(No Model.) 5 Sheets—Sheet 1.

H. P. MAXIM.

MOTOR VEHICLE.

No. 594,805. Patented Nov. 30, 1897.

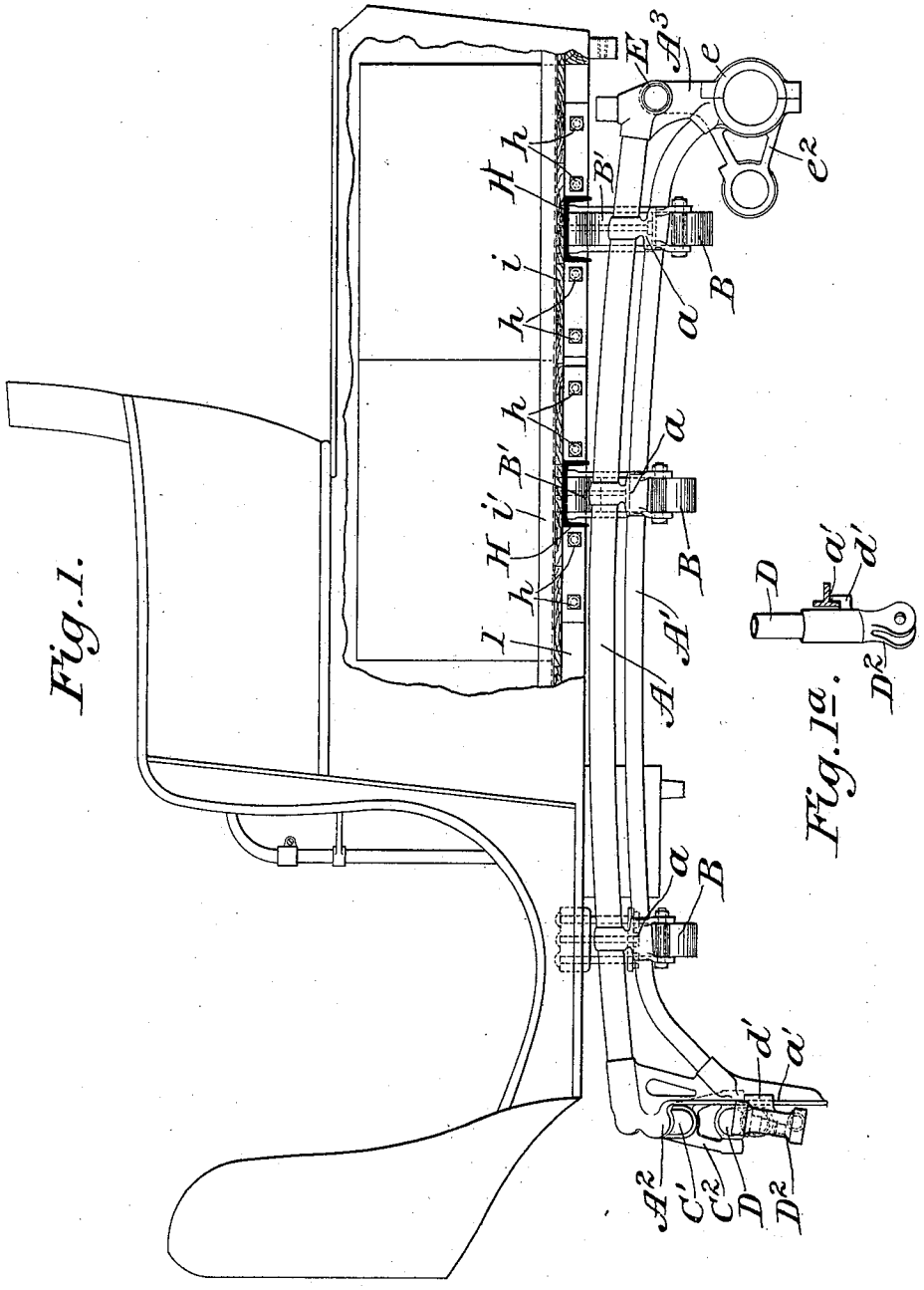

Fig. 1.

Fig. 1a.

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(No Model.) 5 Sheets—Sheet 2.

