(No Model.) 4 Sheets—Sheet 1.

W. S. BELDING.

ELECTRIC RAILWAY CAR.

No. 440,689. Patented Nov. 18, 1890.

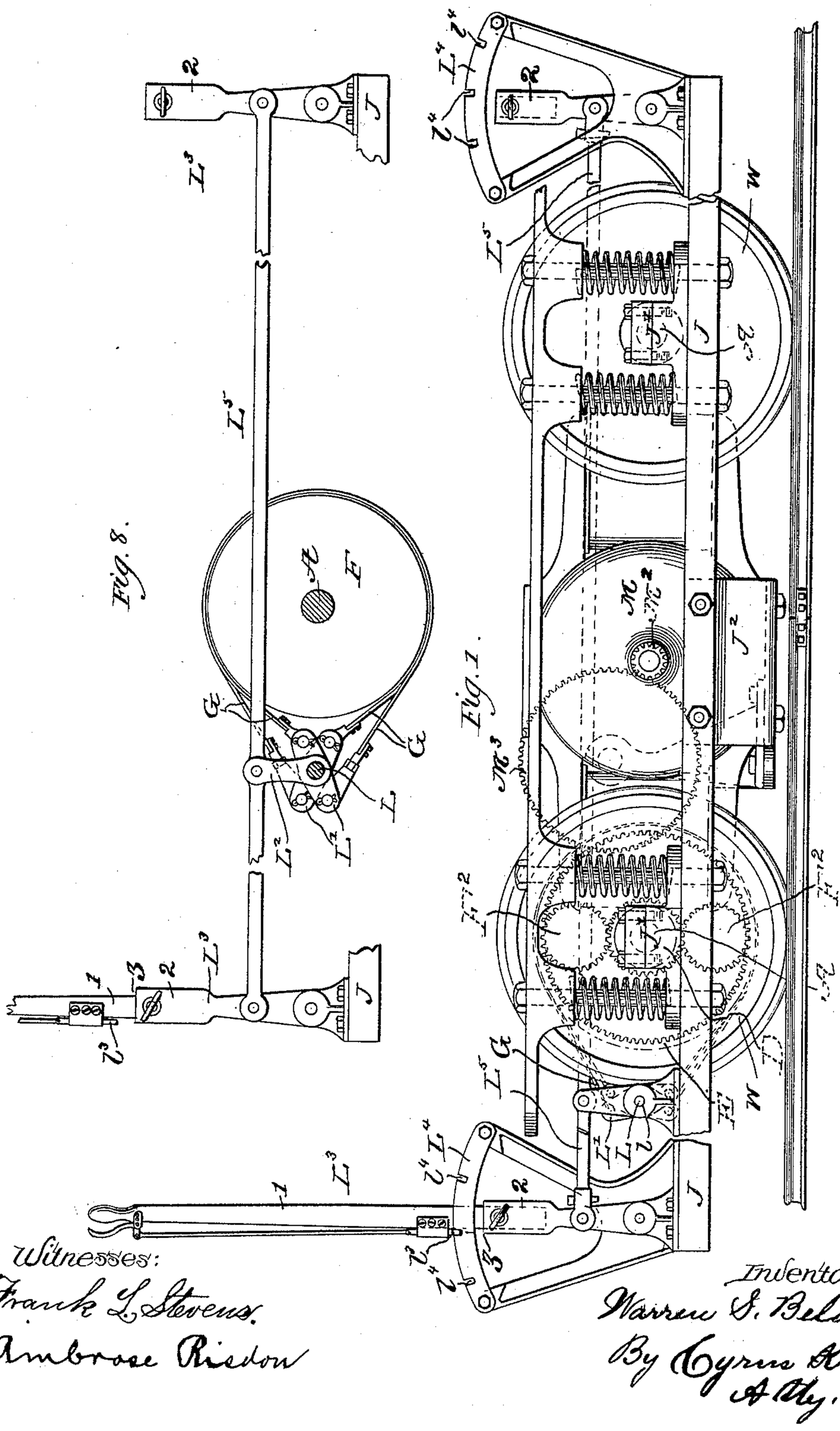

Fig. 8.

