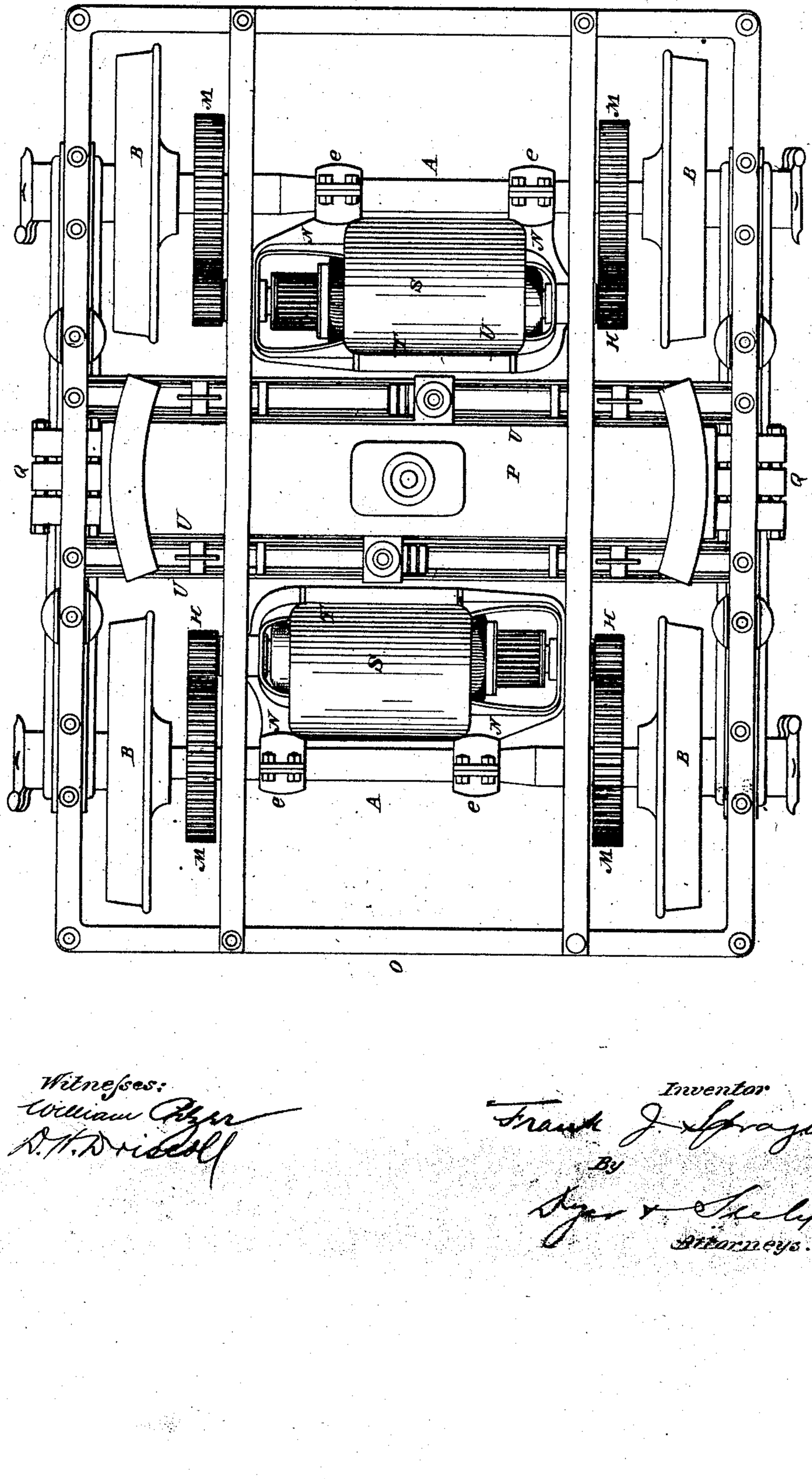
(No Model.) 5 Sheets—Sheet 1.

F. J. SPRAGUE.

ELECTRIC RAILWAY MOTOR.

No. 406,600. Patented July 9, 1889.



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(No Model.) 5 Sheets—Sheet 2.

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ELECTRIC RAILWAY MOTOR.

No. 406,600. Patented July 9, 1889.