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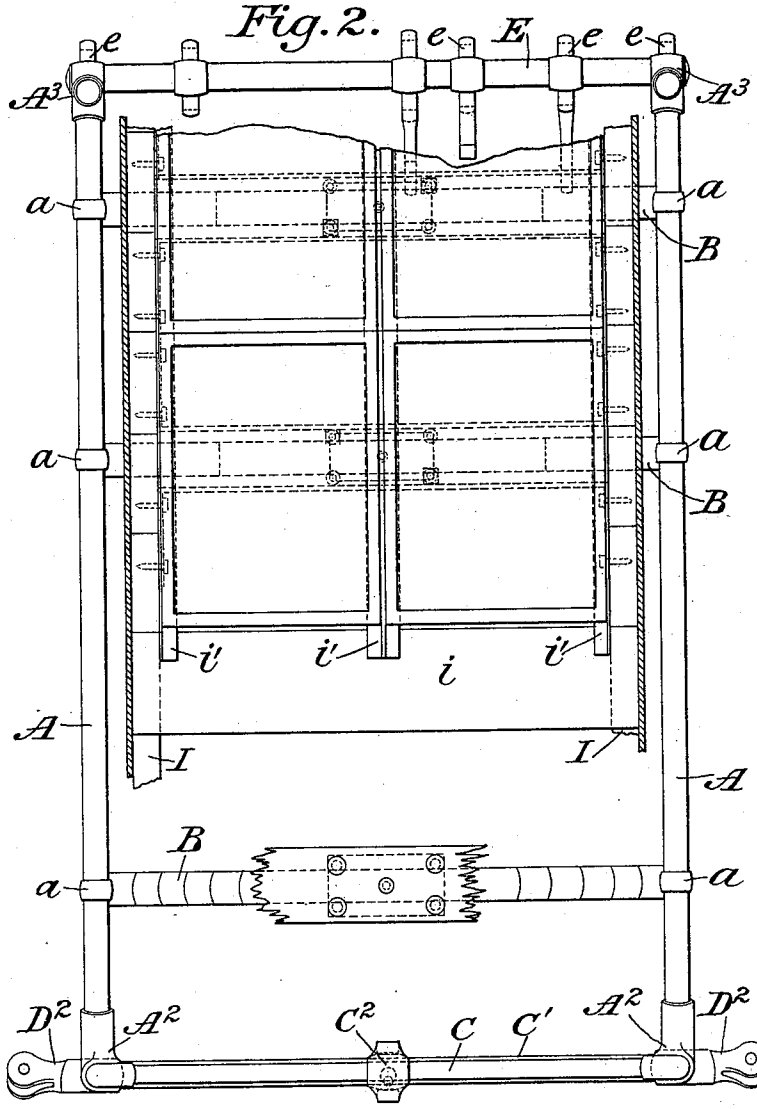
MOTOR VEHICLE.

No. 594,805. Patented Nov. 30, 1897.

Fig. 2.



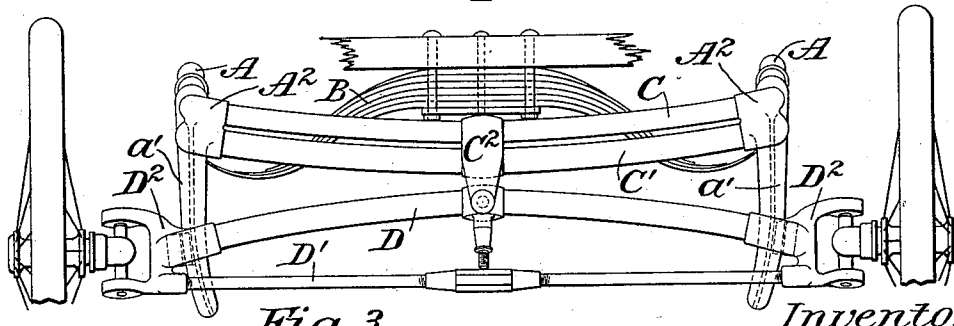


Fig. 3.

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MOTOR VEHICLE.

