(No Model.)

5 Sheets—Sheet 1.

T. M. FOOTE.

ELECTRIC LIGHTING OF RAILWAY CARS.

No. 410,586. Patented Sept. 10, 1889.

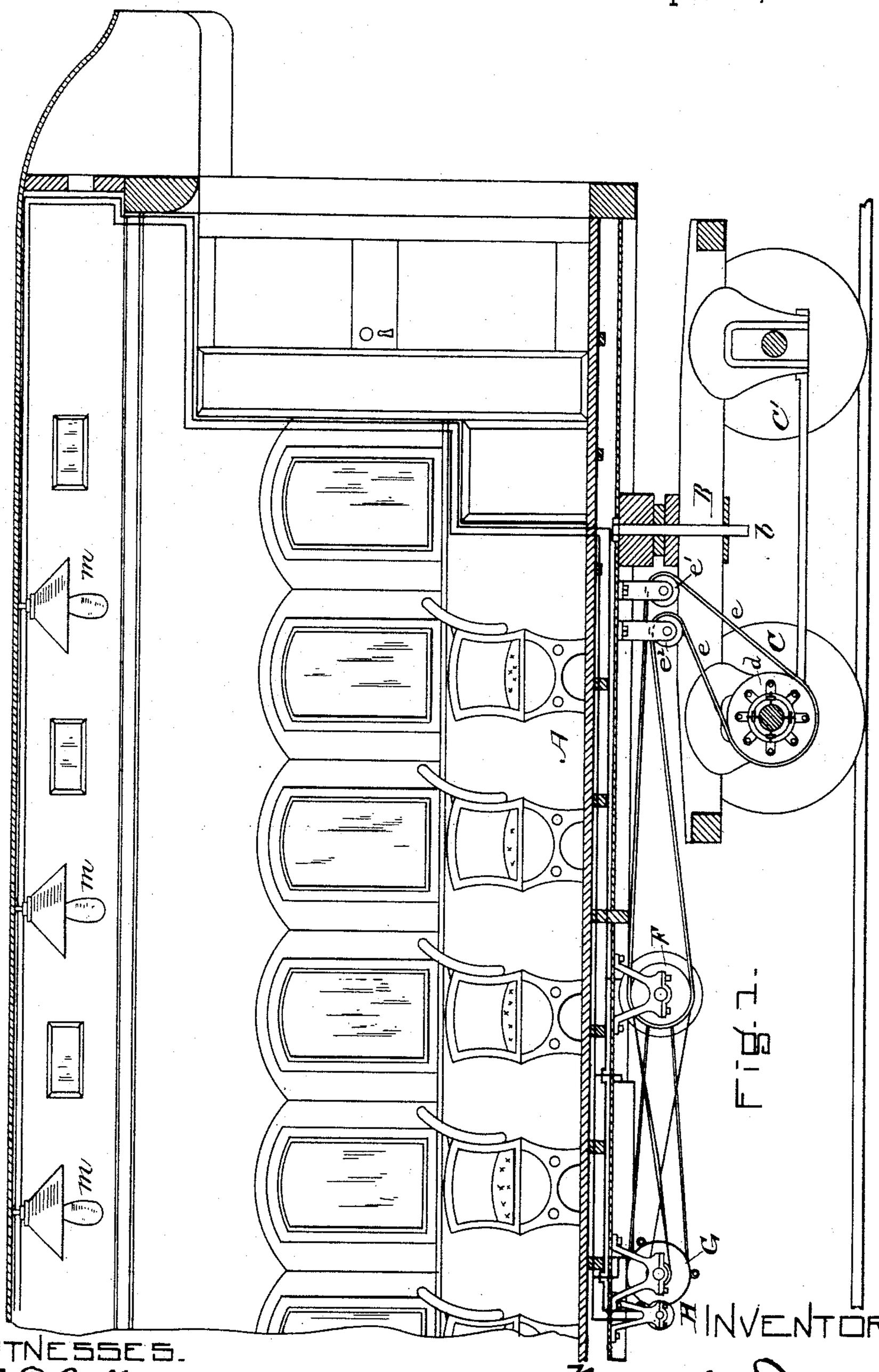

Fig. 1.

