(No Model.) 2 Sheets—Sheet 1.

W. W. GRISCOM.

VEHICLE MOTOR.

No. 408,233. Patented Aug. 6, 1889.

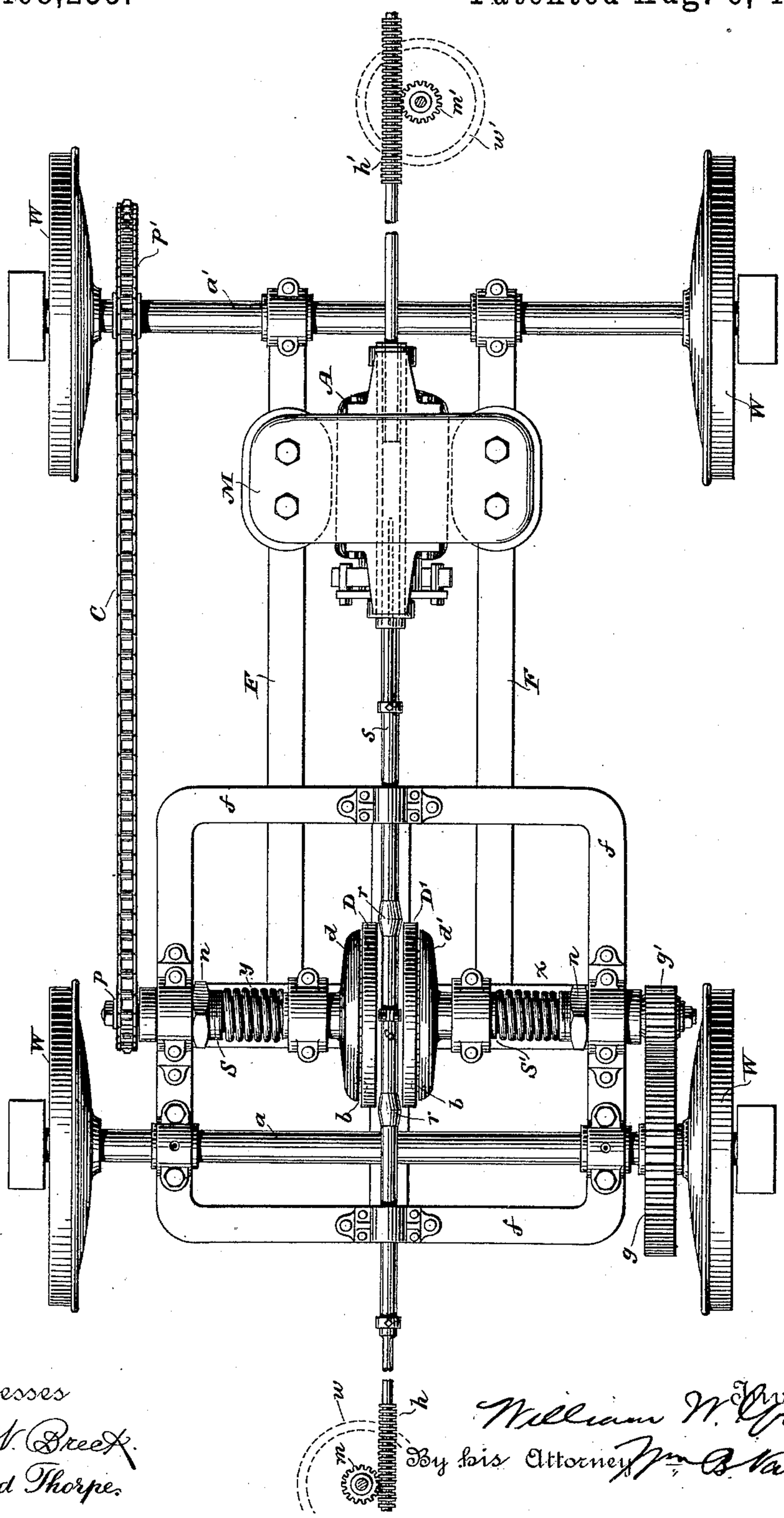

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

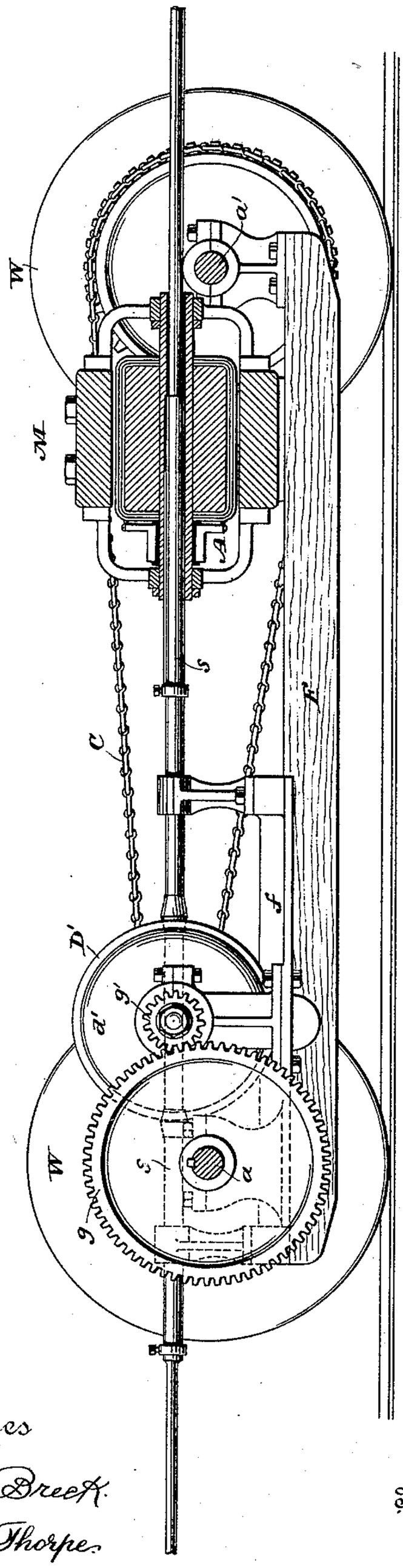
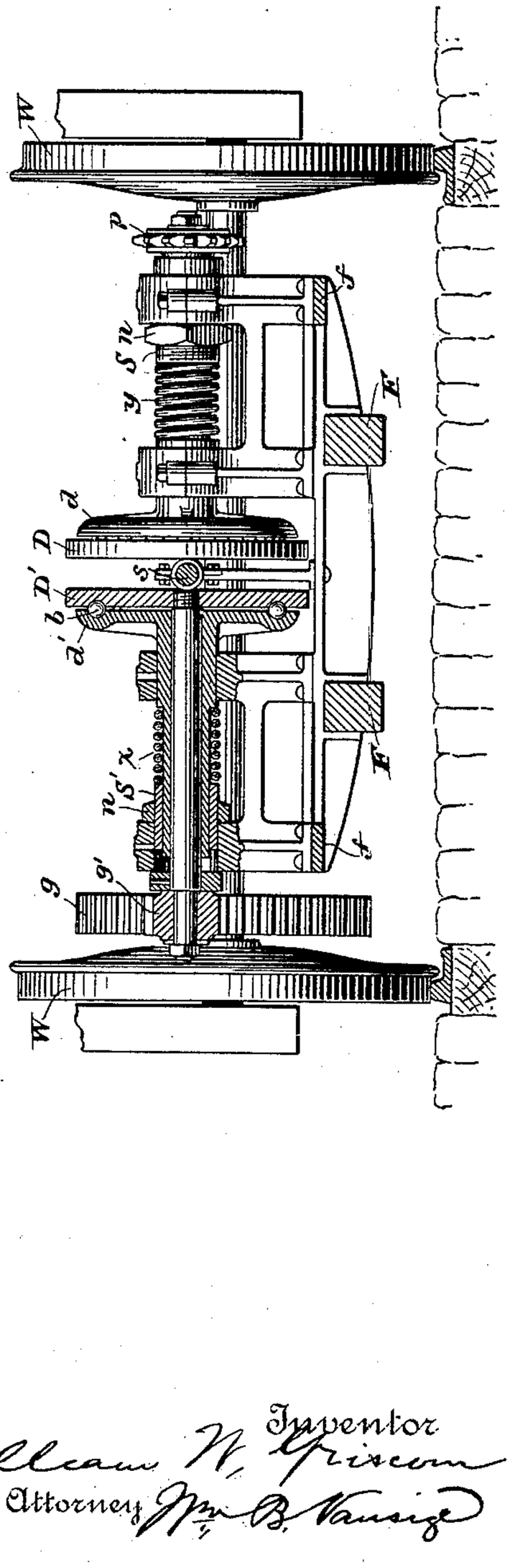


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM W. GRISCOM, OF HAVERFORD COLLEGE, ASSIGNOR TO THE ELECTRO DYNAMIC COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

VEHICLE-MOTOR.

SPECIFICATION forming part of Letters Patent No. 408,233, dated August 6, 1889.

Application filed May 6, 1889. Serial No. 309,762. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. GRISCOM, a citizen of the United States, and a resident of Haverford College, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Propulsion of Vehicles, of which the following is a specification.