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

W. S. BELDING.

ELECTRIC RAILWAY CAR.

No. 440,689. Patented Nov. 18, 1890.

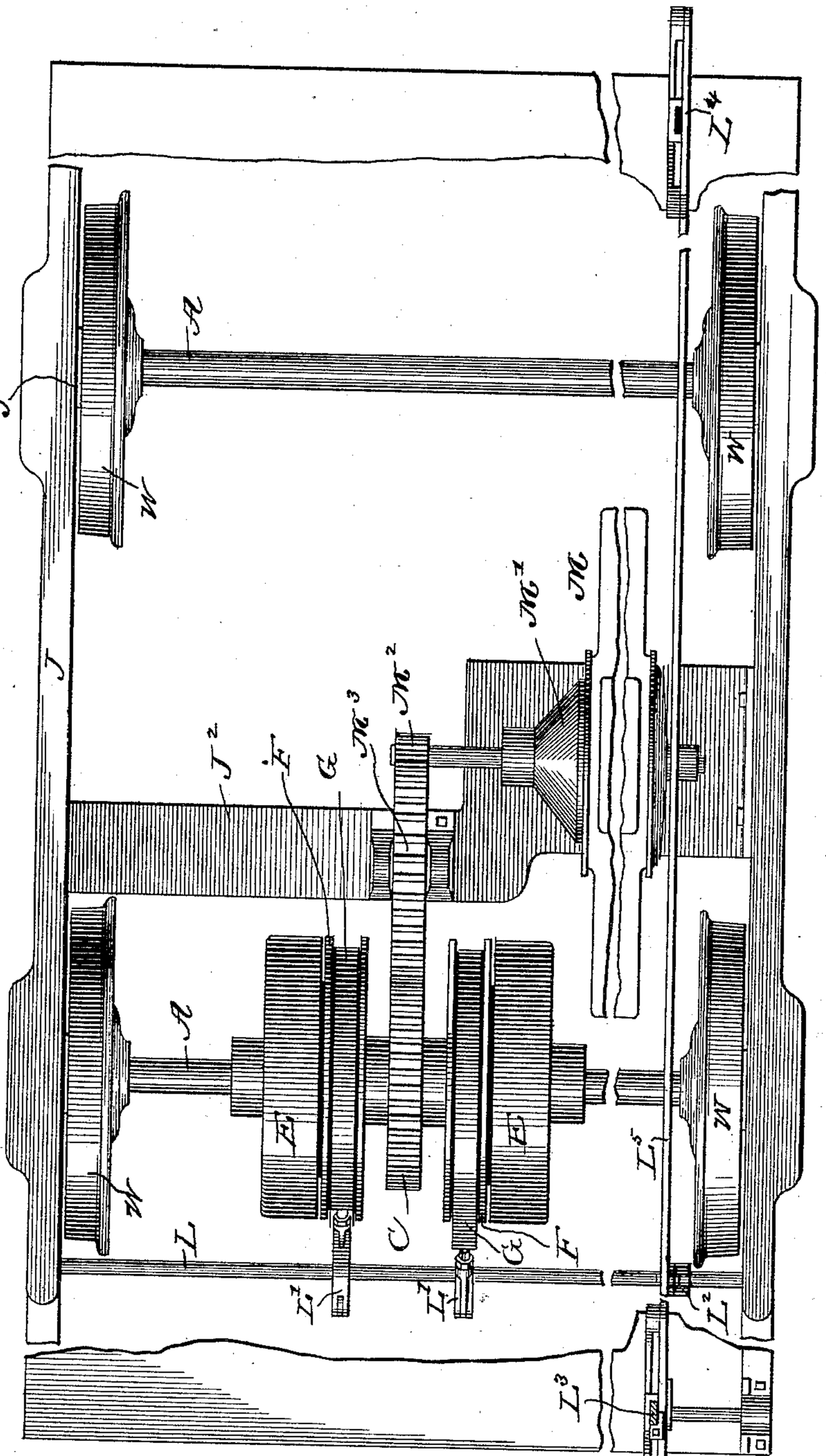

Fig. 2.