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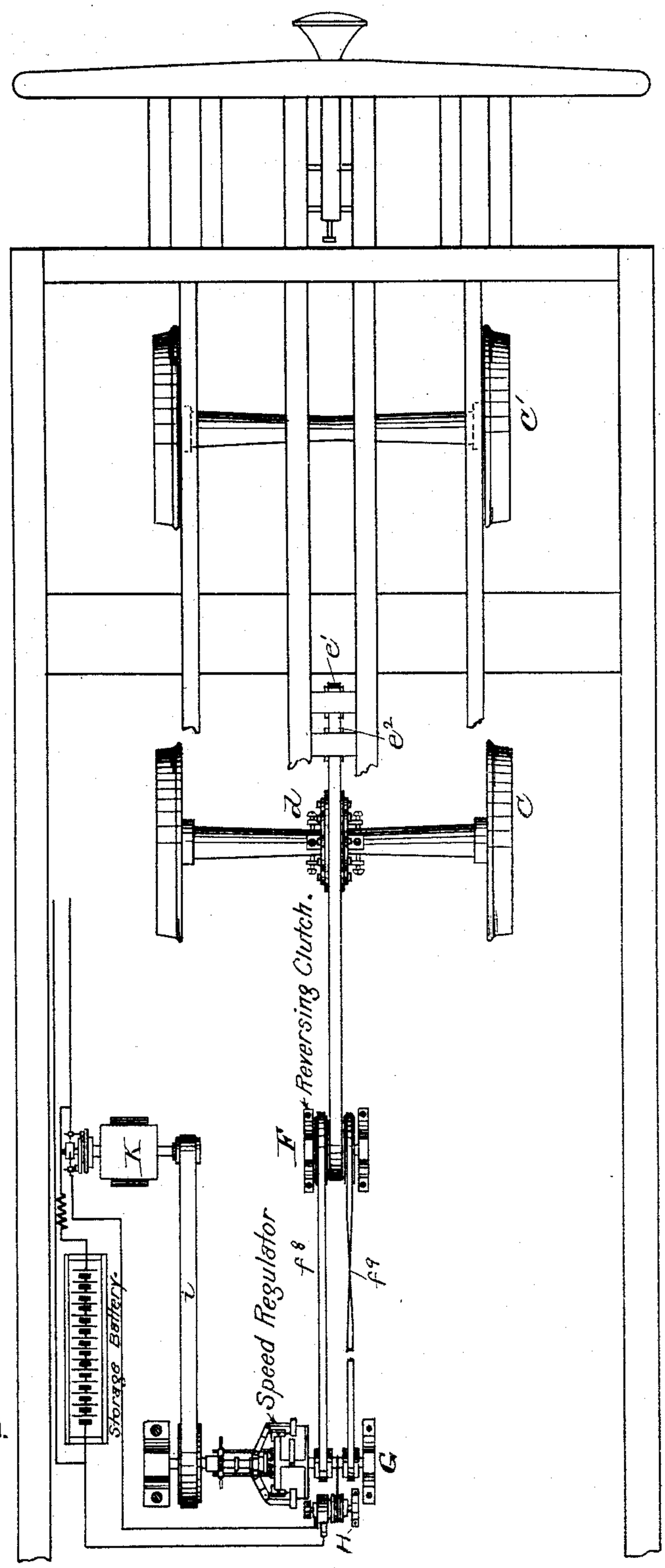

FIG. 2.

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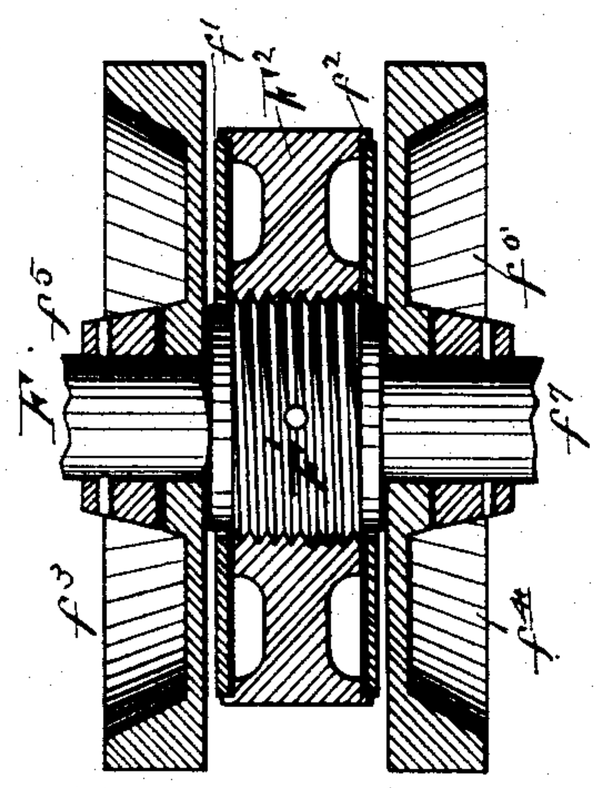

Fig. 4.