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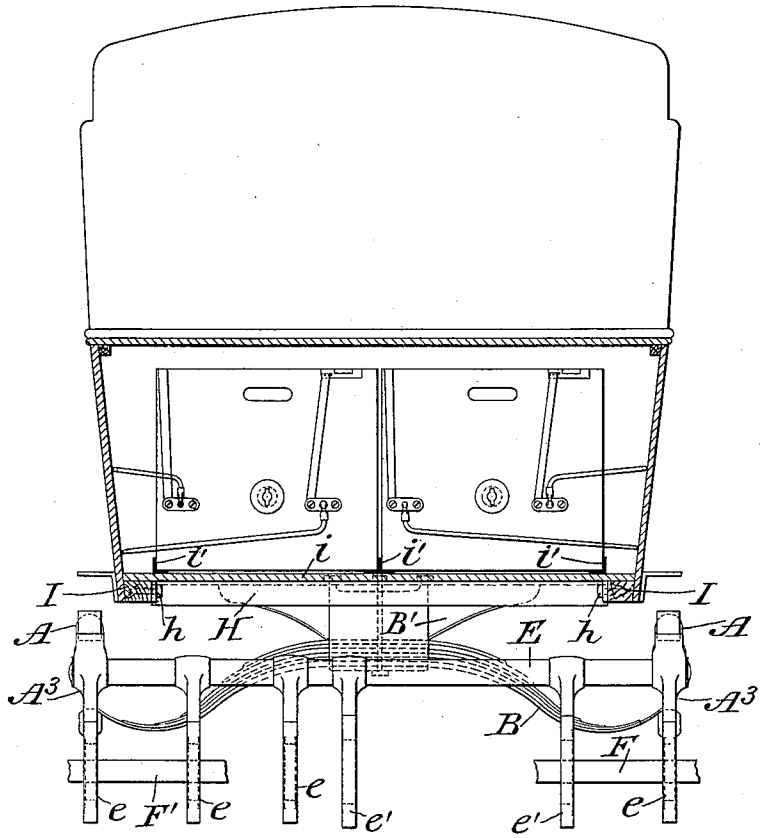
Fig. 4.



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MOTOR VEHICLE.

No. 594,805. Patented Nov. 30, 1897.

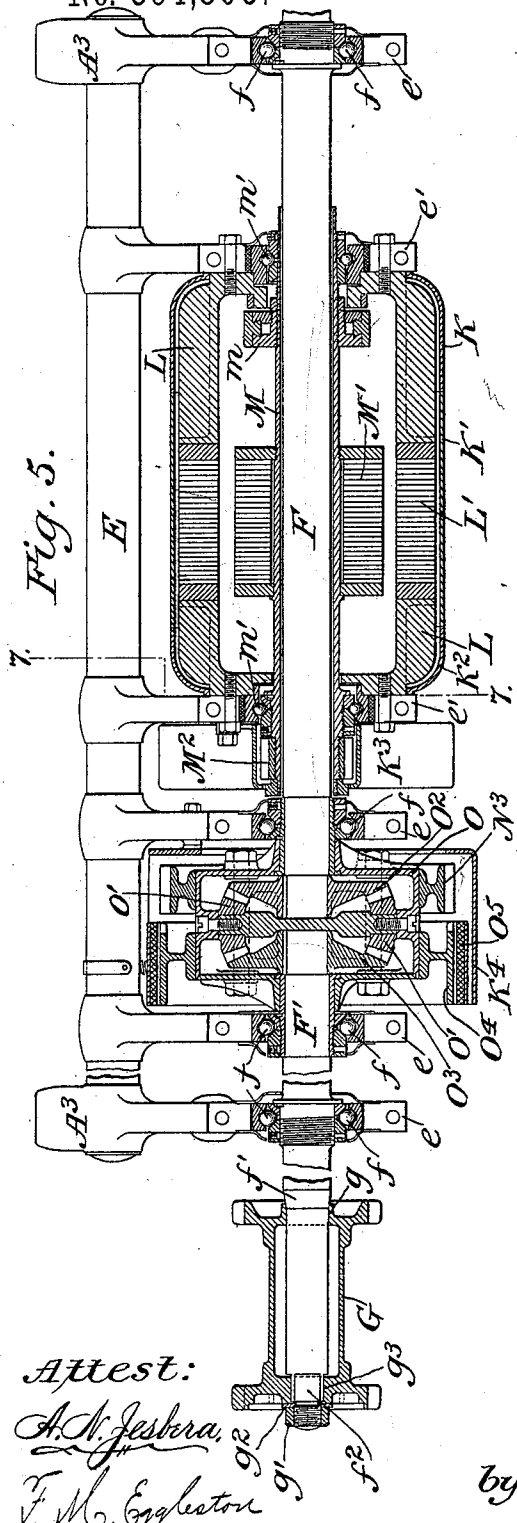

Fig. 5.