My invention is an improvement in the propulsion of vehicles—such as street-cars—and is particularly adapted to use in connection with an electric motor, though applicable to use with other motors.

It is well known that an economical and effective electric motor is such only when its armature is allowed to rotate at what is called its "critical speed," usually a very rapid rate, and when adapted to the propulsion of street-cars or similar vehicles the speed with which the armature rotates must be decreased at the point of connection with the wheels or axles of the car, and this speed must be so arranged as to be easily and widely varied—that is, the speed with which the car is propelled must be variable to permit of gradually starting and stopping; and a further complication of this difficult problem is due to the fact that when starting under slow speed a comparatively greater expenditure of motive power is called for than is the case where the car or vehicle is moving at its maximum speed or at a greatly-increased speed. It is also necessary to produce movement in either of two directions under the conditions substantially above stated.

My invention furnishes a practical solution of the problem above described; and it consists of a new and useful construction and arrangement of apparatus for varying the speed as described, for changing the direction of movement of the car or vehicle, and for producing these changes gradually, while the maximum power of the motor is available at the slowest speed.

I arrange two friction-disks in parallel planes, each on a separate bearing-shaft, and I gear or mechanically connect the two axles of the car with these two bearing-shafts, respectively. The two friction-disks are in close proximity, there being only sufficient space between them for a shaft having its longitudinal axis parallel with the planes in which the disks rotate. On this shaft, separated a distance about equal to the diameter of the disks, are two friction-rollers. The said shaft is connected to the armature of an electric motor and rotates with it. It is capable of a reciprocating longitudinal movement, maintaining its connection with the motor-armature. While rotating, if it be longitudinally moved in one direction—say forward—one of the friction-rollers will enter between the two friction-disks and rotate them both. The point of contact being at the end of a radial line on the disks produces a slow movement of the disks with the greatest leverage or power applied. As it becomes desirable to increase the speed, the longitudinal movement of the shaft is increased, and the point of contact between the friction-roller and the friction-disks approaches the center of the disks, the speed rapidly increasing. In decreasing the speed the reverse longitudinal movement of the shaft is produced until the minimum speed is attained, and if this direction of longitudinal movement of the shaft be continued the second friction-pulley will enter between the friction-disks at the opposite end of a diameter from the point of contact of the first pulley, thus producing movement in the opposite direction, the change from one direction to the other being made at the slowest speed of movement and with the greatest leverage or the most advantageous application of power.

Suitable mechanical means for maintaining the required degree of friction between the friction-disks and the friction-roller and for imparting the longitudinal reciprocating movement to the shaft are provided.

The accompanying drawings illustrate my invention.

Figure 1 is a complete plan view of the running-gear of a tramway-vehicle or street-car with my improvements applied thereto; Fig. 2 is a central vertical longitudinal section; and Fig. 3 is a transverse view, parts thereof being in section.

The car-wheels W W are located upon axles *a* and *a'*. These axles support a frame F

and a supplemental frame *f*, both suitably journaled to the axles. There are two shafts S S′, suitably journaled in or supported by the frames F and *f*. On adjacent ends of these shafts, in parallel planes, are two friction-disks D and D′. Adjacent to friction-disks D and D′, moving loosely on shafts S S′, respectively, are two disks *d d′*. Between disks D and *d* and between disks D′ and *d′* there are ball-bearings *b*, operating in circular grooves, as is well understood in mechanics, for the purpose of avoiding friction. A helical spring *x* on shaft S′ operates to force disk *d′* against friction-disk D′ and to thus press friction-disk D′ and its shaft S′ forward. A similar helical spring *y* on shaft S operates in a similar manner upon disks *d* and D and shaft S, the result being that friction-disks D and D′ are forced toward each other by pressure due to springs *x* and *y*, both springs being adjustable by nuts *n n*. On the outer end of shaft S is a pulley-wheel *p*. This is connected by a chain C with a wheel *p′* on axle *a′*. On the outer end of shaft S′ is gear-wheel *g′*, meshing with a gear-wheel *g* on axle *a*.

M is an electric motor having an armature A, rotating at a substantially-uniform rate, and taking electric current, preferably, from batteries moving with the car or in any suitable way. The core of armature A is hollow and has a keyway cut in its interior. There is a shaft *s* extending from one extreme end of the car to the other. It passes through the armature-shaft and carries a key or feather taking into the keyway in the armature-core. The keyway and feather are of considerable length, and the shaft *s*, while rotating with the armature A, may be moved longitudinally and reciprocated a distance equal to a diameter of the disks D D′. On shaft *s* are fixed two friction-rollers *r* and *r′*. They are separated a distance equal to the diameter of the disks D D′. When roller *r* enters between D D′, D is rotated in one direction and D′ in the other. When *r′* enters between D D′, the direction of rotation of both D and D′ is reversed with respect to the direction of rotation produced by the contact with roller *r*, as described.