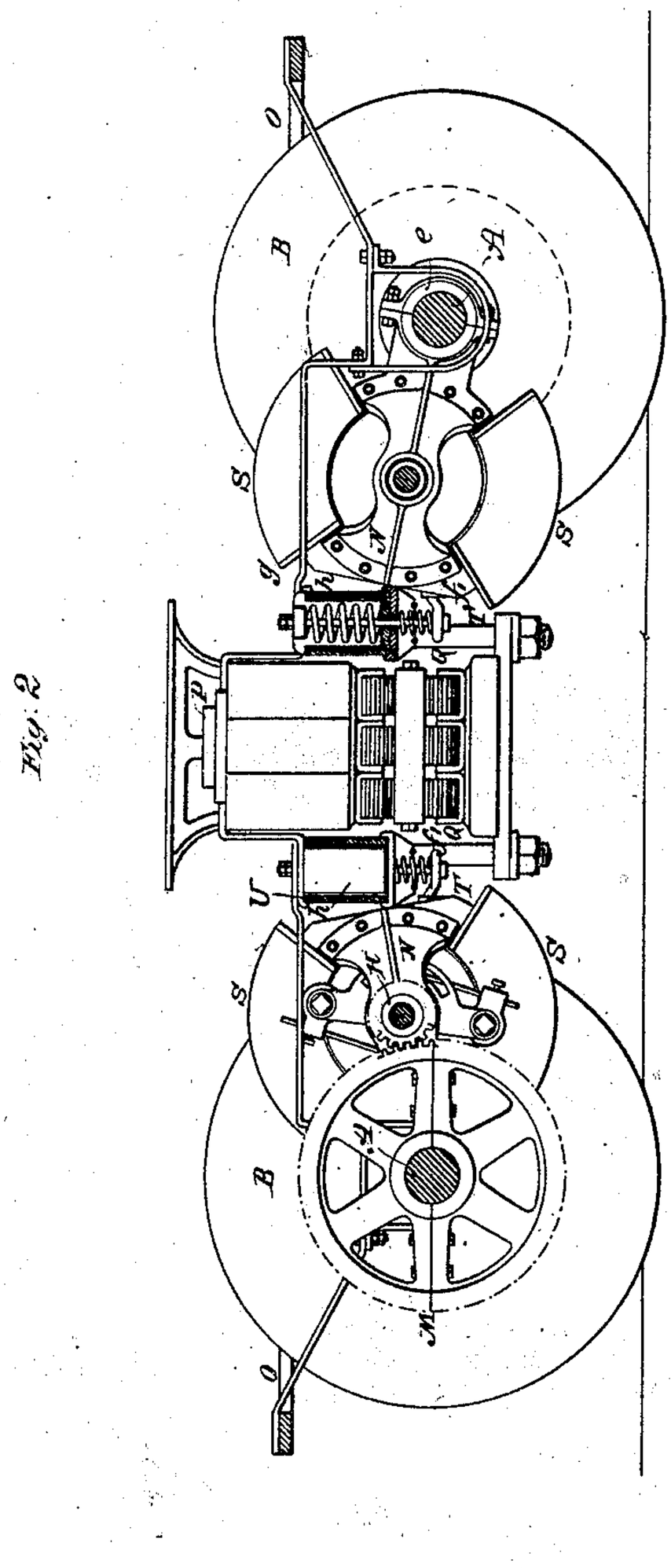

Fig. 2

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(No Model.) 5 Sheets—Sheet 3.

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ELECTRIC RAILWAY MOTOR.

No. 406,600. Patented July 9, 1889.

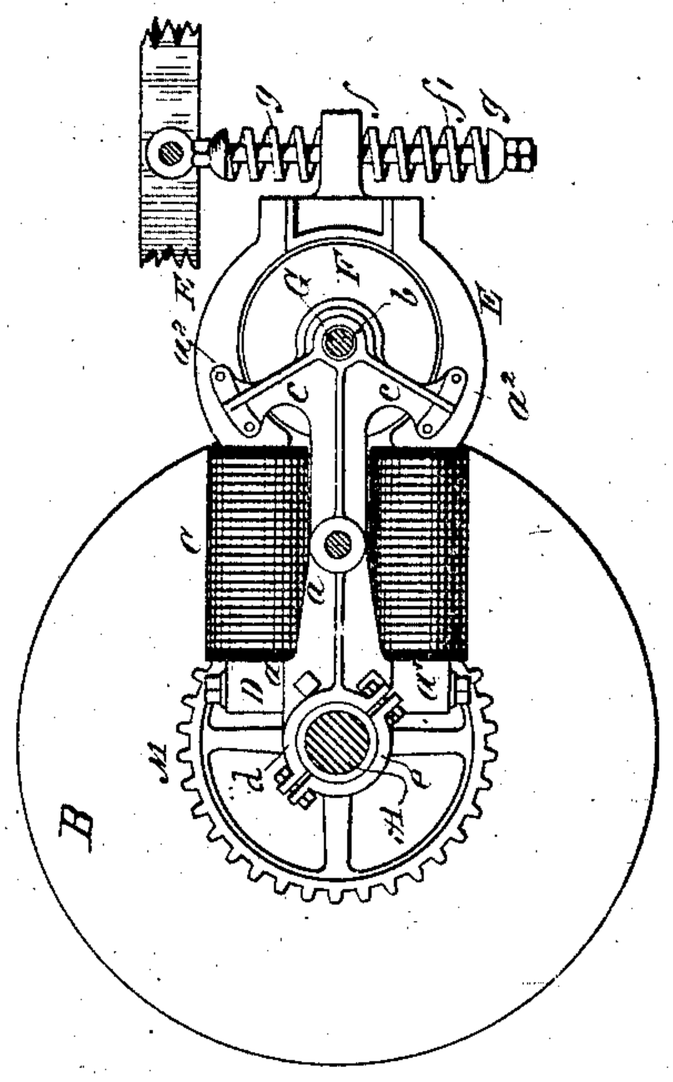

Fig. 4.

