(No Model.)

J. W. HENDERSON.

ELECTRIC CAR.

No. 402,080. Patented Apr. 23, 1889.

FIG. 1

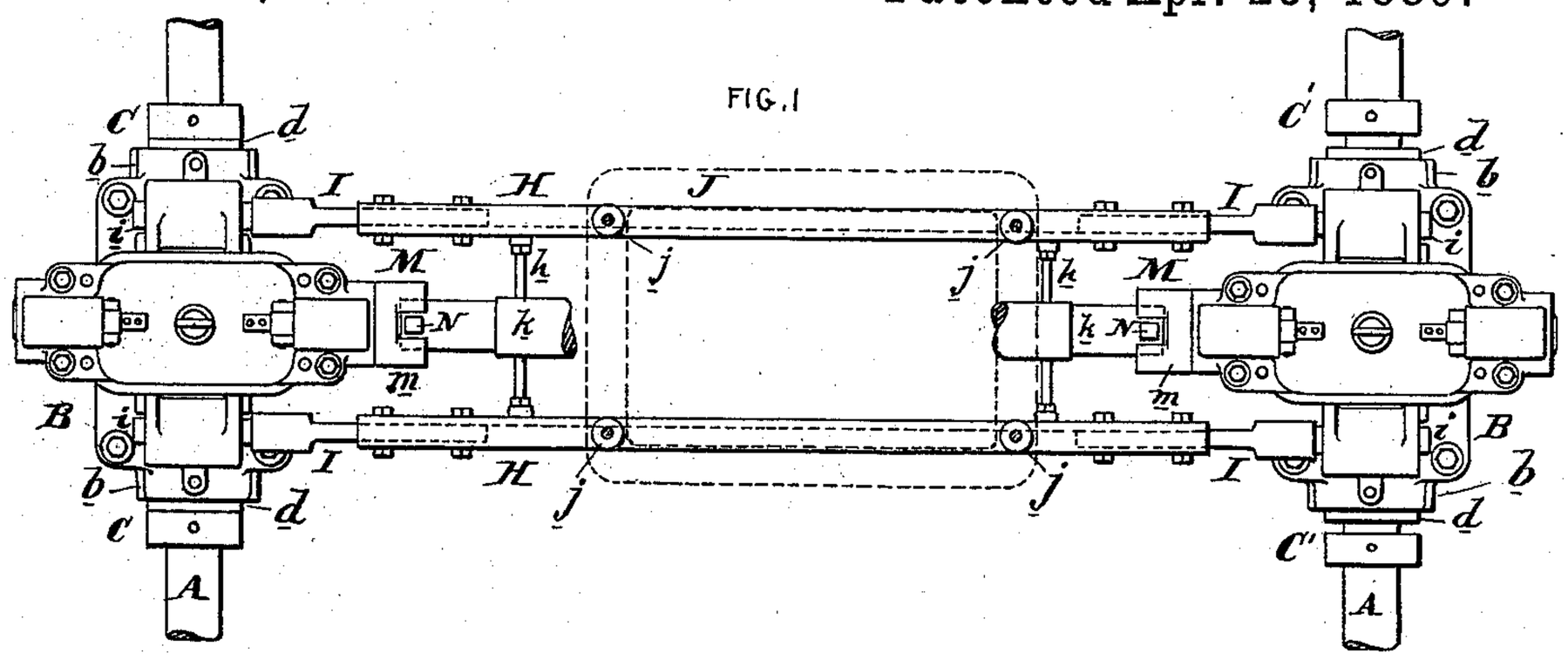


FIG. 2

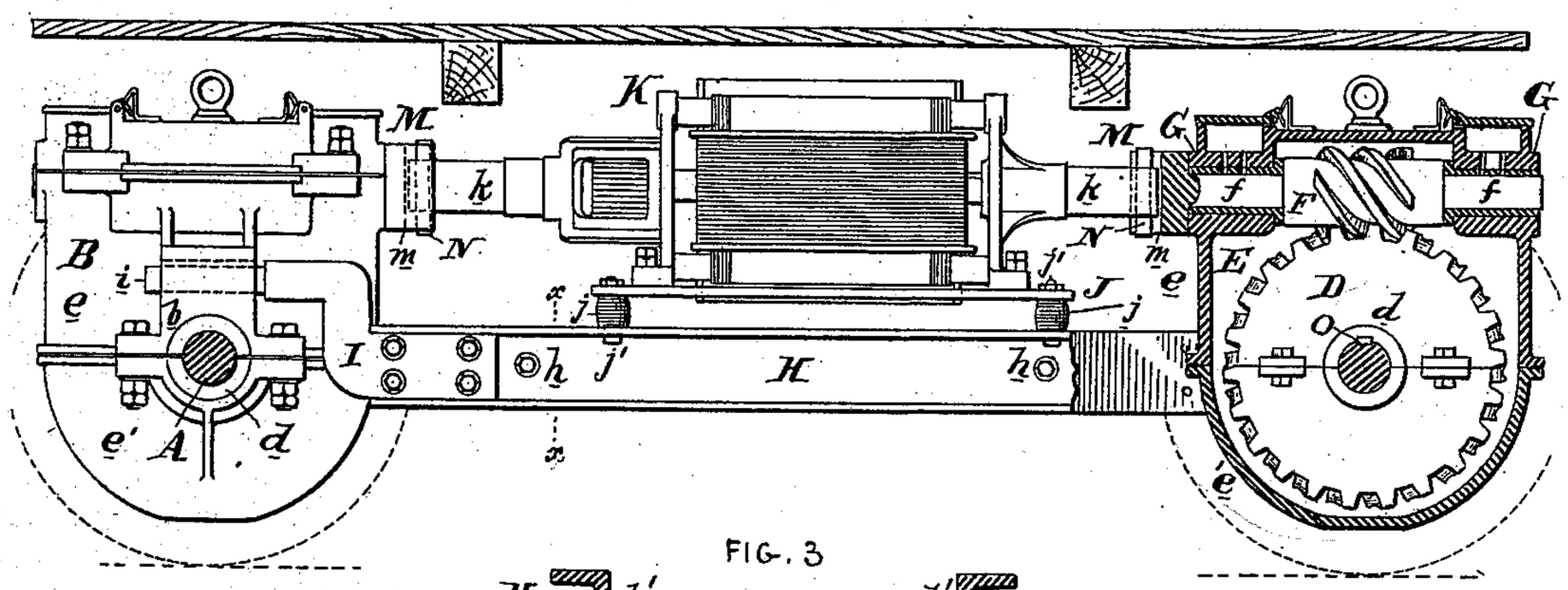


FIG. 3

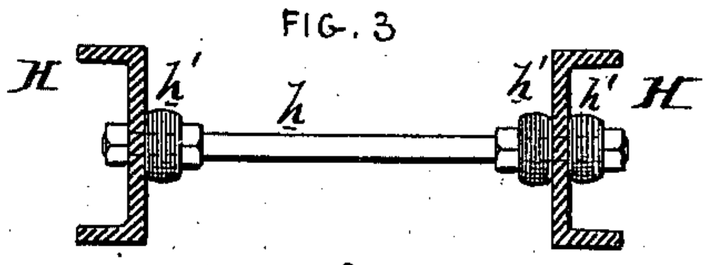


FIG. 4

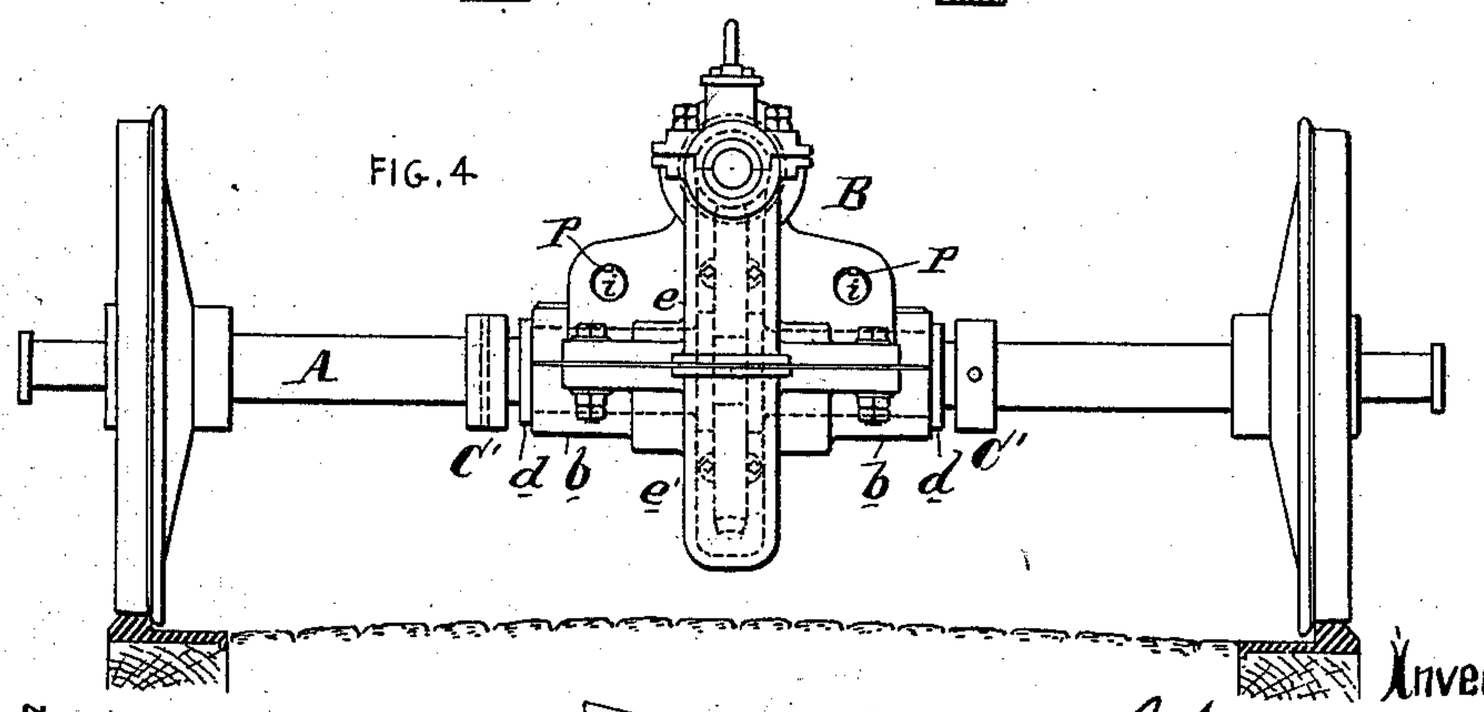
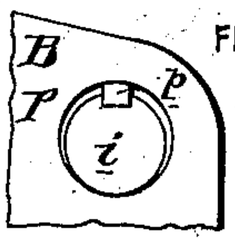


FIG. 5



Attest

David S. Williams

Inventor,

John W. Henderson

By his Atty

UNITED STATES PATENT OFFICE.

JOHN W. HENDERSON, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRIC CAR.

SPECIFICATION forming part of Letters Patent No. 402,080, dated April 23, 1889.

Application filed January 19, 1889. Serial No. 296,797. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. HENDERSON, of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Electric Cars, of which the following is a specification.

My invention has reference to electric cars; and it consists of certain improvements, fully set forth in the following specification, and shown in the accompanying drawings, which form part thereof.

