(No Model.) 2 Sheets—Sheet 1.

W. E. HARRINGTON.

DEVICE FOR TRANSMITTING MOTION FOR ELECTRIC STREET CAR MOTORS.

No. 487,069. Patented Nov. 29, 1892.

Fig. 1.

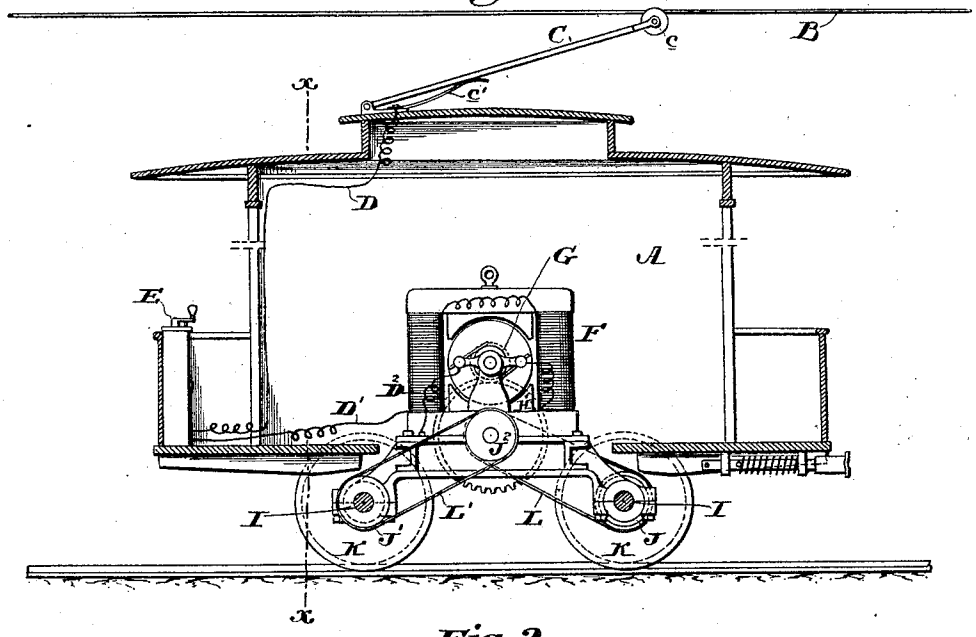


Fig. 2.

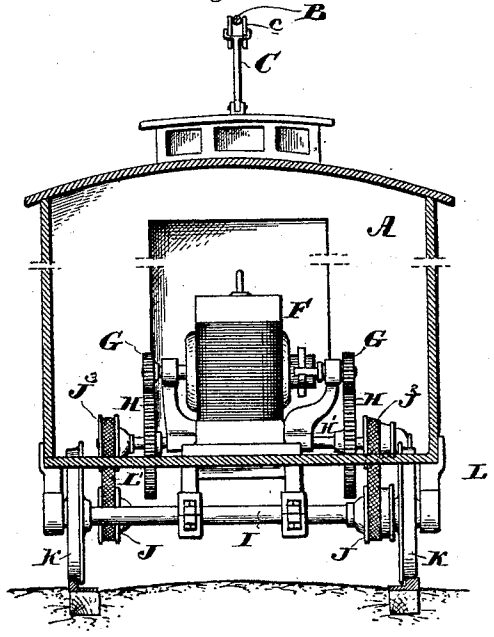
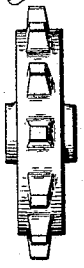


Fig. 9.

Fig. 10.



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Francis T. Chambers

(No Model.) 2 Sheets—Sheet 2.

W. E. HARRINGTON.

DEVICE FOR TRANSMITTING MOTION FOR ELECTRIC STREET CAR MOTORS.

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Fig. 3.

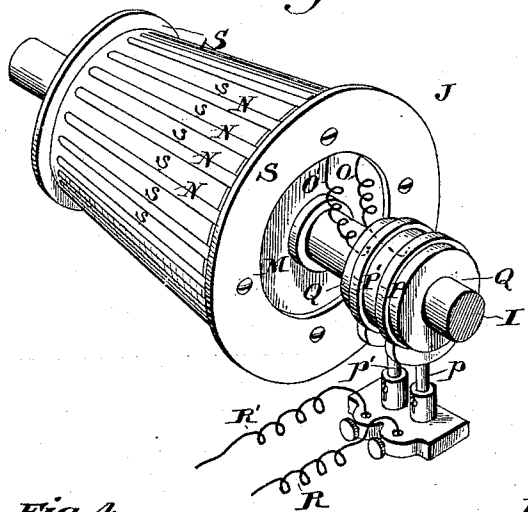


Fig. 4.