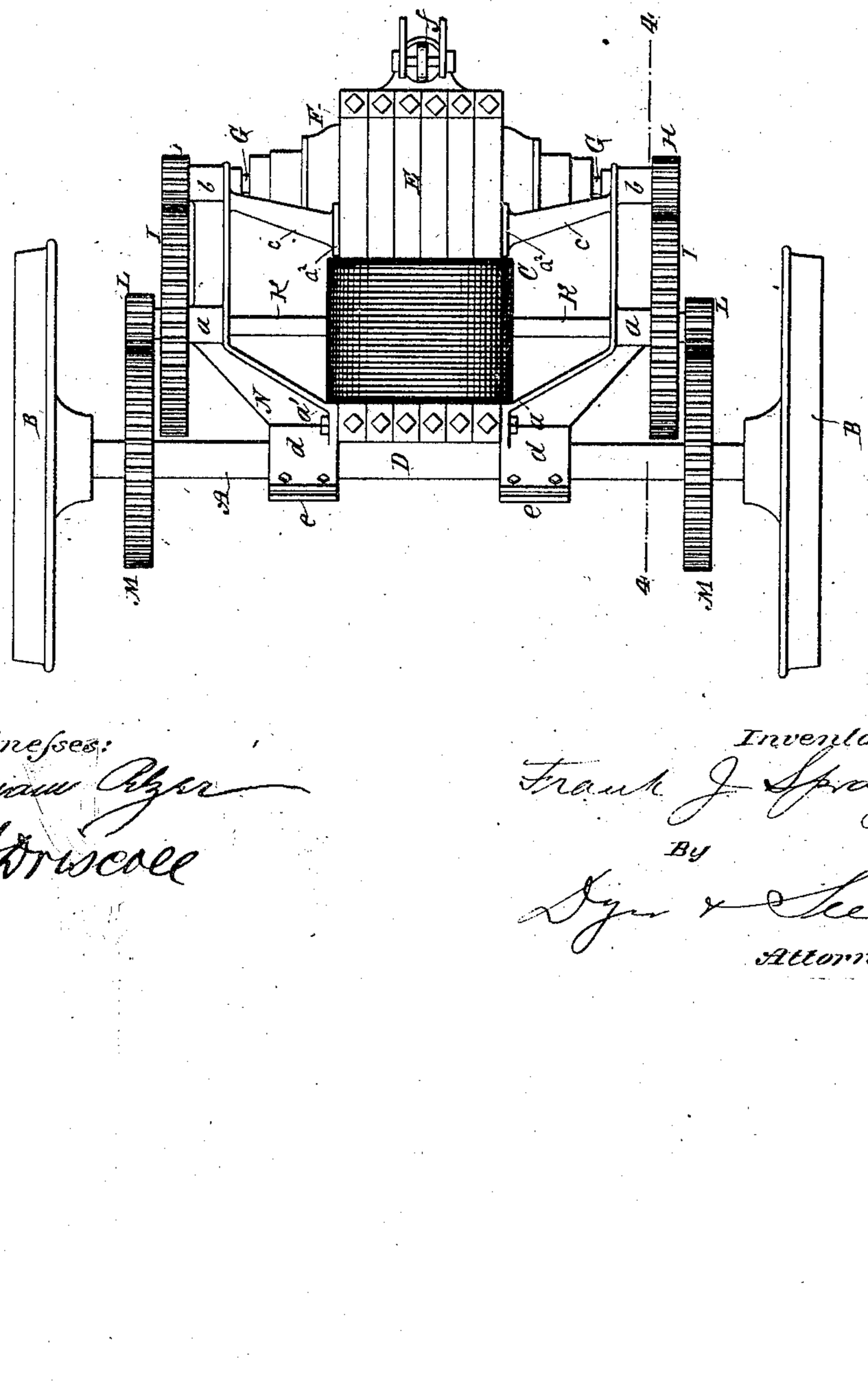

Fig. 3.

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(No Model.) 5 Sheets—Sheet 4.

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ELECTRIC RAILWAY MOTOR.

No. 406,600. Patented July 9, 1889.

Fig. 6.