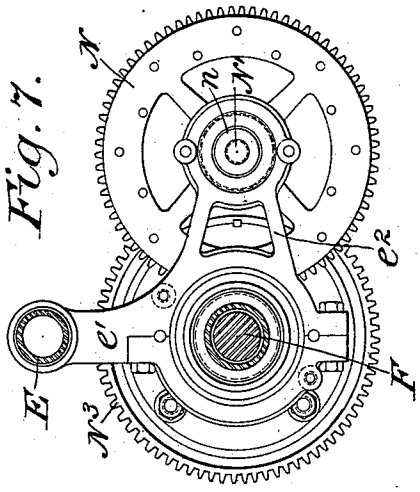

Fig. 7.

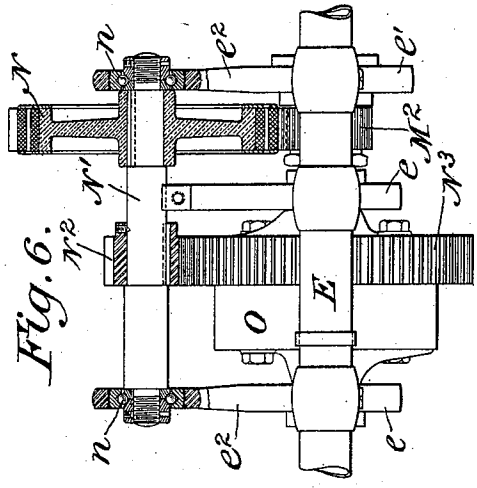

Fig. 6.

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MOTOR VEHICLE.

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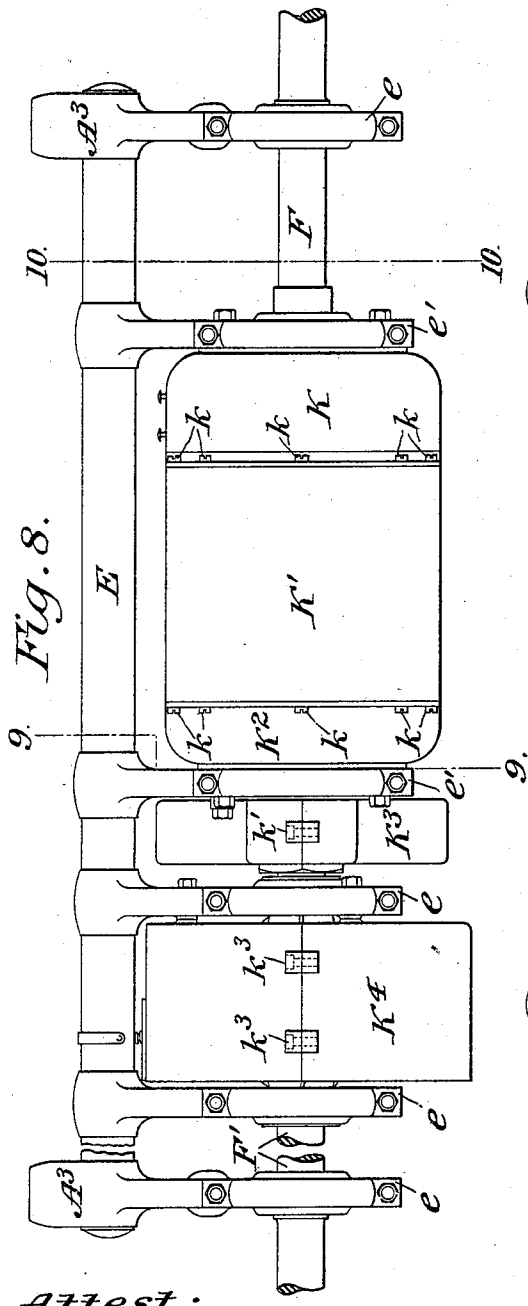

Fig. 8.

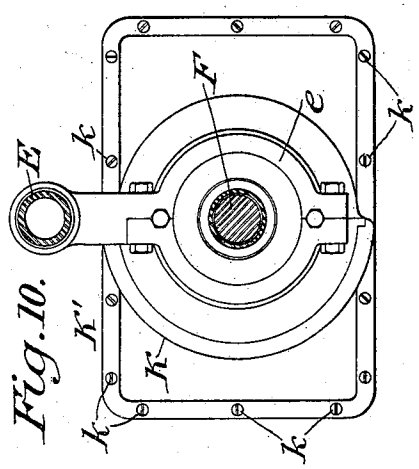

Fig. 10.