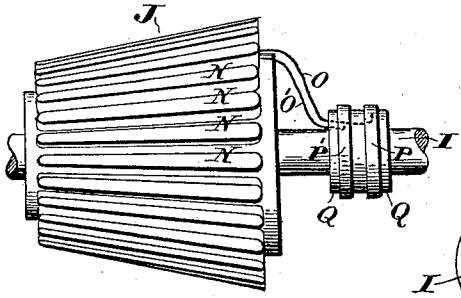


Fig. 5.

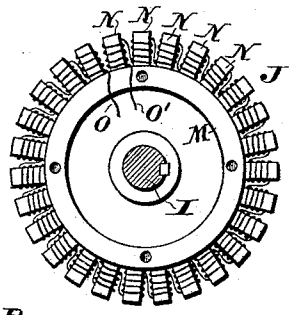


Fig. 8.

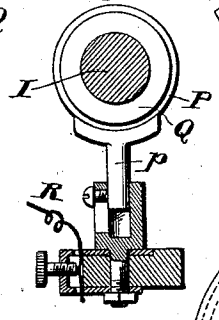


Fig. 6.

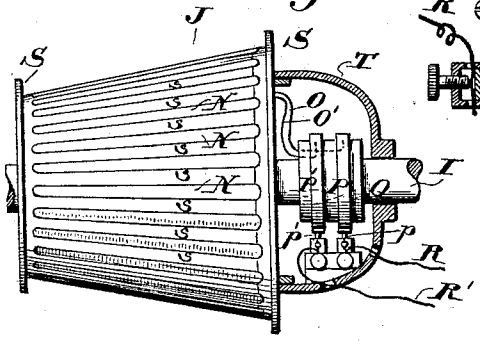
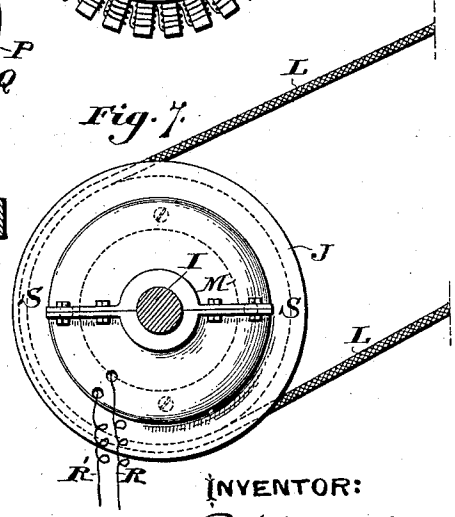


Fig. 7.



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Francis T. Chambers

UNITED STATES PATENT OFFICE.

WALTER E. HARRINGTON, OF ATLANTIC CITY, NEW JERSEY, ASSIGNOR TO FRANCIS T. CHAMBERS, OF PHILADELPHIA, PENNSYLVANIA.

DEVICE FOR TRANSMITTING MOTION FOR ELECTRIC STREET-CAR MOTORS.

SPECIFICATION forming part of Letters Patent No. 487,069, dated November 29, 1892.

Application filed October 4, 1890. Serial No. 367,055. (No model.)

To all whom it may concern:

Be it known that I, WALTER E. HARRINGTON, of Atlantic City, county of Atlantic, State of New Jersey, have invented a certain new and useful Device for Transmitting Motion, Especially Adapted for Electric Street-Car Motors, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to a device for transmitting motion especially adapted for use with electric street-car motors, but fitted for use, also, with all electric and other sources of power. In the early development of electric motors as applied to railway-work the motors were attached to the body of the truck or car and geared directly to the car axle or axles by means of spur-gearing, sprocket-wheels and chains, pulleys and belts, and friction-clutches. The extreme vibrations set up when the power was applied suddenly to the motor and the variations of distance between the axles and the motor secured upon the truck prevented the proper working of such gearing and was the cause of very frequent breakage. The difficulties at first met with were partially overcome by the device of supporting the motor partially upon one axle and partially by springs secured to the truck. It was thus made possible to employ such gearings as I have mentioned between the motor and the axle, upon which it was supported at one end, and the yielding nature of the support at the other end of the motor enabled it in starting to take up in a yielding medium a portion of the power previously taken up in shock. Obviously, however, the use of this mode of attachment rendered it still more difficult to effect a proper gearing of the motor with both axles of the truck.