The object of my invention is to provide a suitable support for the electric motor upon the axles, whereby the motor may be at all times in proper connection with the axles, notwithstanding that the axles may move out of parallelism. By this improvement I am enabled to use one motor with a longitudinal shaft making connection at each end by means of worm and worm-wheel gearing. My supporting-frame is adapted to motors having various power connections between the motor and axles, but is especially adapted to the construction employing worm and worm-wheel power-transmitting devices.

In carrying out my invention I provide each axle with a frame journaled thereon and having two holes in the same of substantially the same horizontal plane and at a distance apart, and between the axles are arranged two parallel beams provided on their ends with journals which fit into the holes in the axle-frames. Upon these beams the motor is secured through elastic supports, and is arranged with its shaft preferably longitudinal in a vertical plane between the beams, and geared to the axles by worm and worm-wheel gearing. This gearing is in practice inclosed within the axle-frames, which are made box-shaped. I make one of the worm-wheels and axle-frames loose upon the axle, so as to slide longitudinally, but to positively rotate with the axle. I also connect the two parallel beams by bolts having elastic washers, so as to allow rocking motion. The structure is such that no matter how much independent movement may be given to either axle with respect to the other the frame adjusts itself to the inequality and the motor has at all times an easy and elastic bed, which not only makes it run more easily, but prevents rattling and noise generally With this construction the running in practice is noiseless.

I do not confine myself to the details above and hereinafter set out, as they are simply given as a type of my improvements, and are those which have been found most satisfactory.

In the drawings, Figure 1 is a plan view of an electric motor and its support arranged between two axles of a car. Fig. 2 is a longitudinal section of same on the axles and shows one of the axle-frames in section to exhibit the worm and worm-wheels. Fig. 3 is a cross-section of same on line *x x*. Fig. 4 is an end view of same; and Fig. 5 is an enlarged view of a portion of one of the axle-frames, showing the hole and journal of the supporting-beam.