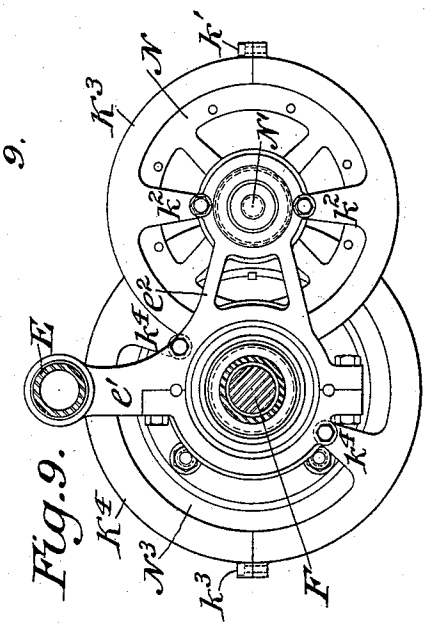

Fig. 9.

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UNITED STATES PATENT OFFICE.

HIRAM PERCY MAXIM, OF HARTFORD, CONNECTICUT.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 594,805, dated November 30, 1897.

Application filed May 3, 1897. Serial No. 634,841. (No model.)

To all whom it may concern:

Be it known that I, HIRAM PERCY MAXIM, a citizen of the United States, residing in the city and county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates in general to the construction of motor-vehicles of that class which are intended for use as road-vehicles or horseless carriages.

One main object which I have had in view in the present invention has been to make the use and care of such vehicles by those who are mechanically unskilful perfectly safe and feasible and free from danger of injury either to the vehicle or to the person through ignorance or carelessness. I have also sought to improve the general construction of such vehicles, so that they shall be better adapted to the conditions of use.

Certain of my improvements relate especially to the means of propulsion, the source of power being an electric storage battery carried by the vehicle; but other features of the invention might be applied to vehicles propelled by other motive power. I have improved the construction of the running-gear to the end that it may be very strong and well adapted to withstand rough usage without being exceedingly heavy. I have also devised efficient and desirable means for supporting the considerable weight of the storage batteries or other source of power.

Another part of my invention relates to the construction and suspension of the motor and the driving connections thence to the driving-shaft of the vehicle. I have also provided novel and desirable means for securing the driving-wheels to the driving-shaft.

The various features of my invention will be more fully described hereinafter with reference to the accompanying drawings, in which they are represented in convenient and practical embodiments as applied together to a suitable vehicle, although it is obvious that they are not necessarily applied to a single structure.

In the drawings, Figure 1 is a side elevation of the vehicle with the wheels removed and with the body partly broken out. Fig. 1ª is a detail view of a clip secured to the front axle. Fig. 2 is a plan view of the running-gear with a portion of the body in horizontal section. Fig. 3 is front end view of the running-gear. Fig. 4 is a rear end view of the running-gear with the body in vertical transverse section and the battery-boxes in elevation. Fig. 5 is a detail view, in sectional elevation, of the rear shaft or axle and the motor and their supports and connections partly broken out to save space. Fig. 6 is a detail view, partly in plan and partly in horizontal section, illustrating particularly the reducing-gears between the motor and the balance-gear on the shaft or axle. Fig. 7 is a section on the line 7 7 of Fig. 5, looking toward the left. Fig. 8 is a view in elevation similar to Fig. 5, but showing the incasing of the motor and gears. Fig. 9 is a section on the line 9 9 of Fig. 8, looking toward the left. Fig. 10 is a section on the line 10 10 of Fig. 8, looking toward the left.

In another application for Letters Patent of the United States, filed June 3, 1896, Serial No. 594,058, I have shown and described in full a motor-vehicle of the same general class as that to which this invention particularly relates. Certain features, particularly those which relate to the manner of attaching the front or steering wheels to the running-gear, are substantially the same as the corresponding features of the vehicle chosen for illustration of the present invention, and therefore need not be particularly described herein. In some respects the present invention may be regarded as an improvement upon the invention disclosed in the said application, while in other respects this invention is wholly independent of said former invention, particularly so far as relates to the means of propulsion, which, as herein shown and described, is an electric motor driven by a storage battery, while in said former application the motor shown and described was of the explosive-engine type.