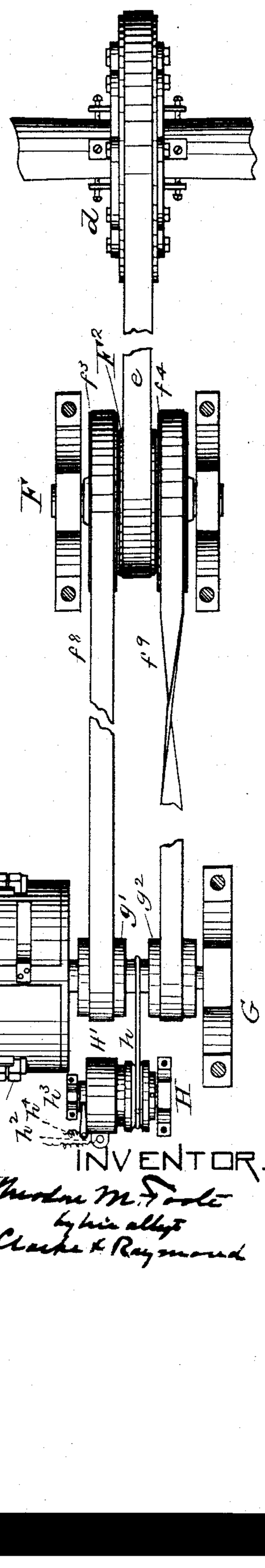

Fig. 5.

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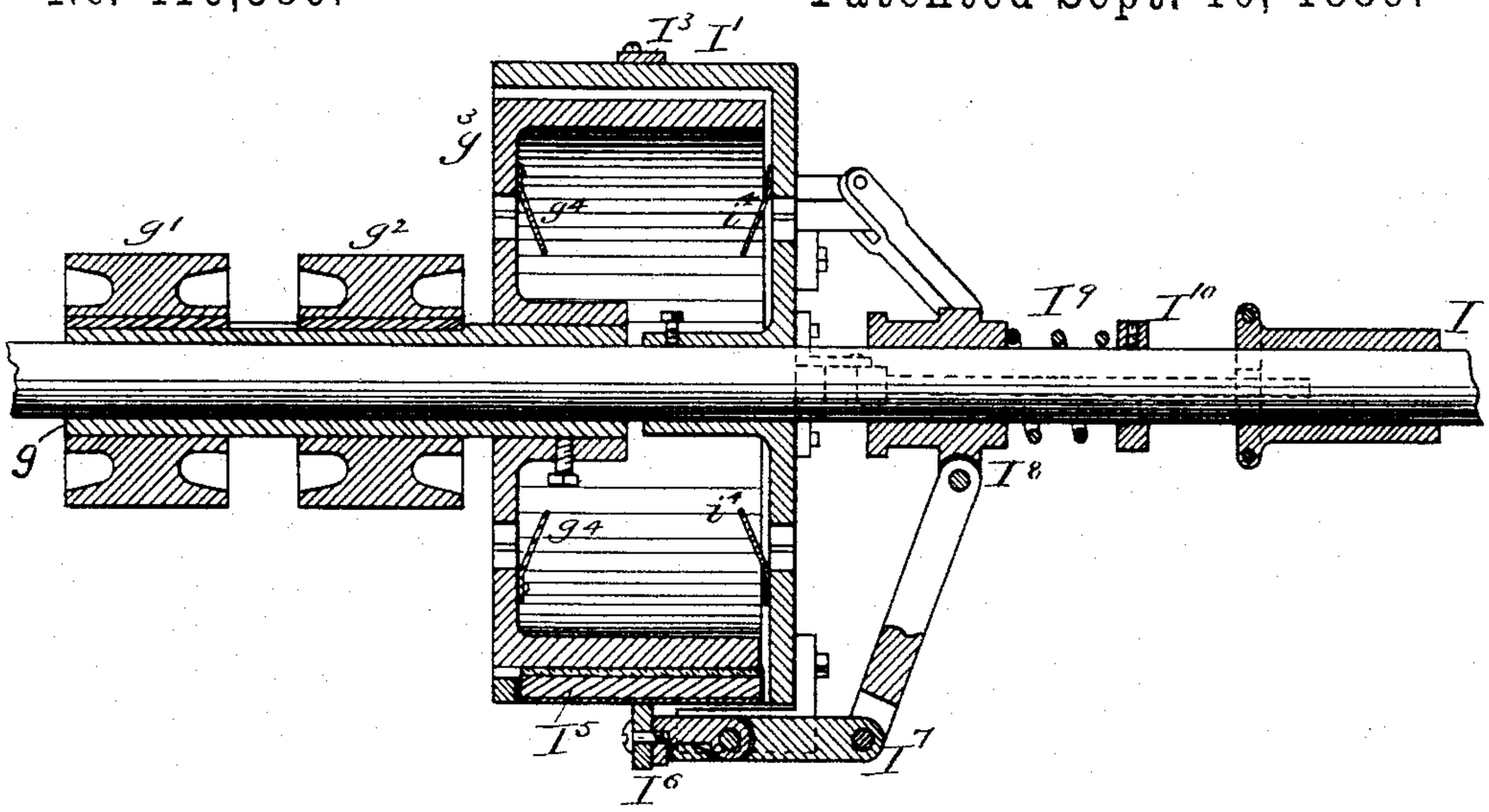

Fig. 5.