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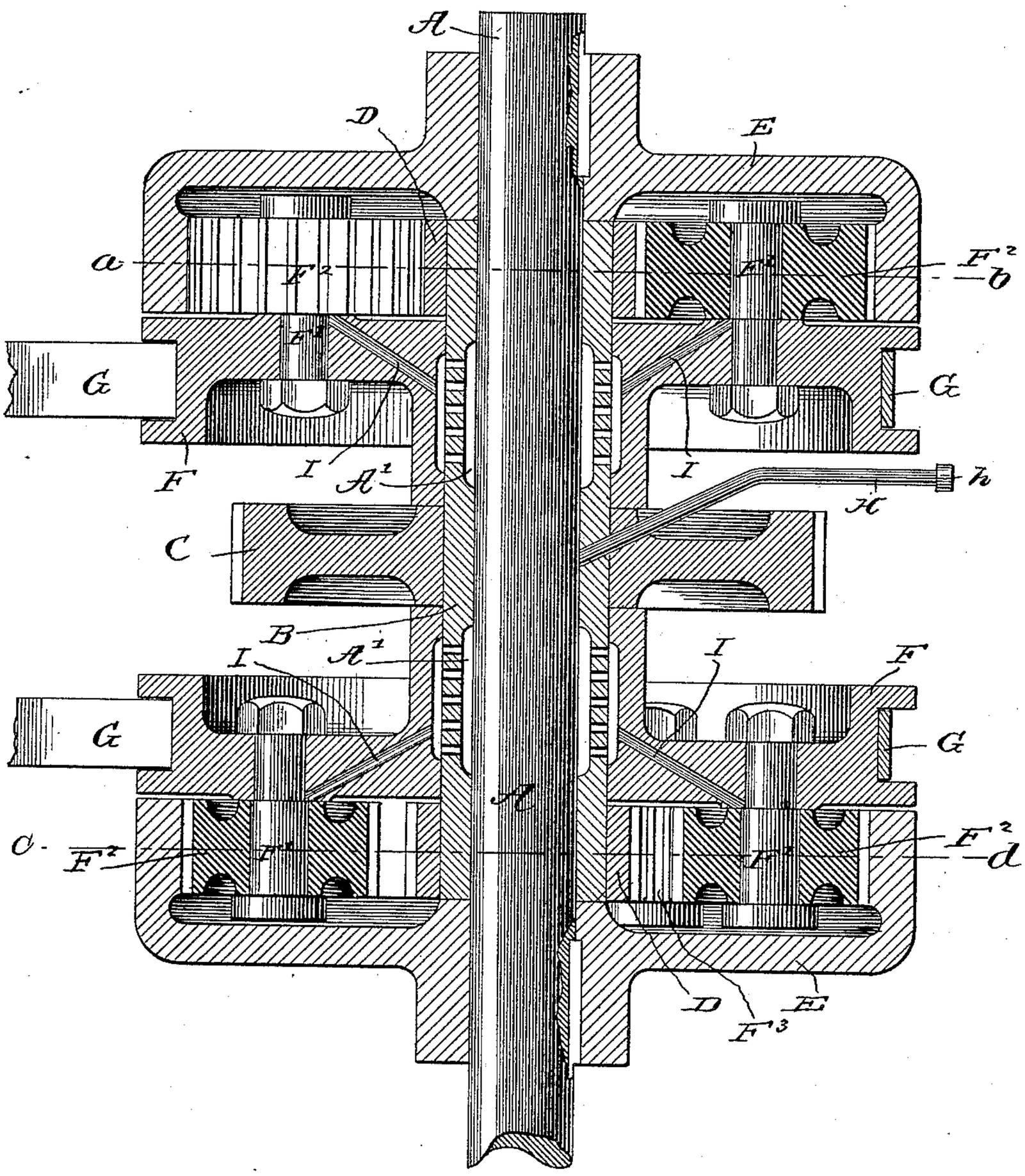
ELECTRIC RAILWAY CAR.

No. 440,689. Patented Nov. 18, 1890.

Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC RAILWAY CAR.

No. 440,689. Patented Nov. 18, 1890.

Fig. 4.

