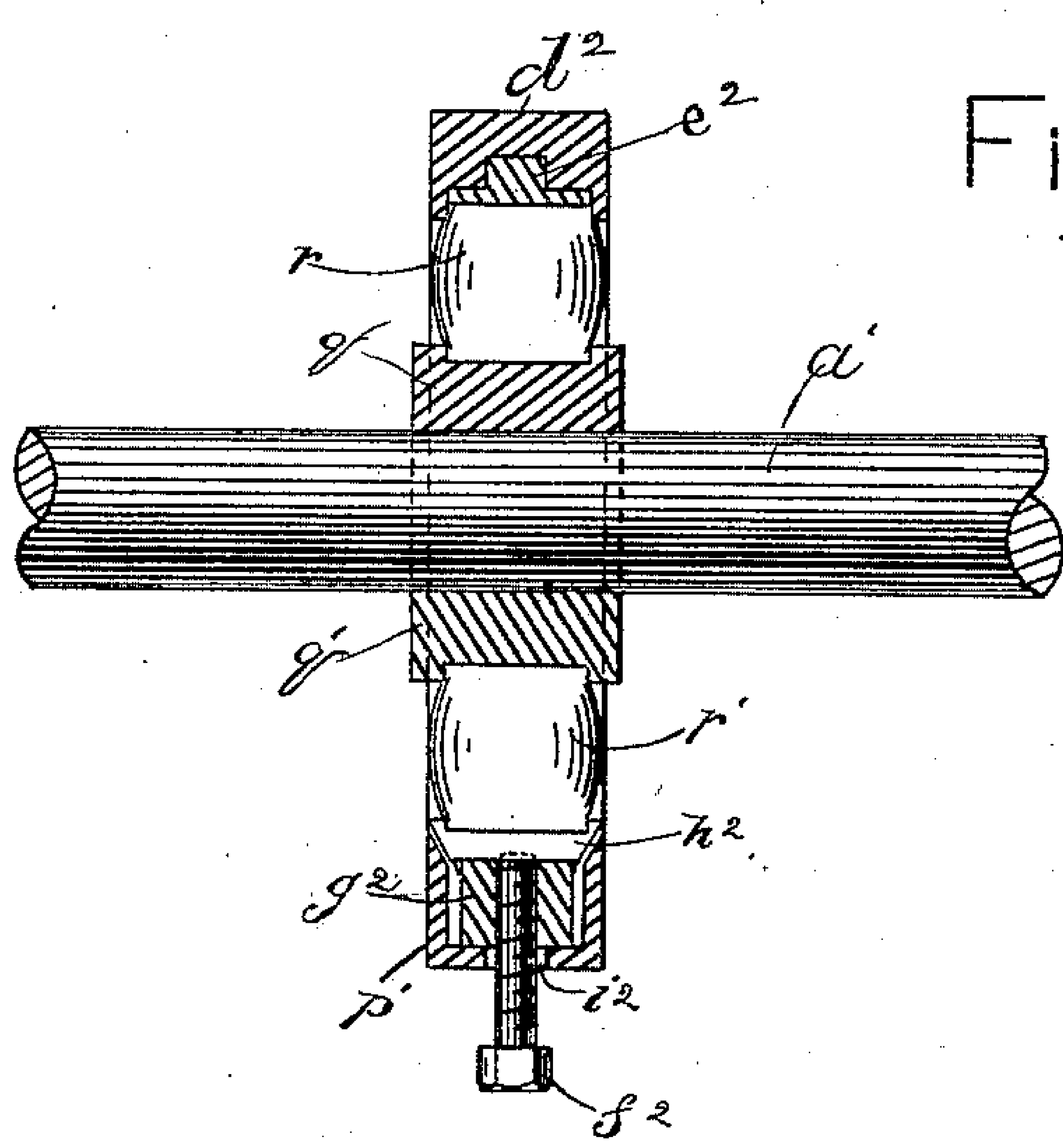

Fig. 6.