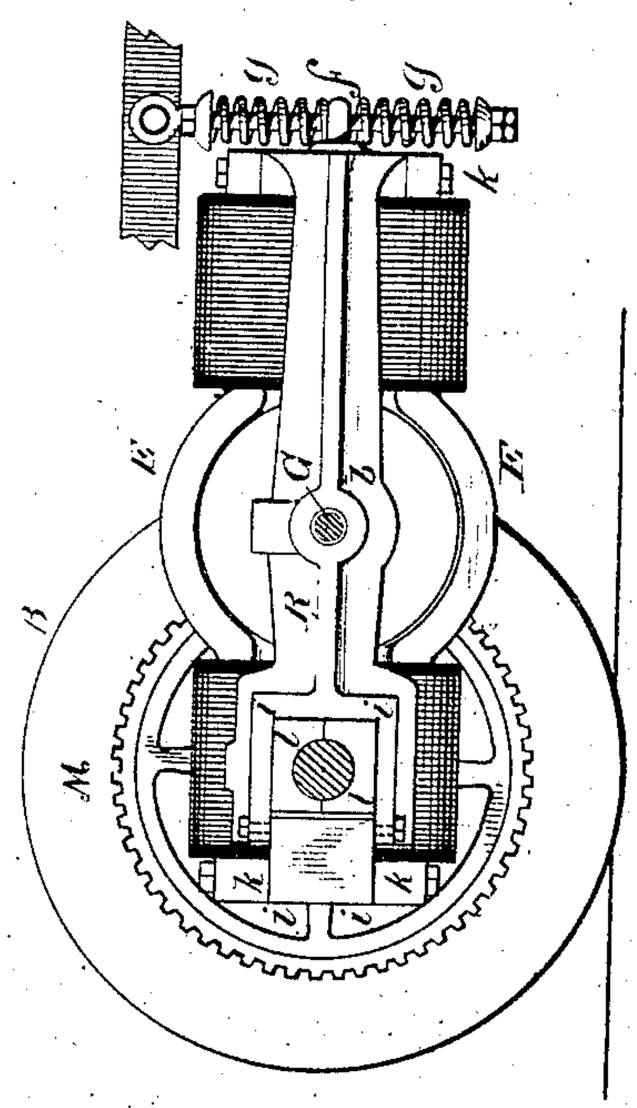
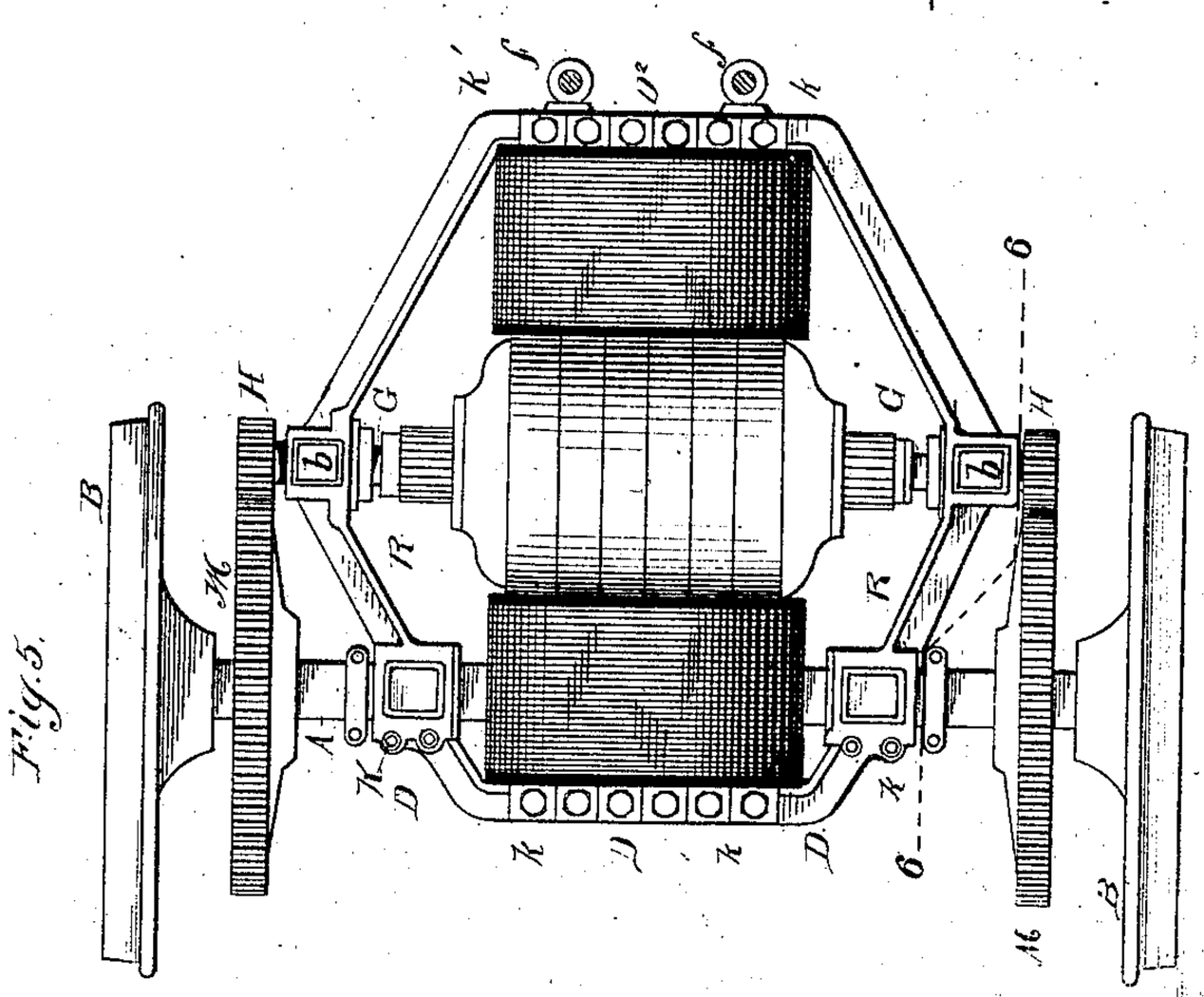


Fig. 5.



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(No Model.)