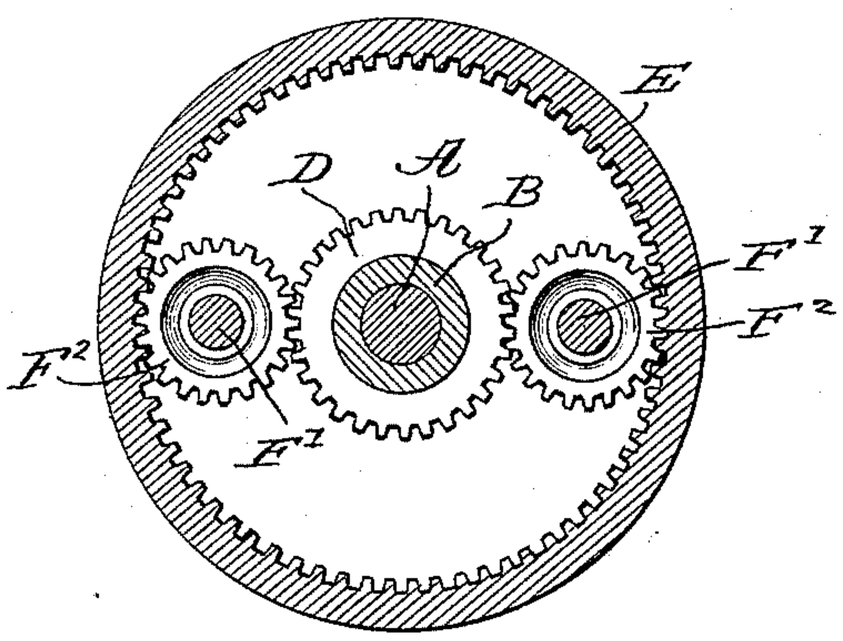


Fig. 5.

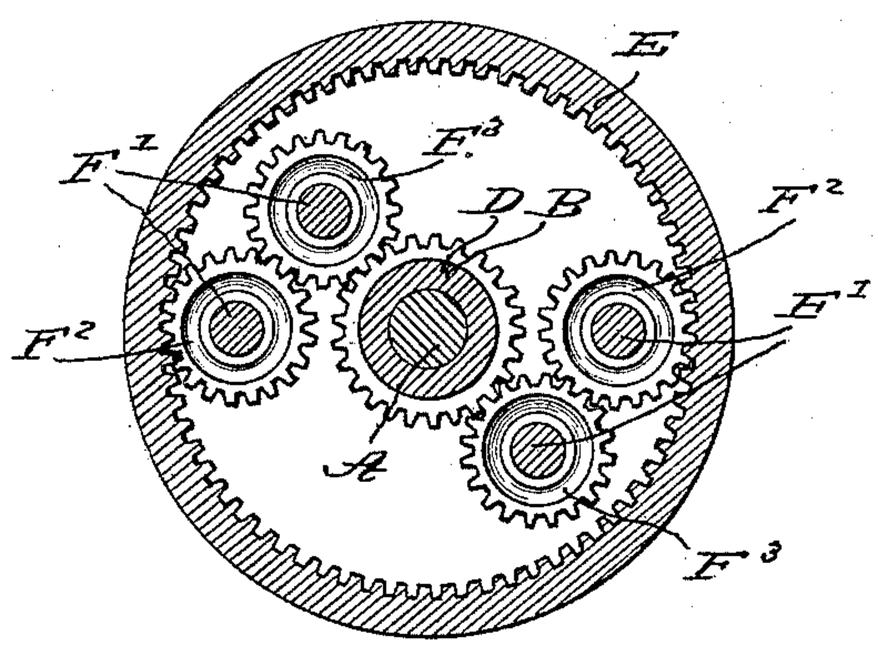


Fig. 6.