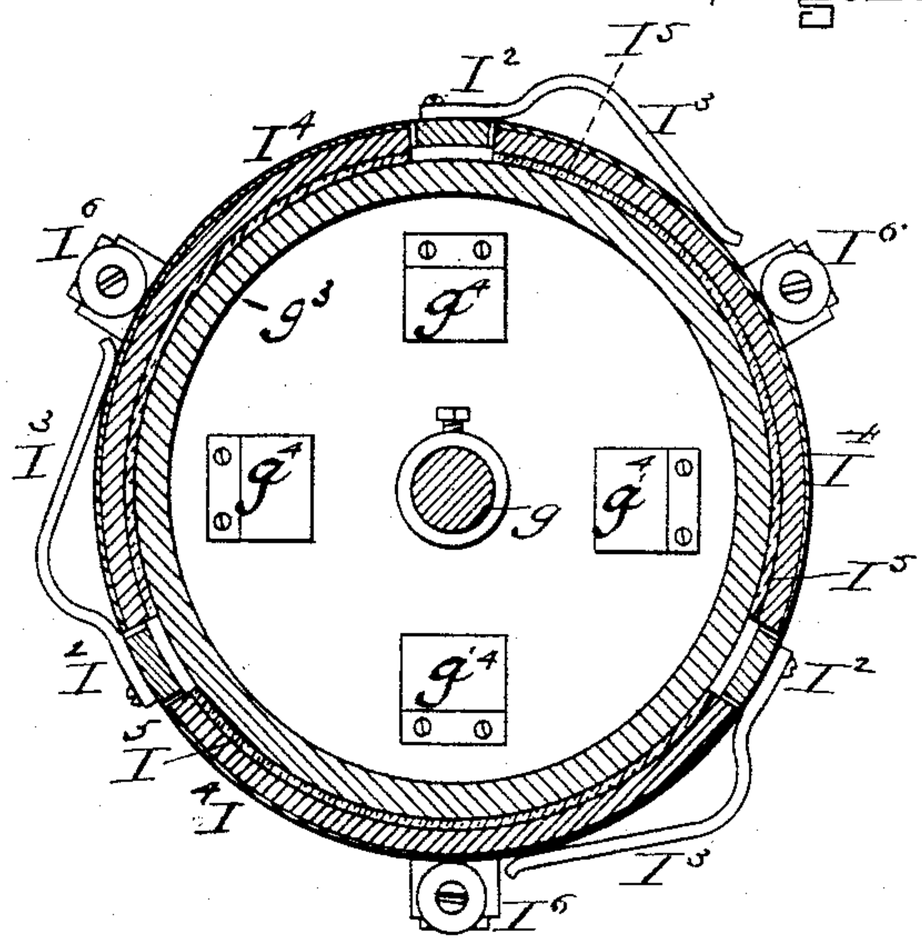

Fig. 6.

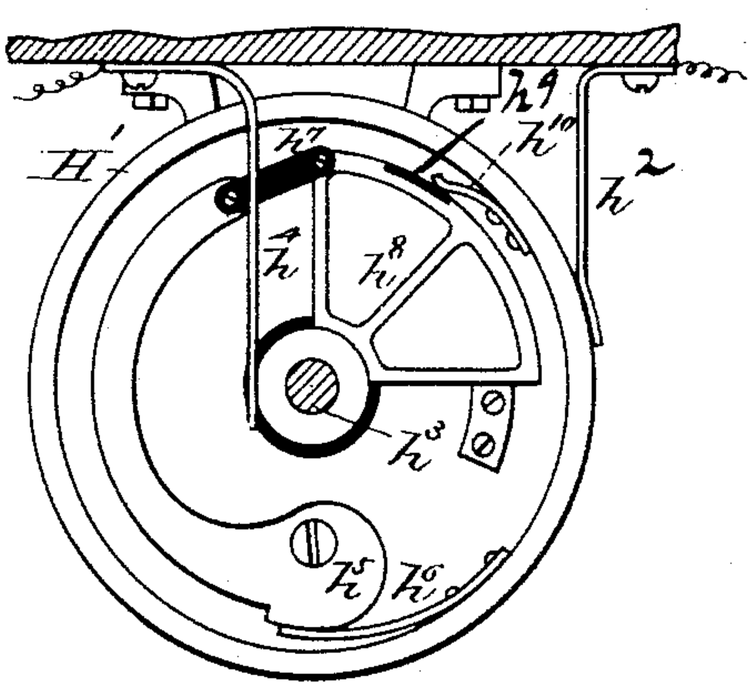

Fig. 7.