A A are the two axles of a truck or a four-wheeled car or other vehicle. Upon these axles are frames B B, which frames are arranged at or near the middle of each axle and have their position insured by collars C and C′. The collars C of one axle keep the frame B in fixed position upon its axle, whereas it is preferable to place the collars C′ of the other axle far enough apart to enable a little movement of the frame B upon the axle. These frames B are made hollow, each forming a chamber, E, made up of the upper and lower halves, *e e′*, which are bolted together, as shown. Within this chamber a worm-wheel, D, is arranged upon the axle and caused to rotate with it by means of a feather or key, O. The worm-wheel has journals *d* on each side, and upon these the bearings *b* of the frame B are journaled. The worm-wheel D and frame B on the axle between the collars C′ both have a freedom of lateral movement. It is evident that, if desired, both worm-wheels and frames may have this lateral movement.

F is a worm having journals *f* journaled in bearings G in the upper part of the frame B, and this worm meshes with the worm-wheel, which latter runs in oil, if desired. Upon each side of the frame B is an extension having a journal box or hole, P, in which the journals *i* of the longitudinal beams H are journaled. The beams H are shown as formed of channel-iron and having frames I at each end secured thereto, and which frames have the hori-

zontal journal-pins *i*, above referred to. These pins *i* are of smaller diameter than the holes P to allow of a little lateral motion, and are preferably provided with a feather or key, *p*, at their top to prevent the frame B rotating with the axle to any extent. (See Fig. 5.) It will be observed that the beams H are lowered down considerably below the holes P, so as to bring the motor-support low and to admit of a lateral swinging of the beams H upon pins *i* as centers. These beams are connected by bolts *h*, Fig. 3, and elastic washers *h'*, which will permit of the beams having independent motions when desired.

K is the motor, which may be of any type, and is bolted or otherwise secured to a base, J, which in turn is secured to the beams H H by bolts *j'* and rests upon the elastic cushions *j*, which may be rubber or coiled springs. This connection, while holding the motor in position, admits of free movement of the support under it. The motor-shaft *k* runs longitudinally with the car and extends toward each frame B. The motor-shaft is connected with each of the worms by a flexible coupling, M, which consists of a slotted head, *m*, on the worm, in the slot of which the end of the shaft *k* extends, and a pin, N, in the end of said shaft projects, as shown.

Heretofore a coupling having four notches and four projections was used; but as only two of the projections were in contact at the same time the changing of the projections coming into contact caused a rattling. By this modification I overcome that noise and provide a simpler and yet equally strong coupling. The motor-shaft is thus flexibly connected at each end with the worms, and there is sufficient play to allow of all movements necessary for displacement due to the relative shifting of the axles in running over irregular roadways or jumping switches, crossings, &c.

It is clearly evident that the parts H and I may be formed of an integral piece of metal. In place of supporting the motor upon the laterally-movable beams in the manner shown, any suitable laterally-movable motor-supporting frame may be employed.

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

1. In an electrically-propelled vehicle, the combination of two axles, an axle-frame journaled upon each axle, a motor-supporting frame hung from said axle-frames with provision for lateral movement, and an electric motor supported by said motor-supporting frame.

2. In an electrically-propelled vehicle, the combination of two axles, an axle-frame journaled upon each axle, a motor-supporting frame hung from said axle-frames with provision for lateral movement, an electric motor supported by said motor-supporting frame having a longitudinal shaft, and gearing between the ends of said shaft and axles.

3. In an electrically-propelled vehicle, the combination of two axles, an axle-frame journaled upon each axle, a motor-supporting frame hung from said axle-frames with provision for lateral movement, an electric motor supported by said motor-supporting frame, having a longitudinal shaft, and gearing between the ends of said shaft and axles consisting of worms and worm-wheels, the latter being secured to the axles.

4. In an electrically-propelled vehicle, the combination of two axles, an axle-frame journaled upon each axle having a worm chamber or case, a motor-supporting frame hung from said axle-frames with provision for lateral movement, an electric motor supported by said motor-supporting frame, having a longitudinal shaft, and gearing between the ends of said shaft and axles consisting of worms and worm-wheels, the latter being secured to the axles and arranged within the inclosing chambers or casings of the axle-frames.

5. In an electrically-propelled vehicle, the combination of two axles, a frame supported by said axles between the wheels, an electric motor, elastic supports wholly supporting and arranged below the motor and between the motor and frame, and power-transmitting devices between the motor and axle.

6. In an electrically-propelled vehicle, the combination of two axles, a frame supported by said axles, an electric motor, elastic supports between the motor and frame, worm-wheels on the axles, worms for meshing with the worm-wheels, and flexible couplings between the motor-shaft and worms.

7. In an electrically-propelled vehicle, the combination of two axles, a laterally-swinging frame supported by said axles, an electric motor, elastic supports between the motor and frame, and power-transmitting devices between the motor and axle.