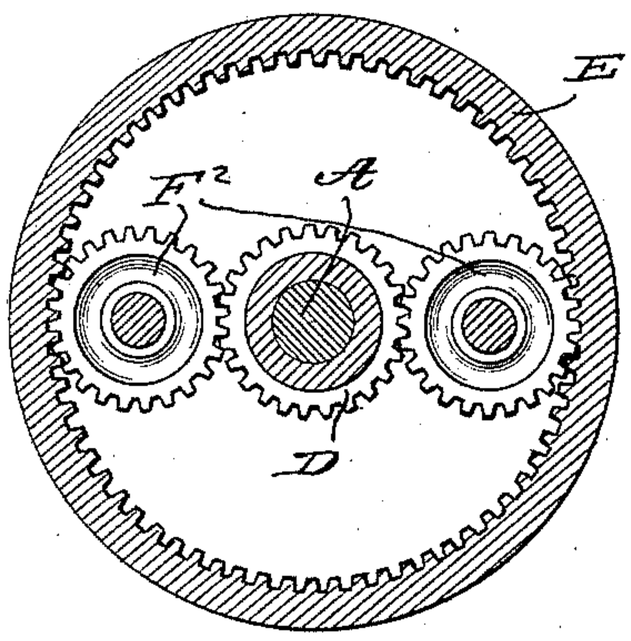
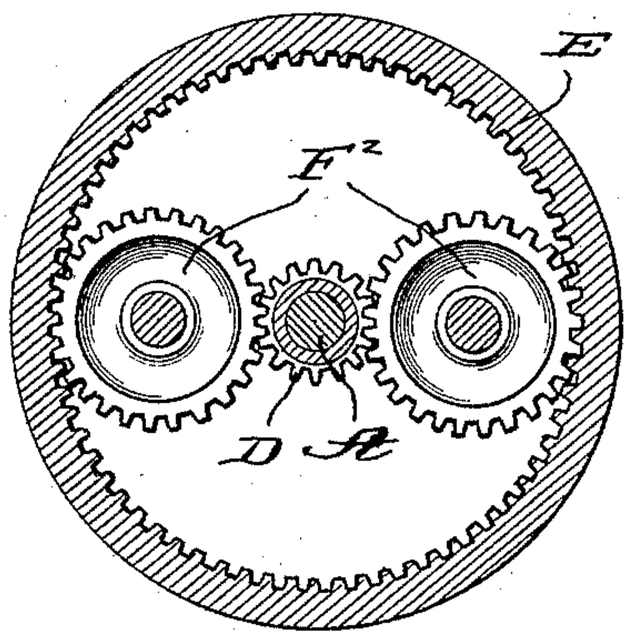


Fig. 7.



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UNITED STATES PATENT OFFICE.

WARREN S. BELDING, OF CHICAGO, ILLINOIS.

ELECTRIC-RAILWAY CAR.

SPECIFICATION forming part of Letters Patent No. 440,689, dated November 18, 1890.

Application filed April 21, 1890. Serial No. 348,855. (No model.)

To all whom it may concern:

Be it known that I, WARREN S. BELDING, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric-Railway Cars; 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My improvement relates to the application of electric motors to the propulsion of railway-cars in such manner as to permit of the constant rotation of the armature of the motor while the car is stationary or in motion.

To this end the improvement comprises, among other things, means for engaging and disengaging the armature of the motor with the wheels or axles of the cars.

The improvement also embodies means for effecting the propulsion of the car in either direction without changing the direction of rotation of the armature of the electric motor.

In the accompanying drawings, Figure 1 is a side elevation of the running mechanism of a car embodying my improvements. Fig. 2 is a plan of the same car. Fig. 3 is a section along one of the car-axles and through the mechanism surrounding said axle. Fig. 4 is a section in line *a b* of Fig. 3. Fig. 5 is a section in line *c d* of Fig. 3. Figs. 6 and 7 are detail views. Fig. 8 is a detail of the brake mechanism.

Since the present improvement does not extend to the means for delivering the electric current to the armature of the electric motor, and the same are well understood, it is deemed unnecessary to illustrate means of this nature.

W W are the wheels of the car, and A A are the axles of the car.

J is the frame of the car. This is supported from the ends of the axle A by means of bearings J′. Upon one of the axles is mounted mechanism in the nature of a duplex power-transmitting mechanism, one member of which is adapted to propel the car in one direction and the other to propel the car in the opposite direction.

The construction of this mechanism is as follows: B is a sleeve loosely surrounding one of the axles A. For the purpose of aiding lubrication the internal diameter of said sleeve B is increased along its middle, so as to leave a space A′ for oil between the shaft A and the sleeve B.