One part of my present invention relates to the running-gear, which has been designed with a view to securing strength and durability without excessive weight. To this end the side members of the running-gear frame are composed of two rods or bars A and A',

preferably tubular, which are disposed one above the other, substantially in the same vertical plane, and are firmly united at or near their ends to the front and rear end members and to each other, as by means of suitable union-pieces A^2 and A^3. The two rods or bars may also be united at intervals between their ends, as by suitable clips *a a*, which also serve as means of attachment for the springs B B, hereinafter referred to. The two rods or bars thus united by the clips practically form a girder which gives the required strength without excessive weight. I prefer also that both rods or bars A and A′ shall be curved or arched upwardly, substantially as shown in Fig. 1, the lower rod or bar A′ having considerable curvature near its ends to bring it into substantial parallelism with the upper rod or bar A for the greater portion of its length. The end portions thus act as braces or knees to most rigidly support the front crab-jaw and rear driving-shaft bearing, respectively, against horizontal strain. The front end member of the running-gear is also composed, preferably, of two rods or bars C C′, preferably tubular, which are disposed one above the other, substantially in the same vertical plane, and are firmly connected to the side members and to each other at or near their ends by means of the union-pieces A^2, heretofore referred to. The front member is preferably arched or curved downwardly, inasmuch as it is supported by the front axle at its middle, and therefore is better calculated to withstand the strain upon it, while the side members, which are supported at their ends and in turn support the weight of the body between their ends, are better calculated to stand the strain upon them by being arched or curved upwardly. The double construction of each side member and front end member imparts greater rigidity and strength to the frame. The front end member is provided at its middle portion with a bracket or fork C^2, to which is pivoted on a horizontal pivot the front axle. The latter is preferably composed of a tubular rod or bar D, which is curved or arched upwardly, and a tie-rod D′, the said rods D and D′ being united at their ends by suitable union-pieces D^2, which also form the forks for the support of the front wheels, as described in my said former application. As will be understood, the front axle swings to a limited extent in a substantially vertical plane in order to permit the four wheels of the vehicle to adapt themselves to inequalities of the surface of the ground, and as the front wheels are made movable with respect to the front axle for the purpose of steering it is desirable to provide means to prevent swinging of the front axle in a horizontal plane, while allowing free movement in a vertical plane. Therefore the union-pieces A^2 are provided with crab-jaws or substantially vertical extensions *a′*, which stand in rear of the front axle and afford vertical bearing-surfaces for the same. Furthermore, each union-piece D^2 or each end of the front axle is provided with a clip *d′*, brazed or otherwise secured thereto, which is extended around and behind the edge of the adjacent crab-jaw to prevent the front axle from being torn away from its bearing against the crab-jaw when backing up, &c. This allows of a well-braced or webbed crab-jaw without limiting the vertical movement of the axle.

The rear member of the running-gear frame, as represented in Fig. 4, may be a substantially straight bar E, preferably tubular, which is rigidly secured to the union-pieces A^3 and is provided with depending brackets *e e* for the support of the rear shaft or axle F and the motor and intermediate mechanism. In order that the rear wheels may have a certain independence of movement, I prefer that the rear shaft or axle shall be in two independent parts coupled together by a balance-gear of substantially ordinary construction, as more fully described hereinafter, each portion of the shaft being supported in ball-bearings *f* or other suitable bearings in the hangers or brackets *e e*. The rear wheels are affixed directly to the respective portions F and F′ of the rear shaft or axle and may be secured by any suitable means; but I prefer the device shown in Fig. 5, in which the shaft has a taper-shoulder *f′* and a reduced screw-threaded end f^2. The hub G of the wheel has at *g* a taper drive fit upon the taper-shoulder *f′*, and the hub is forced to its seat on said taper-shoulder and there held by a nut *g′* and washer g^2 on the extremity of the shaft or axle, the hub also having at g^3 a seat upon the said reduced portion f^2, the said reduced portion being squared or flattened and the hub being correspondingly formed to fit thereon. The taper drive fit of the hub upon the shaft, however, is mainly relied upon to prevent wear and backlash between the shaft and the wheel.