Among additional devices which have been tried or are in use, with the object of avoiding the destructive shock incident to the starting of the motor and the excessive heat developed at starting, I may mention the Sprague method, by which the heavy initial flow of current is reduced by arranging the field-coils of the motor to offer a high resistance to the line-pressure at starting, and the Thomson-Houston method of reducing the heavy initial flow by inserting external resistance, and, as it were, throttling the current at starting, and the use of friction-clutches, all of which devices, however, have well-recognized defects.

The exigencies of railway-work require that so far as possible means of gearing the motor with the axles should be employed, which should, first, permit the motor to be started in advance of the car, so that it can attain its normal counter electro-motive force before the work of driving the car is thrown upon it; second, the device for transmitting motion from the motor should do so automatically and independent of any action by the operator; third, the device should permit a variable-speed ratio between the driving and ribbon shaft, thus utilizing the motor at its best efficiency by external mechanism instead of by throttling the current, as is now the practice; fourth, it is highly desirable that the motor should be connected with both axles of the truck; fifth, it is desirable that the motor should be placed at a point higher from the ground than is now the practice and more thoroughly insulated therefrom.

The object of my invention is to provide a device for transmitting motion which will render these desirable points practicable; and it consists in the said device and in its combination with the various parts hereinafter specified.

My invention will best be understood as described in connection with the drawings, in which it is illustrated, and in which—

Figure 1 is a side sectional elevation of a street-car and motor provided with my improvements. Fig. 2 is a front sectional elevation of the same. Fig. 3 is a perspective view of the magnetic pulley, which forms an important feature of my invention. Fig. 4 is a face view of the pulley with its casing removed; Fig. 5, a side elevation thereof; Fig. 6, a face view showing connections; Fig. 7, a side elevation showing the pulley and belt; Fig. 8, a cross-section showing electrical connections of pulley; Fig. 9, a view of a drive-chain which can be used instead of a belt, and Fig. 10 a sprocket-wheel for use with chain.

A is a car; B, an overhead wire; C, a trolley-rod; *c*, the trolley; *c'*, the spring holding the trolley against the wire; D D', the wires

leading to the motor F; E, the switch; D^2, the ground-wire; G, a gear-wheel on the armature-shaft of the motor gearing with a wheel H on the driving-shaft H′.

In all the above particulars the apparatus is of usual construction, except that the motor is set higher up than is now usually the case or advisable with the devices generally used to transmit its motion to the axle.

On shaft H′ are secured one or more pulleys, as J^2 J^3, the construction of which will be hereinafter described, and from said pulleys belts L and L′ transmit motion to pulleys J on the truck-axles I I, to which wheels K are secured. One and preferably both of the pulleys connected by belt L or L′ is constructed as shown in Figs. 3, 4, 5, and 6—that is, with a metallic rim M, in which are secured iron bars N N, &c., arranged like the teeth of a gear-wheel and wound with wire, so that when a current is passed through said wire they will each become an electro-magnet.

O and O′ represent the free ends of the wire with which the bars N are wound. A convenient mode of connecting these wires is shown in Figs. 3, 4, 6, and 8, the wires being secured to conducting-rings P and P′, which are attached to rings Q, formed of non-conducting material and journaled on shaft I. From rings P and P′ the current is taken by adjustable contact-plates *p p* and thence by wires R and R′. A casing T (see Fig. 6) can be thrown over the rings, &c., to protect them from injury,

S S indicate brass plates bolted to the ends of the pulleys J and having extensions *s s*, &c., which pass between the bars N and protect them and their wire windings, while leaving their faces exposed.

In order to render the speed ratio variable, I prefer for railroad-work to make one or both of the magnetic pulleys connected by a belt of cone form, as shown.

The current transmitted through the wires R and R′ to the magnetic pulleys J may be controlled and regulated in any convenient way. The connection may be with the motor, and thus be automatically regulated by the work the motor is performing, or it may entirely be independent of the motor and directly under the control of the operator.