C is a wheel surrounding the middle of the sleeve B, and keyed or otherwise secured against rotation thereon. Said wheel may be a gear-wheel to be driven by other gears, or it may be a pulley to be driven by a belt or chain or by friction-contact. On each end of the sleeve B is mounted a spur gear-wheel D. These wheels are keyed upon said sleeve B, so as to rotate with the latter. Adjacent to each end of the sleeve B a wheel E is mounted directly upon the axle A and keyed thereto, so as to rotate with said axle. Each of said wheels E has an internal gear-flange about its circumference directed over the adjacent wheel D at a considerable distance from the periphery of the latter. On the opposite side of each of the wheels D is a band-wheel F, loosely surrounding the sleeve B, and of about the same diameter as the wheel E. Each wheel F has one or more studs F′, extending at right angles to its plane into the space between the wheel D and the internal gear of the wheel F, and each such stud supports a loose spur-gear F^2, meshing into the internal gear of the wheel E, and at the right in Fig. 3 each of said wheels F^2 also meshes into the spur-wheel D. At the left of said figure said wheels do not mesh directly into the wheel D; but an intermediate idle spur-wheel F^3 is supported from the wheel F and so located as to mesh into adjacent wheels F^2 and D, so that said wheels F^2 and D operate upon each other through the medium of said idle-wheel. By this modification this member of the power-transmitting mechanism is made to operate in a direction opposite to that in which the member of the mechanism at the right operates.

G G are friction brake-straps arranged to engage the periphery of the wheels F, each being provided with suitable means for forcing it into contact with its wheel. Such means will be hereinafter described.

The operation of the power-transmitting mechanism is as follows: Supposing power to be applied constantly to the wheel C in the

same direction, then said wheel, the sleeve B, and both spur-wheels D D will rotate in unison without change of direction. The spur-wheel in the member of the mechanism at the right will rotate the wheels F^2 in an opposite direction, and since the latter mesh into the internal gear of the wheel E, the latter must be turned by the spur-wheel F^2, or said wheel E must offer sufficient resistance to cause the wheel F^2 to travel upon said internal gear and through the band-wheel F upon the sleeve B. When the brake-strap G does not engage the wheel F, the resistance of the latter is so small as to allow it to turn upon the sleeve B in response to the force exerted by the wheels D and E; but when the brake-strap G is drawn the wheel F is held rigidly and the wheels F^2 are no longer free to revolve around the internal gear of the wheel E. Consequently the wheel D acts directly upon the internal gear of the wheel E through the wheels F^2, thus rotating the wheel E and also the axle A, to which the wheel E is keyed. The section shown in Fig. 4 is taken looking to the right. Supposing the wheels C and D to be rotating in the direction indicated by the arrow in said Fig. 4, then the wheels F^2 will rotate in the opposite direction, and the periphery of the latter will carry the wheel E in the opposite direction also, and since the wheel E is keyed to the axle A the latter will also be rotated in the direction opposite to the direction in which the wheels C and D are rotated. Looking at the gearing of the second member of the power-transmitting mechanism from the same direction, (see Fig. 5,) it will be seen that the wheel D will rotate the wheel F^3 in an opposite direction, while the latter will rotate the wheels F^2 in the same direction, and that the latter will not rotate the wheel E and axle A in the same direction as the direction in which the wheels C and D rotate. It is apparent, then, that the axle A may be at rest while the wheel C is running in response to the extraneous power applied to it, and that if it is desired to rotate said axle and propel the car in one direction one of the band-wheels F is to be engaged, and that if it is desired to rotate said axle and propel the car in the other direction the other brake-wheel is to be engaged. The ratio of the speed of the wheel C and the axle A may be varied by varying the relative size of the wheels D and E. (See Figs. 6 and 7.)