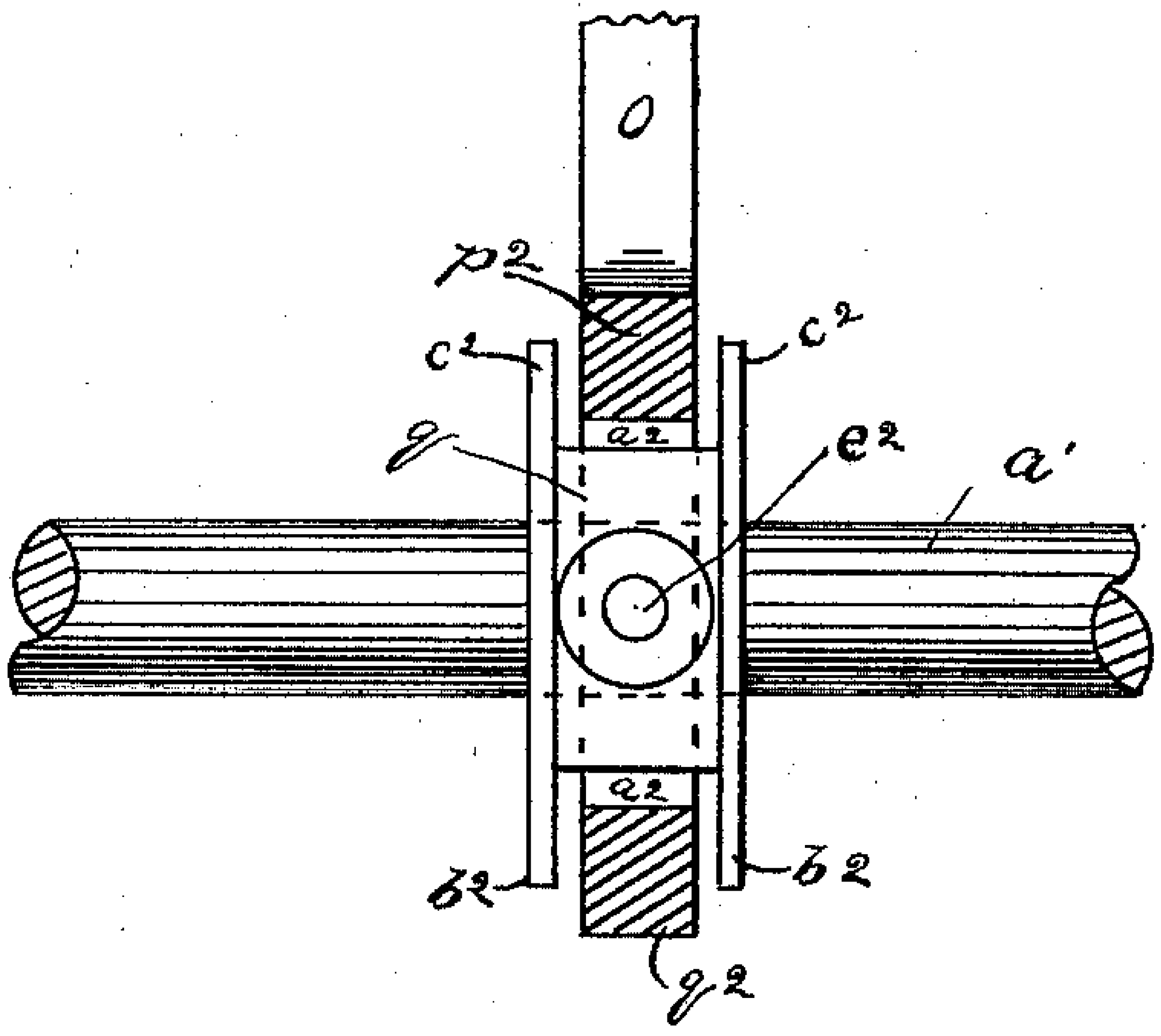

Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM ROBINSON, OF BOSTON, MASSACHUSETTS.

ELECTRIC-MOTOR CAR.

SPECIFICATION forming part of Letters Patent No. 436,440, dated September 16, 1890.

Application filed September 16, 1889. Serial No. 324,156. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ROBINSON, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Electric-Motor Cars, of which the following is a specification.

In electric-motor cars usually the motors are journaled directly to the axles without elasticity. This causes a solid pounding movement of the wheels upon the rails, very destructive to the latter, and also causes a solidity and harshness in riding destructive to comfort. Furthermore, the gear-wheels which drive the car are very noisy and therefore offer a serious objection.

The object, therefore, of my invention is to overcome the above-named objections.

The nature of my invention will be understood from the description which follows, reference being had to the accompanying drawings, which form a part of this specification, in which—

Figure 1 is a top view of an electric-motor truck illustrating my invention. Fig. 2 is a side elevation of the same, partly in section, through the line *x x*, Fig. 1. Fig. 3 is a similar view illustrating a modified method of flexibly supporting the inner or free end of the motor. Fig. 4 is a cross-section illustrating the construction of the intermediate gear-wheel. Fig. 5 is an edge view of the same. Fig. 6 is a section through the line *y y*, Fig. 2; and Fig. 7 is a top view of the pedestal *p* with the top plate of the same removed.

Similar letters of reference indicate corresponding parts in all the figures.

A is a car-truck frame provided with the wheels *a*, connected by the axle *a'*, and the wheels *b*, connected by the axle *b'* in the usual manner.