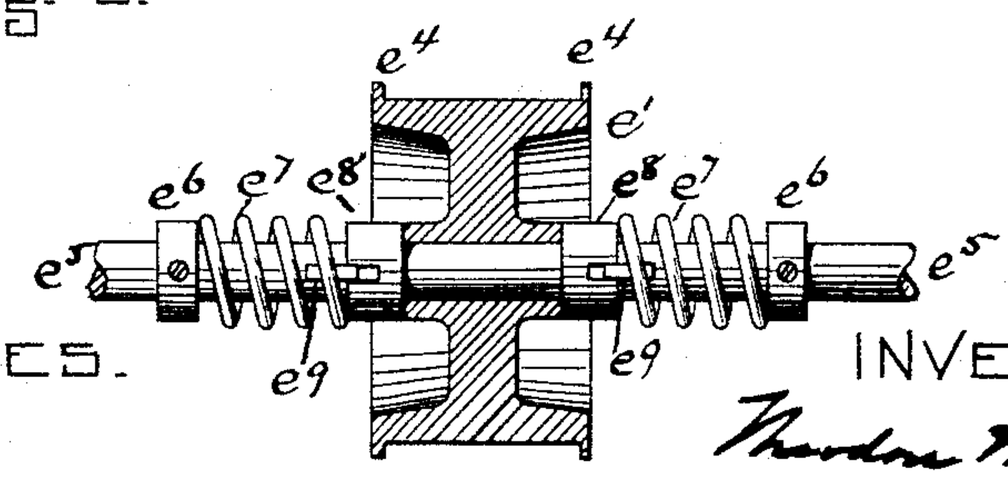

Fig. 9.

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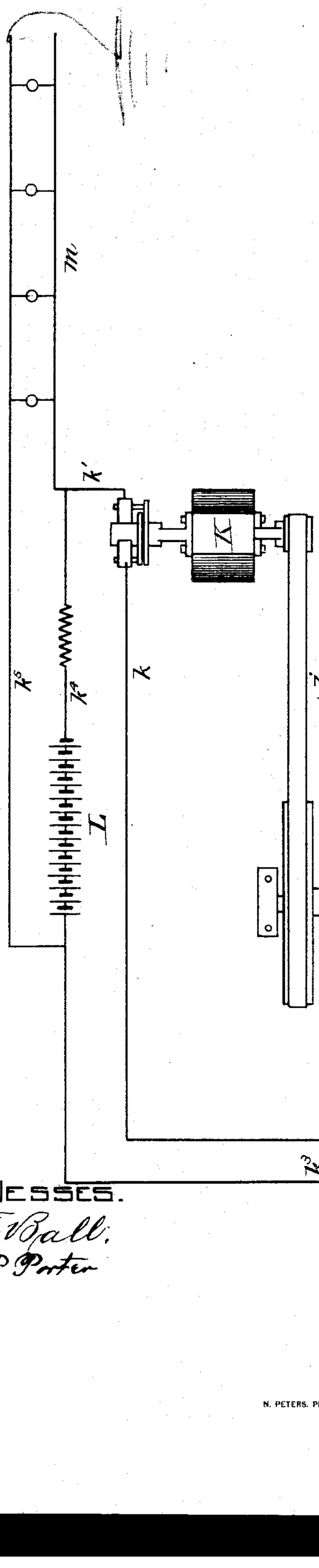

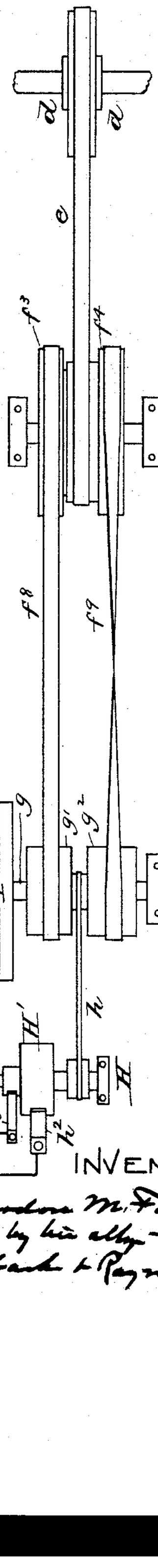

Fig. 6.