The springs B B, which may be of usual or suitable character and are preferably disposed transversely, having their ends secured to the side members of the running-gear frame, support the body of the vehicle. In a storage-battery vehicle the body should be constructed and supported with due regard to the very considerable weight of the storage batteries, and I have consequently so arranged the parts that the supports for the main weight should be disposed substantially beneath the center of gravity thereof. Accordingly above each of the two rear springs shown in Figs. 1 and 2, which are disposed at equal distances fore and aft from the vertical plane which passes transversely through the center of gravity of the set of battery-boxes, of which four are represented in the drawings, one of said springs being nearly beneath the centers of the two forward boxes and the other beneath the centers of the two rear boxes, I arrange a channel-iron H or other suitable beam, which rests upon the corresponding spring B or upon a block B′,

which is interposed between them. These channel-irons are bolted or otherwise secured at their ends, as at *h h*, to the side beams or sills I of the body and are in contact with the under side of the flooring *i*, which rests upon said bars or sills. The channel-irons being disposed transversely with respect to the body, I secure upon the flooring (or, it may be, upon the channel-irons, if no flooring intervenes) longitudinal runners *i'*, preferably angle-pieces, of plate metal, which receive and guide the boxes between them, as clearly shown in Fig. 4, and also support the boxes, supporting their longitudinally-distributed weight over their entire length, while they in turn are supported on the channel-irons, so that the entire weight of the battery-boxes is eventually borne by the channel-irons and the springs without excessive pressure or any strain upon the floor or any other part of the body. Moreover, it will be evident that by the described construction the body is subjected to the strain of the weight of the occupants only, and the greatest dead-load (the source of energy) is carried directly on the springs to the side bars and axles and wheels—a great improvement over other vehicles of this class. Except as described herein, the body of the vehicle may be constructed and arranged in any desired manner.

I have found it a great advantage, in order to secure the best results in operation, to have the field and armature coils of the motor mounted concentrically with the shaft or axle driven by the motor. To this end I prefer the arrangement shown in Figs. 5, 6, and 7, in which the shell or frame L, which supports the field-coils L', is represented as bolted to brackets or hangers *e'*, concentric with the axis of the shaft F F', which is supported by the corresponding brackets or hangers *e*, as heretofore described. The armature-coils M' are mounted upon a sleeve or hollow shaft M, which supports the commutator *m*, preferably within the shell L, and envelops the shaft F, concentric therewith, but free therefrom, so that said sleeve and shaft may revolve independently of each other. The sleeve M is supported in suitable bearings *m'*, preferably ball-bearings, in the brackets or hangers *e'*, so that it shall rotate freely and so that the cases or other members of the bearings are practically integral with or otherwise form a part of the field-housing. This insures the perfect concentric rotation of the armature within the housing and therefore within the field. Outside of one of said brackets or hangers *e'* the hollow shaft receives a pinion M^2. The latter engages a large gear N, secured to a counter-shaft N', which is supported to rotate in suitable bearings *n* in arms e^2, which project from two of the hangers *e*. The counter-shaft N' also carries a pinion N^2, which meshes with the large gear N^3 of the differential or balance gear heretofore referred to. This balance-gear forms no part of my present invention, but it may be described, briefly, as comprising a shell O, which carries upon a suitable frame one or more pinions O', which mesh with oppositely-disposed gears O^2 and O^3, which are secured, respectively, to parts F and F' of the rear shaft or axle. The operation of this balance-gear is well known and needs no description herein. I have represented the shell O as provided with a brake-wheel O^4 for coöperation with a band-brake O^5, but the brake mechanism likewise forms no part of my present invention. It will be understood that the counter-shaft N', with its associated gears, constitutes a reducing-gear between the motor and the driven shaft or axle.

The motor and gearing of a motor-carriage of the general class of that indicated in the drawings are particularly exposed to dust and mud and small stones from the roadway, and I therefore prefer to protect them by casings adapted for the special purpose. As shown in Figs. 8 to 10, the motor is entirely incased by a shell of light waterproof material which is made in sections K K' K^2, so that the shell can be removed readily when necessary, the sections being secured together by bolts or screws *k k* or by any suitable means. The outer ends of the sections K and K^2 are reduced to fit upon the hubs of the shell or frame L, which supports the field-coils L', the casing thus being supported by the hangers or brackets *e'* from the rear member E of the running-gear frame. The gear and pinion $N M^2$ are protected by a shell or casing K^3, which is divided in the plane of the axes of the gear and pinion, the two parts being held together by bolts *k'*. The sides may be cut away for lightness, the shell or casing being secured in position by fingers k^2, which are bolted to the bracket e^2, which is supported from the running-gear frame. The pinion and gear $N^2 N^3$ and the balance-gear are likewise protected by a similar shell or casing K^4 in two parts held together by bolts k^3 and having open sides with fingers k^4, by which they are bolted to the brackets *e e*, which are supported from the running-gear frame.