5 Sheets—Sheet 5.

F. J. SPRAGUE.

ELECTRIC RAILWAY MOTOR.

No. 406,600. Patented July 9, 1889.

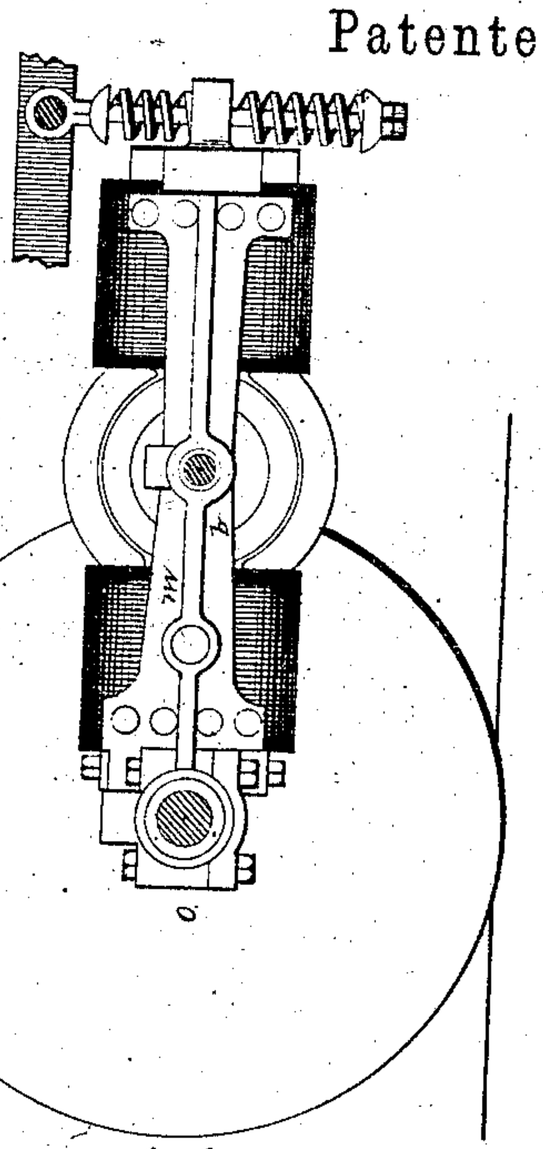

Fig. 8.