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UNITED STATES PATENT OFFICE.

THEODORE M. FOOTE, OF BOSTON, MASSACHUSETTS.

ELECTRIC LIGHTING OF RAILWAY-CARS.

SPECIFICATION forming part of Letters Patent No. 410,586, dated September 10, 1889.

Application filed April 25, 1888. Serial No. 271,799. (No model.)

To all whom it may concern:

Be it known that I, THEODORE MARSHALL FOOTE, of Boston, in the county of Suffolk and Commonwealth of Massachusetts, have invented a new and useful Improvement for the Electric Lighting of Railway-Cars, some parts of which are applicable for other sorts of electric lighting, of which the following is a specification, reference being had to the accompanying drawings.

Many methods have been devised for the electric lighting of railway-cars, some of which rely entirely upon what is usually called a "storage-battery," some of which rely upon chemical batteries without the aid of dynamos to charge them, and some of which rely upon the use of a dynamo carried upon the engine or upon a special car; but I have preferred to endeavor to generate the electricity required for lighting each car individually by a dynamo carried upon the car itself and run by the superfluous power of the movement of the train—in other words, to take the power for running the lights of each car indirectly, by means of the wheels of the car, from the locomotive; and in order to accomplish this many modifications of detail of various appliances are required and new combinations necessitated, which I will proceed to explain. Some of these modifications are already subjects of separate patents or applications; but as they are all employed conjointly, and are all necessary to be employed for obtaining successful results in this method of electric illumination for railway-cars, they are described, so far as necessary, in this specification to make it complete, as well as in their own particular specifications.

In the drawings, Figure 1 is a longitudinal section through the end of a railway-car and its truck, showing in elevation the chain of appliances employed by me. Fig. 2 is a skeleton plan of the platform of a railway-car, showing a portion of its truck and the power-transmitting and electric appliances run from the car-axles. Fig. 3 is a condensed view of the power-axle, the automatic reversing-clutch, the speed-regulator, the automatic electric switch, and the dynamo on an enlarged scale. Fig. 4 is a sectional view, on a still larger scale, of the automatic reversing-clutch. Fig. 5 is a longitudinal section of the speed-regulator, and Fig. 6 is a transverse section of the drum of the speed-regulating device or speed-regulator. Fig. 7 is a transverse section of the electrical switch, and Fig. 8 is a diagram of the combined apparatus. Fig. 9 is an elevation of the shaft of one of the guide-pulleys, with the guide-pulley represented thereon in section, and connected appliances.

A, Fig. 1, is the floor of the body of the car.

B is the frame of the truck, which is connected with the floor of the car in the usual way by a king-bolt *b*.

C and C′ are the wheels belonging to the truck B.

On the center of the axle of the wheel C is placed a driving-pulley *d*, which is also shown in Figs. 2 and 3 and in diagram in Fig. 8. A belt runs from this pulley *d* upward and toward the center of motion between the truck and car-floor, where the two parts of the belt pass over the bracketed pulleys e' e^2, which are made fast to the bottom of the car-floor. By leading the belt back toward and close to the center of oscillation between the truck and the car-body it is obvious that variations in the tension of the belt caused by transverse oscillation of the truck beneath the car are reduced to a minimum. The bight of the belt *e* surrounds the center pulley of the reversing-clutch F.

It is obvious that in lieu of the connection of the reversing-clutch F with the driving-pulley *d* by the belt *e* and guide-pulleys e' e^2 belt *e* might lead as a twist-belt to a pulley on a vertical shaft revolving in fixed relations to the truck, and having its center of motion coincident with the center of oscillation between truck and car and having another belt-pulley near the car-floor, from which a twist-belt should run to the reversing-clutch. This, however, would be hardly more than the device herein described divided into sections, and would involve the essence of the present arrangement—viz., the leading of the power-transmitting mechanism to the center of oscillation between car and truck on the way from the source of power to the driven shaft, or the guide-pulleys e' e^2 might be attached to the

truck at the center of oscillation, in which case other guides ought to be attached to the car-floor.