The functions of the several parts of the improved construction herein shown and described have already been set forth sufficiently and require no further or more detailed description herein. It will also be understood that said functions can be performed in whole or in part by devices differing more or less in form and arrangement from those shown in the accompanying drawings, and that I do not desire, therefore, or intend that my invention shall be limited to the precise construction and arrangement of parts which have been shown and described herein for the purpose of explaining the nature of said invention.

I claim as my invention—

1. A running-gear frame for a vehicle having its side members composed each of two rods or bars one above the other, curved or arched upwardly and connected together at

their ends and having a front member curved or arched downwardly and connected to the side members at its ends.

2. A running-gear frame for a vehicle having its side members composed of two rods or bars one above the other, curved or arched upwardly and connected together at their ends, and having a front member curved or arched downwardly and connected to the side members at its ends, and an axle curved or arched upwardly and connected to the front member at its middle.

3. The combination, in a vehicle with a running-gear frame having its front member composed of two rods or bars one above the other, curved or arched downwardly, of an axle pivotally connected to said front member to swing in a substantially vertical plane and vertical bearing-jaws extended downwardly from said front member to support the axle against movement in a horizontal plane.

4. The combination, in a vehicle with a running-gear frame, having its front member composed of two rods or bars one above the other, curved or arched downwardly, of a front axle curved or arched upwardly and pivotally connected to the front member to swing in a substantially vertical plane and vertical bearing-jaws extending downwardly from said front member to support the axle against movement in a horizontal plane.

5. In a motor-vehicle, the combination with the driving shaft or axle having a taper-shoulder and a screw-threaded end, of a wheel having a hub with a taper fit upon said taper-shoulder and a nut to engage the threaded end of said shaft or axle and force and hold the hub upon its seat on said axle.

6. In a motor-vehicle, the combination with a driving shaft or axle having a taper-shoulder and a screw-threaded end with flattened sides, of a wheel having a hub with a taper fit upon said taper-shoulder and formed to fit upon said end with flattened sides and a nut to engage said threaded end of said shaft or axle and force or hold the hub upon its seat on said axle.

7. In a motor-vehicle, the combination with the running-gear frame having a rear member, a driven shaft or axle and a motor, of hangers or brackets supported from said rear member and having bearings for said shaft or axle and hangers or brackets supported from said rear member and having bearings for the armature of said motor, and reducing mechanism between said motor and said shaft or axle.

8. In a motor-vehicle, the combination with the rear member of the running-gear frame, a driven shaft or axle and a motor, of hangers or brackets supported from said rear member and having bearings for said shaft or axle, other hangers or brackets supported from said rear member and having bearings for the armature of the motor, arms projecting from the first-named hangers or brackets, a counter-shaft having bearings in said arms and reducing-gears connecting the armature of the motor, the counter-shaft and the driven shaft or axle.

9. In a motor-vehicle, the combination with the rear member of the running-gear frame, a two-part driven shaft or axle, a balance-gear interposed between the two parts of said driven shaft or axle, two hangers or brackets supported from said rear member and having bearings for each part of said driven shaft or axle, two hangers or brackets also supported from said rear member and having bearings for the armature of said motor and reducing-gears interposed between said armature and said balance-gear.

10. In a motor-vehicle, the combination with the rear member of the running-gear frame, a driven shaft or axle and a motor, of hangers or brackets supported from said rear member and having bearings for said driven shaft or axle, and two hangers or brackets supported from said rear member and having bearings for the armature of said motor and supporting the field-coils of said motor.

11. In a motor-vehicle, the combination with the running-gear frame having a rear member, a driven shaft, a counter-shaft and a motor, of hangers or brackets having bearings for driven shaft, counter-shaft and motor, gears between said motor, counter-shaft and driven shaft, and a two-part casing inclosing the gears between said motor and counter-shaft and secured to said hangers or brackets.

12. In a motor-vehicle, the combination with the running-gear frame having a rear member, a driven shaft, a counter-shaft and a motor, of hangers having bearings for said driven shaft, counter-shaft and motor, gears between said motor, counter-shaft and driven shaft, and a two-part casing inclosing the gears between said counter-shaft and said driven shaft and secured to said hangers or brackets.

This specification signed and witnessed this 29th day of April, A. D. 1897.

HIRAM PERCY MAXIM.

In presence of—
ALBERT P. DAY,
HERMANN F. LUNTZ.