The longitudinal movement of the shaft *s* is produced from either end of the car by means of gear-teeth *h h′* on the shaft *s*, gear-wheels *m m′*, each on a vertical shaft, and hand-wheels *w* and *w′*, as clearly shown in the drawings.

The operation of the apparatus is as follows: We will assume that the motor M is operating from current supplied from some suitable source, and that armature A is continuously rotating in one direction at a substantially-uniform speed, as is also the shaft *s*. It is desired to start the car or vehicle by operating the wheel *w* or *w′*. Shaft *s* is given a longitudinal movement, causing friction-roller *r* on shaft *s* to enter between friction-disks D D′. The rapidly-rotating roller *r* causes disk D to rotate in one direction and disk D′ to rotate in the opposite direction. The rotation is imparted to shafts S and S′, from shaft S the motion is imparted to axle *a′* through chain C, and from shaft S′ the motion is imparted to axle *a* through gears *g g′*. As the point of contact between *r* and D D′ is at the end of a radial line drawn on D D′, the rate of rotation will be reduced and the leverage with which the power is applied is a maximum. To increase the speed of rotation of the axles *a a′*, the roller *r* and shaft *s* are moved still farther along in a longitudinal direction, the radial point of contact growing shorter and shorter, and the speed of the car increasing as the friction-roller nears the center of disks D D′, and the maximum speed is attained. To slow down or stop, the shaft *s* is moved longitudinally in the opposite direction until the roller leaves the surface of the disks. To reverse the movement, the shaft is moved in the reverse direction to that first described until the roller *r′* enters between disks D D′ at the opposite end of the same diameter. It is to be noticed that a reversal of movement can only take place when the speed is reduced to the minimum—that is, when the roller *r* is at the end of a diameter, for the roller *r′* can only enter at the opposite end of this diameter when the roller *r* has arrived at the periphery of the disks by a progressive movement and has broken contact therewith. It would therefore be impossible to so start, stop, or reverse the movement as to produce a jar or jolt or to wrench the machinery. The degree of friction between the disks D D′ and the friction-rollers *r r′* is regulated by the springs *x* and *y*, and by passing the friction-rollers uniformly over the face of the friction-disks there will be little or no cutting or grinding.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a wheeled vehicle, a motor for propelling said vehicle located thereon, and means for applying the movement of said motor to the running-gear of said vehicle, consisting of two parallel friction-disks mechanically connected with said running-gear, one or more friction-rollers operating upon the faces of said disks and connected with the moving parts of the motor, and means for varying the radial point of contact between said roller and disks, substantially as described.

2. The combination of a wheeled vehicle, a motor for propelling said vehicle located thereon, and means for connecting said motor to the running-gear of said vehicle, consisting of two parallel friction-disks mechanically connected to said running-gear, two friction-rollers mechanically connected with the moving part of said motor, and means for bringing either roller into contact with said friction-disks to produce movement in either direction, substantially as described.

3. The combination of a wheeled vehicle, a motor for propelling said vehicle located

thereon, operating with a substantially uniform speed and direction of movement, and means for communicating the movement of said motor to the running-gear of said vehicle to produce a variation in speed of movement in either of two directions, said means consisting of two parallel friction-disks mechanically connected to the running-gear of the vehicle, two friction-rollers fixed to a shaft located between said friction-disks and adjustably connected with the moving part of said motor, and means for bringing either of said friction-rollers into contact with the opposing faces of said friction-disks at varying but equidistant radial points on both said disks, substantially as described.

4. The combination of a wheeled vehicle, a motor for propelling said vehicle located thereon, operating with a substantially uniform speed and direction of movement, and means for communicating the movement of said motor to the running-gear of said vehicle to produce a variation in speed of movement in either of two directions, said means consisting of two parallel friction-disks mechanically connected to the running-gear of the vehicle, a spring for each disk acting to force said disks toward each other, a supplemental disk and ball-bearings between each spring and friction-disk, two friction-rollers fixed to a shaft located between said friction-disks and adjustably connected with a moving part of said motor, and gear-teeth and gear-wheels at each end of said shaft for imparting a longitudinal movement to said shaft, substantially as described.

5. The combination of a wheeled vehicle, a motor for propelling said vehicle located thereon, and means for connecting said motor to the running-gear of said vehicle, consisting of one or more friction-disks mechanically connected to said running-gear, two friction wheels or rollers mechanically connected with the moving part of said motor, and means for bringing either roller into contact with said friction-disk to produce movement in either direction, substantially as described.

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F. D. L. WALKER.