The reversing-clutch F is shown in detail at Fig. 4. Upon the shaft f^7 of the clutch, and firmly keyed to it, is a screw marked F′, and the pulley F^2 is screwed upon the screw F′, and it has a little lateral play between the two loose pulleys f^3 and f^4. Two bosses f^5 and f^6 are keyed or pinned to the main shaft f^7, and each side of the pulley F^2 has a shield upon it, which loosely fits the shaft. They are lettered f' f^2. It is obvious that if the pulley F^2 is run from right to left in the position shown in the drawings, Fig. 4, it will move on the screw in the direction of the loose pulley f^3, and that the shield f' will be forced against the flat surface of the pulley f^3, and the hub of the pulley f^3 will be moved toward the boss f^5 and pressed strongly against it, and the pulley f^3 will therefore move in the same direction as the pulley F^2, while if the pulley F^2 is turned in the opposite direction from left to right it will move on the screw F′ toward the pulley f^4 and clamp it in a similar manner in the opposite direction, and will run the pulley f^4 in the opposite direction from what the pulley f^3 had previously been run. The belts from these pulleys f^3 and f^4 are shown in Fig. 3 as f^8, a straight belt, and f^9 a cross-belt, which belts therefore, taking hold of pulleys g' and g^2 on the sleeve g of the speed-regulator G, run this sleeve g always in the same direction without regard to the direction in which the wheel C is revolving, so that the wheel C runs the sleeve g in a given and desired direction, whether the car is moved forward or backward.

The automatic reversing-clutch herein described is substantially, but not in every detail, the clutch described in Letters Patent No. 378,088, patented February 21, 1888, and is not claimed in this application, except in combination with other parts of the mechanism.

The automatic speed-regulator is indicated generally upon the drawings, Figs. 1 and 2, at G. It is shown in detail at Figs. 5 and 6, and it forms the subject of an application now pending in the Patent Office. It is not claimed in the present application, except in combination with other parts of the machinery. It is, in substance, a combined friction-clutch and governor, by which the rate of speed of the shaft I is regulated, so that any given speed of the wheel C acquired from the motion of the train will not run the shaft I, which is clutched and moved by this apparatus, faster than a predetermined rate of speed.

The construction of this automatic speed-regulator, so far as it is necessary to be explained in this application, may be understood from Figs. 5 and 6. In these g is the sleeve mounted on shaft I, receiving the power from the automatic reversing-clutch F of Fig. 1, and g' and g^2 are driven pulleys fastened upon this shaft. g^3 is a drum fastened to this shaft g and revolving with it. To examine the interior of this drum inspection-holes are made in its transverse plate, over which flaps g^4 are placed to keep out the dirt and allow a circulation of air. Upon the shaft I, upon which is mounted the sleeve g, is fastened another drum I′, the transverse plate of which has similar inspection-holes and covering-flaps (marked i^4) to those which we have previously seen are contained in the drum g^3. The periphery of this drum I′ has three stout arms I^2 fixed to the transverse plate, to which arms are made fast the springs I^3. These springs press upon a portion of the periphery of the drum, which is made movable inward and outward in a radial direction, which portion of the movable periphery is lettered in Figs. 5 and 6 I^4, and between this movable portion I^4 and the periphery of the drum g^3 is interposed, as shown in Figs. 5 and 6, a friction-packing I^5, which preferably revolves with the drum I′, but which probably might be contrived to revolve with the drum g^3, although I do not consider this a good construction, because of the irregularity of surface on the interior of the drum I′, which this packing would then encounter in its revolution. To these movable portions I^4 of the drum I′ are attached ears, (shown in Figs. 5 and 6 at I^6,) and by a system of linkage (shown in Fig. 5 and marked I^7) these ears are connected to a collar I^8 on the shaft I. This collar is pressed toward the drum I′ by the spring I^2, which abuts against a collar I^{10} on the sleeve I. On revolving the shaft g the frictional contact between the packing I^5 and the periphery of the drum g^3 will cause the drum I′ to revolve at the same speed until the centrifugal force of revolution, acting upon the linkage I^7, overcomes the resistance of the spring I^9 and relieves in some degree the frictional contact between the drum g^3 and the interior frictional surface of the drum I′, when the rate of speed of the shaft I will be reduced to that which has been predetermined in adjusting the relation between the centrifugal force, the load, and the frictional contact referred to. Thus the shaft I cannot exceed a given predetermined rate of speed.

Around the sleeve g, as shown in Fig 3, is placed a belt h, which runs the automatic electric switch H. The details of this device are shown in Fig. 7. In this figure H′ is a hollow metallic drum, which is revolved by the belt h of Fig. 3. The exterior of this drum is pressed by a spring h^2, which is an electric conductor. This drum is insulated from the shaft h^3 of Figs. 3 and 8, as shown in Fig. 7. An electric conducting-spring h^4 in Figs. 7 and 8 presses upon a hub which is fast to the shaft h^3. Upon the interior of the drum is pivoted the segmental arm h^5, which is pressed inward near its hub by the spring h^6, and the end of which segmental arm is linked by the insulating-link h^7 to the metallic segment h^8, the hub of which is fast to the shaft h^3, and