The power of the motor is to be applied to the wheel C. This may be accomplished in a variety of ways; but I deem it sufficient to describe in detail only one way. J^2 is a bridge extending horizontally from one side of the frame J to the other at the rear of the axle bearing the power-transmitting mechanism. M is the electric motor. M′ is the armature of said motor, and M^2 is a spur-gear mounted upon the end of the armature-shaft. M^3 is an idle spur gear-wheel mounted in bearings upon the bridge J^2 between the wheels M^2 and C and meshing into each of said wheels. In view of this arrangement it will be obvious that when the armature M′ is in motion the wheels M^2 and M^3 will also be in motion and will continuously drive the wheel C, the sleeve B, and the wheels D D. By varying the size of the wheel M^2 the ratio of the velocities of the armature and the wheel C will be varied. With the armature M′ constantly in motion, the car may be put into motion in the desired direction by tightening the proper strap G. Instead of establishing connection between the wheels C and the armature-shaft by means of gearing, a band or chain may be used. In some cases it may be preferable to use a sprocket or other positive chain. It will be seen that the axis of the motor is arranged parallel to the axle A; but said motor may be arranged at right angles to said axle, if so desired. Connection with the wheel C may then be made by bevel-gear or by a worm-gear or otherwise.

Attention is now directed to the means for grasping the brake-wheels F and holding them immovably.

L is a rock-shaft, supported in bearings *l*, resting on the frame J. Opposite each wheel F the rock-shaft L supports a cross-arm L′, rigidly fixed to said shaft, and the ends of the straps G are attached to the adjacent ends of the cross-arm L′, said straps extending around the wheels F. One of the cross-arms L′ is turned upon the shaft B in such position as to cause it to draw upon and tighten the strap G when the rock-shaft is rotated in one direction, and the other cross-arm is turned upon the shaft L to such position as to cause it to draw upon and tighten the strap G on the other wheel F.

L^2 is an arm rising from the middle of the rock-shaft L. At each end of the car is located a rack-lever L^3, and adjacent to the latter is a rack L^4, having notches l^4 for the engagement of the bolt l^3 of the lever L^3.

L^5 is a connecting-rod, extending from one lever L^4 to the other and coupled to each and to the arm L^2. The function of the levers and the connecting-rod and the arm L^2 is to rock the rock-shaft, in order that the latter may by means of the cross-arm L′ draw the straps G.

The lever L^3 may be comprised of two separable sections 1 and 2, the section 2 being joined to the section 1 at 3. A single section 2 may then be used for both of the sections 1, such section 2 being released from one end of the car and taken to the other when the car is to be run in the opposite direction. When the car is always driven in the same direction—as on an endless track or on a track having a turn-table at each end—a lever L^3 is needed at only the forward end of the car, and the connecting-rod L^5 need extend only from said lever to the arm L^2. The car shown in the drawings is sufficiently long to carry a load of passengers, and there is to be a platform at each end to be occupied by the driver. When the car is made short and used to pull other cars, the driver may be given a posi-

tion near the middle of the car and the lever L^3 extended directly upward from the arm L^2.

The power of the electric motor may be used at any time for quickly stopping the car. This may be done by quickly reversing the lever L^3, so as to apply the power of the motor against the motion of the axle A. When the regular course of the car is in only one direction, the duplex mechanism will be useful in quickly stopping the car or in backing it; but when the regular course of the car is in only one direction the two members of the power-transmitting mechanism may be made to operate in the same direction, but at different speeds. Then one or the other of the members of the mechanism may be used, according to circumstances. When there is a heavy load or a steep grade, the member of the mechanism giving the greater power may be used, while on a level or with a light load the member of the mechanism giving the greater speed may be used.

Attention is now directed to one means for lubricating the mechanism. A tube H is extended toward the axis between the wheel C and one of the wheels F, and then extended obliquely through the wheel C and sleeve B, so that it opens into the space between said sleeve and the shaft A. At its outer end said tube is provided with any suitable cap or plug *h*. The sleeve B is provided with radial perforations within the hubs of the wheels F. Opposite such perforations tubes I extend through said hubs obliquely outward to the bearings of the wheels F^2 and F^3. To lubricate the apparatus, the lubricating material is poured into the tube H and allowed to descend into the space A′ around the axle A. From this space the lubricating material is carried radially outward by centrifugal action through the tubes I to the bearings of the wheels F^2 and F^3.

It is to be observed that my improvement may be applied to other vehicles besides railway-cars—as, for example, ordinary carriages, road-wagons, and velocipedes.