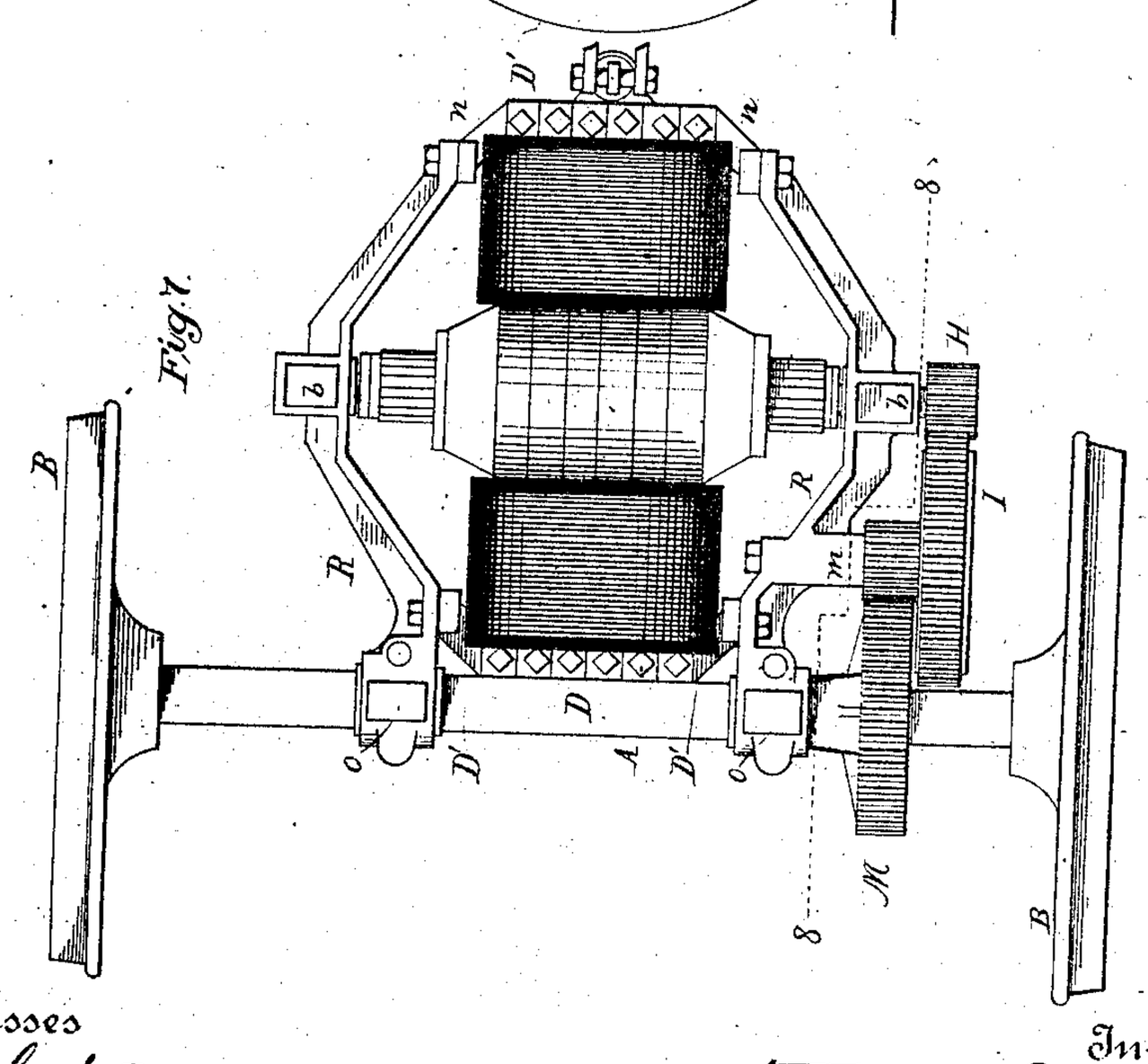

Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANK J. SPRAGUE, OF NEW YORK, N. Y., ASSIGNOR TO THE SPRAGUE ELECTRIC RAILWAY AND MOTOR COMPANY, OF SAME PLACE.

ELECTRIC RAILWAY-MOTOR.

SPECIFICATION forming part of Letters Patent No. 406,600, dated July 9, 1889.

Original application filed March 1, 1889, Serial No. 301,683. Divided and this application filed June 4, 1889. Serial No. 313,093. (No model.)

To all whom it may concern:

Be it known that I, FRANK J. SPRAGUE, a citizen of the United States, residing at New York, in the county and State of New York, have invented a certain new and useful Improvement in Electric Railway-Motors, of which the following is a specification.

In my patent, No. 324,892, dated August 25, 1885, is set forth a mode of construction and arrangement for an electro-dynamic motor placed upon a wheeled vehicle for the purpose of propelling the same, in which the motor is centered upon the driving-axle of the vehicle by sleeving its field-magnet on such axle and supported by springs, and the armature is carried upon the said field-magnet and geared to the said driving-axle in such manner that the armature-shaft will always remain parallel with the driving-axle, whereby a true engagement of the gears is always permitted in spite of any movements of the body of the vehicle on its springs, and at the same time the driving-axle is relieved of the dead-weight of the motor.

My present invention relates to certain improvements upon this construction, the main object being to distribute the weight of the motor more evenly upon the driving-axle, to prevent the motor from straining laterally, and to reduce the liability of the disabling of the apparatus by accident.

The improvement mainly consists in dividing the bearings of the motor upon the axle into two parts, which are somewhat removed from each other on the axle. In practice I accomplish this by providing two brackets attached to or forming part of the field-magnet, preferably at its yoke or keeper, which brackets are formed or provided with sleeves inclosing the driving-axle on each side of the magnet, and which also extend to points on each side, where they are formed or provided with bearings for a driving-shaft, which may be the armature-shaft of the motor or an intermediate counter-shaft or stud. I prefer to attach such brackets removably to the motor, so that either of them can be taken off when necessary for purposes of repair or replacement.

It will be seen that my invention is equally applicable whether the gearing is by the direct engagement of a pinion or pinions on the armature-shaft with one or more toothed wheels on the driving-axle, or whether indirect gearing through a counter-shaft or stud is employed. In the latter case the brackets, as just stated, form the bearings or support for the counter-shaft or stud.

My invention, further, is applicable whether the gearing is distributed at both ends of the shafts or whether it is concentrated on one side only, and it is also independent of the particular form of motor used. The spring suspension of the motor is preferably at the end farthest from the driving-axle. Where a motor is employed in which two branches of the field-magnet are placed one above the other, I find it convenient in some cases to pass the shaft which is driven by the armature-shaft, and which may be either the driving-axle or the counter-shaft, between such branches of the field-magnet. I so arrange the machine that its keeper is nearest to the axle or that its pole-pieces are removed from the axle, whereby the magnetic disturbance which may be caused by the mass of iron in the axle is removed or greatly lessened.

In the accompanying drawings, my invention is illustrated in connection with several different forms of motors and different arrangements of gearing.

Figure 1 is a plan view of a complete truck provided with two electro-dynamic motors arranged according to one form of my invention. Fig. 2 is a longitudinal section of the same on the line 2 2 of Fig. 1; Fig. 3, a plan view of a simple arrangement of a motor of U-shaped form; Fig. 4, a section of the same on the line 4 4 of Fig. 3; Fig. 5, a plan view of an arrangement for a motor in which the field-magnet extends longitudinally in both directions from the armature; Fig. 6, a section of the same on the line 6 6 of Fig. 5; Fig. 7, a plan view showing a motor of the same form as in Fig. 5, but with modified arrangement of gearing and modified construction in certain parts; and Fig. 8, a section on line 8 8 of Fig. 7.

Referring first to Figs. 3 and 4, A is the driving-axle of the vehicle, at the ends of which are mounted the wheels B B.