8. In an electrically-propelled vehicle, the combination of two axles, an axle-frame on each axle, a motor-supporting frame hung from said frames, worm-wheels on the axles, worms for said worm-wheels journaled in the axle-frames, a motor supported on motor-supporting frame, and flexible couplings between the motor-shaft and worms.

9. In an electrically-propelled vehicle, the combination of two axles, an axle-frame on each axle, a motor-supporting frame hung from said frames, worm-wheels on the axles, worms for said worm-wheels journaled in the axle-frames, a motor supported on the motor-supporting frame by elastic connections, and flexible couplings between the motor-shaft and worms.

10. The combination of two axles, a laterally-movable motor-supporting frame carried by the axles, a motor on said frame, and a power-transmitting connection between one or both axles and motor-shaft.

11. The combination of two axles, an axle-

frame journaled upon each axle, and a motor-supporting frame hung upon said axle-frame by longitudinal journals.

12. The combination of two axles, an axle-frame journaled upon each axle and having two holes, and a motor-supporting frame formed of two parallel beams hung upon said axle frames by longitudinal journals of smaller diameter than the holes of the axle-frames.

13. The combination of two axles, a worm-wheel upon each axle, an axle-frame journaled concentrically with each axle, worms held by said frames, a motor to rotate said worms, and a longitudinal frame structure loosely connecting with each axle-frame to prevent them from rotating with the axles, but allow of movement of one axle-frame independent of the other.

14. The combination of two axles, a worm-wheel upon each axle, an axle-frame journaled concentrically with each axle, worms held by said frames, a motor to rotate said worms, a flexible coupling between the worms and motor-shaft, and a longitudinal frame structure loosely connecting with each axle-frame to prevent them from rotating with the axles, but allow of movement of one axle-frame independent of the other.

15. The combination of two axles, a worm-wheel on each axle, an inclosing-frame journaled concentric with each axle, a worm journaled in the upper parts of each of said frames and also inclosed thereby and meshing with the worm-wheels, an electric motor having a longitudinal shaft arranged in line with the worms, and flexible connections between the motor-shaft and worms.

16. The combination of two axles, a worm-wheel secured to each axle, a worm meshing with the upper part of each worm-wheel, an inclosing-frame for said worm-wheel, a worm on each axle forming a receptacle for oil and keeping out dust, and a longitudinal motor-shaft extending from worm to worm in a line above both axles.

17. The combination of an axle, a worm-wheel on the axle, a worm meshing with the worm-wheel, a motor, and a flexible coupling between the motor-shaft and worm, consisting of a slotted head, *m*, and pin N, substantially as shown.

18. The combination of two axles, axle-frames on each axle, two longitudinal beams hung from said axle-frame on longitudinal journals, elastic connections between the beams, and a motor supported on said beams.

19. In an electrically-propelled vehicle, the combination of two axles, an axle-frame journaled upon each axle having a worm chamber or case, a motor-supporting frame hung from said axle-frames with provision for lateral movement, an electric motor supported by said motor-supporting frame having a longitudinal shaft, and gearing between the ends of said shaft and axles, consisting of worms and worm-wheels, the latter being secured to the axles, arranged within the inclosing chambers or casings of the axle-frame, and in which the axle-frame, worm-wheel, and worm on one axle are fixed against lateral movement and the similar parts on the other axle are free to have lateral movement by sliding upon the axle.

20. The combination of two axles, an axle-frame on each axle having a hole, P, and a longitudinal beam having journals *i* at each end loosely fitting said holes P and provided on top with a key or feather or similar projecting part, *p*.

21. The combination of two axles, a worm and worm-wheel and connecting-frame carried upon each axle, an intermediate loosely-connected motor-supporting frame connecting the frames on the two axles, and a motor supported by said motor-supporting frame having its shaft connected with the worms.

22. The combination of two axles, a worm-wheel on each axle, a worm for each worm-wheel, a frame for holding the worm to the worm-wheel, a detachable motor-frame connecting the frames for the worms to hold them in place, and a motor secured to the motor-frame and movable with it and having its shaft connected with the worms.

23. The combination of two axles, a worm-wheel on each axle, a worm for each worm-wheel, a frame for holding the worm to the worm-wheel, a detachable motor-frame connecting the frames for the worms to hold them in place, a motor secured to the motor-frame and movable with it, and a detachable connection between the motor-shaft and worms.

In testimony of which invention I hereunto set my hand.

JOHN W. HENDERSON.

Witnesses:

ERNEST HOWARD HUNTER,

E. M. BRECKINREED.