The motor B, which drives the axle *b'*, is provided with journal-bearings *h h'*, through which one end of said motor is supported flexibly on said axle *b'*. The method of securing this flexible support will be understood by reference to Figs. 2 and 3, in which the motor B is provided with the open or slotted pedestal *c*. Said pedestal *c* embraces the axle *b'* and the journal-boxes *e*, in which said axle is journaled. On the upper part of the journal-boxes *e* is placed the spring *f*, and on this spring rests the upper part *d* of said pedestal *c*. The spring *g* is placed between the lower part *e'* of the boxes *e* and the lower part *d'* of the pedestal *c*.

It will be understood that the journal-bearing *h'* is constructed in every respect exactly like the journal-bearing *h*.

The upper springs of the bearings *h h'*, it is evident, support one end of the motor B flexibly on the axle *b'*, while the lower springs present an elastic cushion against too great a rebound. Thus all movements of said motor relatively to said axle are cushioned by said springs, and consequently elastic.

The inner sides of the pedestal *c*, in contact with the journal-boxes *e*, are formed in curves struck from the center of the shaft *i*, as shown, and the sides of the journal-boxes *e* are formed on curves corresponding to those just described. The pedestal *c* and the boxes *e* are thus arranged to move up and down freely relatively to each other.

It will be observed that the movement of the pedestal *c* in a curve on the journal-boxes *e* keeps the pinions *k k'*, with their shaft *i*, always in the same position relatively to the gear-wheels *l l'*, no matter what up-and-down movement said pedestal may make on the springs *d d'*. The pedestal *c* is kept from lateral movement on the boxes *e* by the flanges *m m'* on said boxes *e* or in any suitable manner.

In the description given *i* is a counter-shaft driven by the armature-shaft *n*, as shown. When convenient or desirable, however, the armature-shaft *n* may take the place of the counter-shaft *i* and gear directly with the gears *l l'* of the driving-axle *b'*. The object of the curved pedestals and journal-boxes is to keep the shaft which directly drives the axle *b'* always in the same position relatively to said axle during any automatic adjustment between said pedestals and journal-boxes, no matter what may be the particular mechanism used to communicate power from said driving-shaft to said axle *b'*. The springs placed above the journal-boxes support the weight of the motor normally, and the lower springs afford an elastic resistance to the sudden raising of the motor from its upper springs by the sudden action of the gears or from other cause.

To the inner end of the motor B is rigidly secured the bracket o, which is provided at its opposite end with the open or slotted pedestal p, which embraces the axle a' and the journal-box q. Said pedestal p rests on the spring r, which is supported by the journal-box q, while the spring r' is inserted between the lower part q' of the box q and the lower part p' of the pedestal p. Thus whether said pedestal vibrates up or down it meets an elastic cushioning resistance on one or other of said springs r r'. That the axles a' b' may have play relatively to each other the pedestal p is free to move back and forth somewhat relatively to the journal-box q. To this end spaces a^2 (see Fig. 7) are left between the sides p^2 q^2 of the pedestal p and the sides of the box q, as shown. The flanges b^2 c^2 of the box q overlap the sides p^2 q^2 of said pedestal p and keep said box and pedestal in proper adjustable position relatively to each other. The axle a' is also free to move endwise in the box q, relatively to the pedestal p, and the upper part or plate d^2 of the pedestal p is free not only to slide on or over the spring-seat e^2, but also to turn or a vertical axis relatively thereto. Thus, while the axle a' supports flexibly one end of the motor B, said axle is allowed free and unobstructed movement in any direction relatively to said pedestal p.

The degree of flexibility allowed to the springs r r' between the axle-box and pedestal is regulated by the screw f^2, which screws into the plate g^2 and presses against the spring-seat h^2. The lower part or plate p' of the pedestal p forms a shoulder and sliding seat n^2 for the plate g^2, and said lower plate p' of the pedestal is provided with a slot i^2, through which the adjusting-screw f^2 passes. Thus said plate p' of the pedestal p is free to move in any direction relatively to the axle without regard to the screw f^2, passing through said pedestal-plate.

In Fig. 3 the inner end of the motor B is supported flexibly from the truck-frame A by the springs k^2 l^2, as shown.

The gear-wheels l l', secured to the axle b', have their teeth cut diagonally across their peripheries. The teeth of these two wheels incline in opposite directions, as shown—that is, the teeth of the two wheels extended would meet each other on an angle. The pinions k k', respectively, on the counter-shaft i have their teeth also cut diagonally and in opposite directions to mesh with the gear-wheels l l'. In like manner the pinions t t' on the armature-shaft n, having teeth cut diagonally in opposite directions, mesh, respectively, with the diagonally-cut gear-wheels s s' on the counter-shaft i.