C C are the branches of the field-magnet,

placed one above the other, D being the yoke or keeper, and E E the curved pole-pieces inclosing the rotating armature F.

G is the armature-shaft, at each end of which is placed a pinion H, such pinions engaging with toothed wheels I I, mounted on a counter-shaft K, which extends across the truck between the branches C C of the field-magnet. Upon the ends of the counter-shaft K are pinions L L, which engage with toothed wheels M M on the driving-axle A, whereby the rotation of the armature is communicated to the wheels B B to propel the car.

At each side of the motor is a bracket N, such brackets being of the form illustrated in Figs. 3 and 4, and independently attached to the keeper D of the field-magnet by bolts a' a', and these brackets extend out laterally on either side to the counter-shaft K, where they are constructed with sleeves a a, which form bearings or supports for the said counter-shaft and then extend back opposite the ends of the armature, having at their extremities sleeves b b, which form bearings for the armature-shaft G. Such brackets are also joined to the field-magnet pole-pieces by arms c c, extending from near the extremities of the brackets and bolted to the pole-pieces at a^2. While this arrangement is desirable for strength, in some cases the bracket may not extend continuously from sleeve a to sleeve b; but the said sleeves b b may be supported alone by the arms c c, extending from the pole-pieces.

At the other end of each of the brackets N, where it is joined to the yoke D, such brackets are formed with half-sleeves d d, which inclose the upper portion of the driving-axle A, and bolted to which are similar half-sleeves e e. It will be seen that by this arrangement the field-magnet is sleeved upon the driving-axle at two points removed laterally from each other, and that the driving-shaft (or the armature and counter-shaft) is supported from the field-magnet in such manner that they always maintain the same position relative to each other and to the field-magnet and driving-axle, whereby a constant engagement of the various gear-wheels with each other is insured. By placing the centering-supports inside the wheels and the gearing between the centering-supports and the axle-boxes I am enabled to bring the motor close to the axles, whereby a compact structure is produced. At the armature end of the field-magnet it is provided with an outwardly-extending lug or projection f, and by means of bolt f' and heavy spiral springs g the motor is supported flexibly from a suitable portion of the truck or the car-body. Another mode of spring-suspension is shown in Figs. 1 and 2, in which O represents a truck-frame, and P is the cross-beam or bolster, which is supported on the springs Q. The motors shown in Figs. 1 and 2 are circular in form, S S being the field-magnet coils, and T T being the curved pole-pieces. Each motor is sleeved at two points e e on one of the driving-axles A of the truck, and each has its armature-shaft carried in bearings formed in brackets N N. In the arrangement shown in Figs. 1 and 2 no counter-shaft is employed, the gearing being direct from the pinions H on the armature-shaft to the toothed wheels M on the driving-axles.

The spring-suspension of the motors is from the pairs of cross-bars U U of the truck-frame, secured to each of which is a box h, in which the springs g are secured, through which springs bolts extend down to the lugs or projections f on the motor pole-pieces. One of the boxes h is shown in section in Fig. 2.

The arrangements above described are, as will be seen in general, the same as that set forth in my prior patent above referred to, and have all the advantages set forth in said patent; but in addition they accomplish the objects above mentioned in distributing the weight of the motor on the driving-axle, in preventing lateral straining of the motor, and in avoiding the liability to disabling by accident, which may arise where the centering is at one point only on the axle, as in the patent referred to, and by bringing the driving-axle close to the motor and to the neutral part of the field-magnet, or removing one or both of the poles away from such axle, whereby the magnetic disturbance is reduced or avoided and a compact structure is produced.

In Figs. 5 and 6 is shown a motor of a different form—that is, one in which the field-magnet extends in both directions from the armature, as in the so-called "Siemens" form of dynamo-electric machines. In this arrangement also the armature-shaft is geared directly to the driving-axle by gears H M. The driving-axle in this case extends between the branches of the field-magnet at one end, and arms D′ D′ extend from the keeper D at that end back toward such driving-axle. Each bracket R is formed in two branches i i, which are bolted to the projecting arms D′ D′ of the keeper by bolts k, and which extend one above and one below the axle A, and support between them journals l, which form the bearings for the axle. The brackets R R extend out to near the ends of the armature-shaft G, and are there formed with sleeves b for receiving such shaft, and from this point they extend to the other keeper D^2 of the field-magnet, to which they are bolted by bolts k'. This end of the motor is hung on springs g, in the manner already explained, to the cross-frame or other suitable and convenient part. It will be seen that in this form also the brackets which support the driving-axle and armature-shaft are detachably secured to the motor, so that one or the other of them can be readily removed when required for the purpose of repair or replacing them, or for removing the armature, if necessary.

Figs. 7 and 8 show a similar form of motor to that in Figs. 5 and 6, but with different ar-

rangement of gearing and of the driving-axle and centering-supports. In this case the gearing is all on one side of the machine, the armature-shaft having a single pinion H, engaging with a gear-wheel I, which gear-wheel, instead of being on a counter-shaft extending across the machine, is mounted at the end of a short stud *m*, extending from the bracket R on one side. On the stud *m* is also the pinion L, which engages with the gear-wheel M on the driving-axle A. Such driving-axle extends across the end of the machine in the same way as in Fig. 3, and the brackets R R are attached to upwardly-turned arms D′ D′, which extend out diagonally from the keeper D. Such brackets carry boxes *o*, which inclose the driving-axle on each side of the motor, and they extend back, forming bearings for the armature-shaft at *b*, and are secured to the other keeper E′ by means of arms *n*, to which they are bolted in the same way as at the end next the driving-axle.