The form of brake mechanism for holding the wheels F F is made the subject-matter of another application filed by me for Letters Patent. The duplex power-transmitting mechanism is also made the subject-matter of an application for Letters Patent filed by me.

I claim as my invention—

1. The combination, with a railway-car, of duplex propelling mechanism applied to one of the axles of said car, mechanism for alternately engaging the members of said propelling mechanism with said axle, a connecting-rod for controlling said engaging mechanism and extending from one end of the car to the other, a rack-lever at each end of said connecting-rod for imparting motion to the latter, and a rack at each rack-lever for locking said rack-lever, substantially as shown and described.

2. The combination, with a railway-car, of duplex propelling mechanism applied to one of the axles of said car, mechanism for alternately engaging the members of said propelling mechanism with said axle, a connecting-rod for controlling said engaging mechanism and extending from one end of the car to the other, a lower section of a separable rack-lever at each end of said connecting-rod, an upper section of a rack-lever to be attached to either of said lower sections for imparting motion to the latter and said connecting-rod, and a rack at each such lower section for locking the complete lever, substantially as shown and described.

3. The combination, with a railway-car, of propelling mechanism applied to one of the axles of said car, said propelling mechanism embodying two brake-wheels F, brake-straps G, applied to said friction-wheels, a rack-lever, and intermediate parts for alternately engaging said friction-straps, substantially as shown and described.

4. The combination, with an electric-railway car, of a duplex power-transmitting mechanism applied to one of the axles of said car, said mechanism consisting of a sleeve B, surrounding said axle, a wheel C, mounted upon said sleeve, wheels E, constructed substantially as described and keyed upon said axle at the ends of the sleeve B, wheels D, mounted upon said sleeve B adjacent to each wheel E, a loose brake-wheel F, arranged upon said sleeve B opposite each wheel E and each supporting loose spur-wheels extending between and engaging with the wheels D and the gears of the adjacent wheels E, an electric motor supported by said car and suitably connected with said wheel C, and suitable brake mechanism for alternately engaging the brake-wheels F, substantially as shown and described.

5. The combination, with an electric-railway car, of a duplex power-transmitting mechanism applied to one of the axles of said car, said mechanism consisting of a sleeve B, a wheel C, mounted upon said sleeve, wheels E, constructed substantially as described and keyed upon said axle at the ends of said sleeve, wheels D, mounted upon said sleeve adjacent to the wheel E, loose brake-wheels F, mounted upon said sleeve, one adjacent to each of the wheels E and each supporting loose spur-wheels extending between and engaging with the wheels D and the gears of the adjacent wheel E, the relation of said wheels supported by the brake-wheel F to the adjacent wheel D differing from the relation between the wheels supported by the other brake-wheel F to the other wheel D, to the end that one member of the transmitting mechanism may differ in motion from the other, an electric motor supported by said car and suitably connected with said wheel C, and suitable brake mechanism for alternately engaging the wheels F, substantially as shown and described.

6. The combination, with an electric-rail-

way car, of a duplex power-transmitting mechanism applied to one of the axles of said car, said mechanism consisting of a sleeve B, a wheel C, mounted upon said sleeve, wheels E, constructed substantially as described and keyed upon said axle at the ends of said sleeve, wheels D, mounted upon said sleeve adjacent to each wheel E, a loose brake-wheel F, surrounding said sleeve, one adjacent to each of the wheels E and one supporting spur-wheels F^2 in the space between the adjacent wheel D and the gears of the wheel E and engaging said gears and said wheel D, and the other of said brake-wheels supporting wheels F^2 between the adjacent wheel D and the gears of the adjacent wheel E and meshing only into the latter, and said last-mentioned brake-wheel also supporting a wheel F^3 in the space between the wheel D and the gears of the wheel E and meshing into the wheel D and the adjacent wheel F^2, an electric motor supported by said car and suitably connected with said wheel C, and suitable brake mechanism for alternately engaging the wheels F, substantially as shown and described.

In testimony whereof I affix my signature, in presence of two witnesses, this 18th day of April, in the year 1890.

WARREN S. BELDING.

Witnesses:
CYRUS KEHR,
FRANK L. STEVENS.