It will be observed that the two corresponding gear-wheels on each shaft have their teeth cut, respectively, at opposite angles. When gear-wheels having their teeth cut diagonally, as described, are meshed and run at speed, the driving-tooth engages the one driven by touching it first at one corner and gradually moving the contact along over the whole side of the tooth. This movement causes the gearing to run with comparatively little noise. If only one diagonally-cut gear-wheel were used on a shaft, the side pressure of its mate on the diagonally-cut teeth would cause an end movement of said shaft and corresponding end or side pressure on the journal-boxes. This end pressure, however, is entirely obviated and perfectly-even running of the shaft secured by putting at least two gear-wheels on each shaft and cutting their teeth, respectively, on angles running in opposite directions, as shown.

Figs. 4 and 5 illustrate a construction of the gear-wheels which still further diminishes their noise. In this case the wheel is composed of alternate layers of metal and vulcanized fiber or other substance answering as a damper and absorber of sound. The layers u are metal and the layers v are fiber. These layers are firmly secured together by riveting or otherwise, and the teeth w are cut diagonally across the periphery of the wheel, cutting both the metal and the fiber at an angle, as shown. The metal affords strength, and the fiber acts as a damper and absorber of sound, and at the same time causes a softness of touch between the meshing gear-wheels. The diagonal cut of the teeth on this compound wheel makes it much more noiseless than a similarly-constructed wheel with teeth cut in the usual manner would be, since the teeth of the wheels gearing together mesh and interlock gradually, as already described, insteadof suddenly and with a blow on the whole side of the tooth, as is the case when the teeth are cut straight across the periphery of the wheel.

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

1. The combination, substantially as described, of a motor car or truck, a motor arranged to drive the same, and curved guides between said motor and the axle which it drives, said motor being flexibly supported by said axle and adjustable in the line of said curved guides.

2. The combination, substantially as described, of a motor car or truck and a motor arranged to drive the same, said motor being provided with curved pedestals or guides and supported flexibly by springs on the axle which it drives, said motor moving adjustably on said axle and springs in the line of said curved guides.

3. In a motor car or truck, the combination, substantially as described, of a motor arranged to drive said car or truck, curved pedestals or guides secured to said motor, a journal box or boxes on the axle driven by said motor, said journal-boxes having sides curved to correspond to the curvature of said pedestals or guides, and springs supporting said motor on said curved journal-boxes, said motor having a curvilinear adjustment on said journal-boxes relatively to said axle.

4. In a motor car or truck, the combination, substantially as described, of the driving-axle, the motor supported flexibly on said axle and arranged to drive the same, a shaft arranged to convey or transfer power to said driving-axle, and means for causing a flexible adjustable movement in a curve between said motor and driving-axle, whereby the shaft which drives said axle will always retain its normal distance from the same.

5. The combination, substantially as described, of a motor car or truck, a motor arranged to drive the same, springs placed above and below the driving-axle, and curved guides arranged to cause a curvilinear flexible adjustment between said axle and motor.

6. The combination, substantially as described, of a motor car or truck, a motor arranged to drive the same, curved guides arranged to cause a curvilinear adjustment between said motor and the axle which it drives, springs placed above and below said axle, and means for adjusting the tension of said springs.

7. The combination, substantially as described, of a motor car or truck and a motor arranged to drive the same, said motor being supported flexibly on one or more axles of said car or truck, the axle supporting one end of said motor being free to move in a horizontal plane relatively to said motor.

8. The combination, substantially as described, of a motor car or truck and a motor arranged to drive the same, said motor being wholly or partly supported on one or more axles of said car or truck, one of the axles supporting said motor being free to move lengthwise relatively to said motor.

9. The combination, substantially as described, of a motor car or truck and a motor arranged to drive the same, said motor being supported flexibly on the adjacent axles of said car or truck, one of said axles being free to move in a horizontal plane relatively to the pedestal or motor-bar supported by said movable axle.

10. The combination, substantially as described, with two shafts, of gear-wheels arranged to communicate motion from one of said shafts to the other, said gear-wheels being arranged on their respective shafts in pairs, the two wheels of each pair having their teeth formed diagonally on their peripheral surfaces, and the teeth of the respective wheels inclining at an angle toward those of the other wheel of the pair on the same shaft.

11. In a motor car or truck, the combination, substantially as described, of the driving-axle, the motor which drives the same, and gear-wheels arranged to communicate power from said motor to said driving-axle, said gear-wheels being arranged on their respective shafts in pairs, the two wheels of each pair having their teeth formed diagonally on their peripheral surfaces, and the teeth of the respective wheels inclining at an angle toward those of the other wheel of the pair on the same shaft.

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