The operation of the device will be readily understood. A current being transmitted through the wires wound upon the bars N N, &c., converts each of them into an active electro-magnet, and all of them, which are in contact with the metallic belt L, act to draw the belt toward them and resist its tendency to slip over their surfaces. The amount of force thus exerted upon the belt to prevent its slipping can be nicely determined and regulated, and where any opposing force of greater amount is offered the belt will slip upon the face of the pulley, thus preventing injurious shock, while at the same time it is constantly exerting the determined amount of power upon the driven shaft, and, as it were, gradually transmitting the motion of the driving-shaft thereto without any injurious strains or shocks. The mechanical friction of the belt upon the face of the pulley is reduced as low as practicable, the ends of the magnetic bars being smooth and preferably oiled, so that the mere mechanical friction will be of the very least. Obviously the power exerted to hold the belt to the pulley or pulleys does not depend at all upon the tightness of the belt. Therefore the speed ratios can readily be varied in the simple way of making the face of the magnetic pulleys of cone shape, so as to change the speed ratio as the belt is shifted from one side to the other.

I have found in practice that a belt of woven iron wire passing over magnetic pulleys on both shafts will give the best results. Obviously, however, an iron drive-chain may be used, such as is indicated in Fig. 9, said chain passing over the face of one magnetic pulley and gearing with a sprocket-wheel—such as is indicated in Fig. 10—upon the counter-shaft. This arrangement, however, allows slip only on one of the engaged shafts, while by using two magnetic pulleys slip is allowed upon either or both of them, and the woven belt is besides less liable to breakage than the drive-chain.

As, owing to the nature of my device for transmitting motion, it is not essential that the driving and driven shafts should maintain a constant distance from each other, I am enabled to place the motor higher up on the truck than is now the practice and where it can be better inclosed and protected than in present arrangements, and I am also enabled to gear the motor directly with both axles of the truck, as shown in the drawings, so that the power can be evenly distributed between them.

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

1. The combination, with two pulleys made powerfully magnetic by suitable winding, of an endless belt of magnetic material running over said pulleys and held thereto by magnetic attraction.

2. As a device for transmitting motion, a pulley having its face composed of a series of transversely-extending electro-magnets and a belt of magnetic material, passing over said pulley, substantially and for the purpose specified.

3. As a device for transmitting motion, a cone-pulley made powerfully magnetic by suitable windings and a belt of magnetic material of less breadth than the face of the pulley, passing over said pulley, substantially as and for the purpose specified.

4. As a device for transmitting motion, pulleys situated opposite to each other on parallel shafts, each having its face made up of a series of electro-magnets, and an endless belt

of magnetic material, passing over said pulleys, but not attached thereto, all substantially as and for the purpose specified.

5. As a device for transmitting motion, pulleys situated opposite to each other on parallel shafts, each having its face made up of a series of transversely-extending electro-magnets, and a belt of magnetic material, passing over said pulleys, substantially as and for the purpose specified.

6. In combination with an electric motor, a pulley positively actuated by said motor, the face of which is made up of a series of transversely-extending electro-magnets, a driven shaft having a pulley thereon opposite to the magnetic pulley, and a belt connecting said pulleys and composed of magnetic material, substantially as and for the purpose specified.

7. In combination with a car-truck, an electric motor supported on said truck, a shaft positively driven by said motor, a pulley secured to said shaft, having its face made up of a series of electro-magnets, a pulley secured to the axle of the truck, and a belt passing over said pulleys and composed of magnetic material.

8. In combination with a car-truck having two axles, an electric motor supported on said truck, a shaft positively driven by said motor, two pulleys secured to said shaft and each made powerfully magnetic by suitable windings, pulleys secured to each of the truck-axles, and belts of magnetic material, passing over each magnetic pulley and to the pulleys on the respective axles, all substantially as and for the purpose specified.

9. In combination with a car-truck, an electro-motor situated thereon, a shaft driven positively by said motor, a pulley secured to said shaft and having its face made powerfully magnetic by suitable windings, a similar pulley secured to an axle of the car, and a belt of magnetic material, connecting said pulleys.

10. In combination with a car-truck, an electro-motor situated thereon, a shaft driven positively by said motor, a cone-pulley secured to said shaft and made powerfully magnetic by suitable windings, a plain-faced pulley of similar construction, secured to an axle of the car, and a belt of magnetic material, connecting said pulleys.

WALTER E. HARRINGTON.

Witnesses:

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JOSHUA MATLACK, Jr.