It will be seen that all the different arrangements illustrated and described embody the same feature of making the centering-support at two points on the driving-axle on each side of the motor, and of providing brackets extending from such centering-supports, which brackets form also supports for a driving shaft or shafts, which may be the armature-shaft, the counter-shaft or stud, or both. Such brackets are also preferably detachable independently for the purpose above mentioned.

I do not claim herein specifically an electro-dynamic motor mounted upon and propelling a wheeled vehicle and having its field-magnet sleeved on an axle of the vehicle at its keeper or end farthest from its pole-pieces, or the same in combination with a flexible support for the field-magnet at its other end, or the same when the keeper of the field-magnet is situated parallel with and in proximity to a driving-axle of the vehicle, and provided with extensions or projections which are sleeved on said axle, since all these features are claimed in my application filed March 1, 1889, Serial No. 301,683, of which the present application is a division. Neither do I claim herein equalizing-bars extending from one axle-box to the other on each side, in combination with a cross-piece or frame joining said bars and an electric motor supported at one end by said cross piece or frame and centered at its other end upon an axle with which its armature-shaft is geared, or the same in combination with two electric motors each supported at one end upon the cross piece or frame and each centered at its other end upon an axle with which its armature-shaft is geared. These features are claimed in my application filed June 11, 1889, Serial No. 313,874. Furthermore, I do not claim in this application any novel features shown or described herein which have especial reference to the supporting of two or more motors upon the same car or vehicle, or to the supporting of a motor through the vertically-movable axle-boxes of a vehicle or equalizing-bars or other parts attached thereto or connected therewith, or to supporting an electric motor and a car-body independently flexibly upon the same truck, these features being claimed in my application filed March 30, 1889, Serial No. 305,476, and the present application being confined to the peculiar mode of centering or sleeving the motor upon the driving-axle and the special mode of supporting and arranging the shafts and gearing shown and described herein.

What I claim is—

1. The combination of a wheeled vehicle and an electro-dynamic motor mounted thereon and propelling the same, the same being centered at one end on an axle of the vehicle at more than one point, and a flexible support for said motor at its other end, substantially as set forth.

2. The combination of a wheeled vehicle and an electro-dynamic motor mounted thereon and propelling the same, having its field-magnet sleeved at one end on an axle of the vehicle at more than one point, and a flexible support for said field-magnet at its other end, substantially as set forth.

3. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, the same being centered at one end on an axle of the vehicle at two points—one on each side of the motor—and a flexible support for said motor at its other end, substantially as set forth.

4. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, having its field-magnet sleeved at one end on an axle of the vehicle at two points—one on each side of the motor—and a flexible support for said field-magnet at its other end, substantially as set forth.

5. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, brackets extending from the field-magnet of said motor on each side and sleeved on an axle of the vehicle, a driving-shaft supported by said brackets, and gearing between said driving-shaft and said axle, substantially as set forth.

6. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, brackets extending from the field-magnet of the motor on each side and sleeved on an axle of the vehicle, the armature-shaft of the motor supported bearings on said brackets, and gearing between said armature-shaft and said axle, substantially as set forth.

7. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, brackets extending from the field-magnet of the motor on each side and sleeved on an axle of the vehicle, the armature-shaft of said motor, a counter-shaft supported by the brackets, gearing between said armature-shaft and said counter-shaft,

a l gearing between said counter-shaft and said axle, substantially as set forth.

8. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, brackets extending from the field-magnet of the motor on each side and sleeved on an axle of the vehicle and formed or provided with bearings in which the armature-shaft of the motor is supported, a counter-shaft also supported by said brackets, gearing between said armature-shaft and said counter-shaft, and gearing between said counter-shaft and said axle, substantially as set forth.

9. The combination, with a wheeled vehicle, of an electro-dynamic motor mounted upon and propelling the same, the keeper of the field-magnet of said motor being situated parallel with and in proximity to a driving-axle of said vehicle and provided with two extensions, one on each side, which are sleeved on said axle at points outside the center of the motor, substantially as set forth.

10. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same and centered at one end on an axle of the vehicle at more than one point inside the wheels on said axle, and a flexible support for said motor at its other end, substantially as set forth.

11. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same and centered at one end on an axle of the vehicle at more than one point, a flexible support for said motor at its other end, and gear-wheels on said axle between the centering-supports of the motor and the axle-boxes, substantially as set forth.

12. The combination of a wheeled vehicle, an electro-dynamic motor mounted thereon and propelling the same, brackets detachably secured to the field-magnet on each side and sleeved on an axle of the vehicle, a driving-shaft supported by said brackets, and gearing between said driving-shaft and said axle, substantially as set forth.

This specification signed and witnessed this 3d day of June, 1889.

FRANK J. SPRAGUE.

Witnesses:
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