which carries upon its exterior periphery the insulating-band h^9, on which band presses the spring h^{10}, which is fast to the periphery of the drum H′ of the apparatus. It will be seen, therefore, that as represented in Fig. 7, with the spring h^{10} resting upon the insulating-band h^9, there is no electrical communication between the periphery of the drum H′ and its shaft h^3; but it will also be seen that if the drum be revolved at a high rate of speed the centrifugal force of this high rate of speed will compel the segmental arm h^5 to travel outward a short distance and carry with it the segment h^8, whereby, by the movement of this segment around the center of motion of shaft h^3, the contact-spring h^{10} will touch the metallic surface of the segment h^8 and cause an electrical connection between the periphery of the drum and its shaft, so that by the introduction of this mechanism into the electric circuit no electric current can be established through this part of the circuit, except when the machinery is running at a predetermined minimum rate of speed. I have now, by means of the automatic speed-regulater, provided that the speed delivered by the shaft I shall not be excessive, and by the electrical switch H, just described, that the electrical current shall not be established until a given minimum rate of speed or this shaft g has been reached.

The dynamo is marked K in Fig. 3, and it is run by the belt i from the shaft I.

Turning now to the diagram, Fig. 8, I have the driving-pulley d on the car-axle, the reversing-clutch F, which is attached to the body of the car, the speed-regulator G, by which the speed of the shaft I is prevented from exceeding a predetermined rate, and the dynamo K, which by this arrangement must always be run in the same direction, no matter which way the car is moving, and which cannot be run at an excessive rate of speed. The lighting apparatus is lettered in this diagram m, and the lights in Fig. 1 are similarly lettered m. It is obvious, from what has been hitherto stated, that this apparatus, were it not supplemented by some other appliance, would not light the car at stations nor at times when the dynamo was not running at a proper rate of speed. In order to do this, a storage-battery, secondary battery, or accumulator L is introduced into the circuit.

The method of wiring is as follows: A wire k is led from the dynamo to the contact-spring h^4, and a wire k' is led from the opposite pole of the dynamo to the lighting-circuit m. The storage-battery L is connected from one of its poles to the contact-spring h^2 by the wire k^3, and from its opposite pole by the wire k^4 to the wire k'. The wire k^5 connects the wire k^3 with the lighting plant m. If, now, the lighting plant be shut off and the dynamo K be run at a proper rate of speed, the storage-battery L will be called upon to receive the current from the dynamo, and when it is sufficiently charged the current may be shut off. As the current will not be established until a proper rate of speed has been reached, there will be no danger of the storage-battery L reacting against the dynamo K and reversing its poles, and as the speed is regulated by the speed-regulator there will be no danger of an excessive current. If, however, the speed of the train is not sufficient to run the dynamo and there is a necessity for lighting the cars, the current necessary will be supplied by the storage-battery L.

It is obvious that where six-wheeled trucks are employed the power could be as or more readily taken from the center axle as or than from either of the exterior axles; and it is also obvious that in case more power is desired than can be readily obtained from one axle of the truck, two or more axles could be belted together, so as to deliver more power than could be obtained from one alone. It is also obvious that in the combinations herein claimed any automatic reversing-clutch will be the equivalent of the clutch F; any efficient automatic speed-regulator which limits the speed of a dynamo to a predetermined maximum will be equivalent to the speed-regulator G, and that any automatic electric switch which closes the electric circuit from the dynamo only at a minimum speed will be the equivalent of the switch H.

As it will be necessary to ease somewhat the belt e in its change of direction, I have devised a plan of mounting the guide-pulleys e' e^2 between springs, as shown, Fig. 9. The guide-pulley e' in this figure has flanges e^4, and is mounted on a shaft e^5, which has collars e^6 pinned to it, serving as abutments to the springs e^7. These springs e^7 press strongly against collars e^8, which are allowed a little endwise play on shaft e^5, because of the slot which fits around spline or pin e^9. The collars e^8 press sidewise against the hub of guide-pulley e'. This combination lessens noise and modifies belt-tension advantageously.

I claim as my invention and desire to secure by Letters Patent—

1. In an electric-lighting system, the combination of the dynamo K, the storage-battery L, the lighting plant m, the automatic electric switch H, and the automatic speed-regulator G, substantially as described.

2. An electric-lighting system containing the combination of the driving-pulley d, the automatic reversing-clutch F, the automatic speed-regulator G, the automatic electric switch H, the dynamo K, the storage-battery L, and the lighting plant m, substantially as and for the purposes described.

3. In a railway-car having the usual swiveling-trucks and a combination of car-wheels with an electric-lighting system for said car, the combination consisting of the pulley C′ upon an axle of the car-truck, the belt e, led from said pulley toward and near to the center of oscillation between the car and truck, the guide-pulleys e' e^2, attached to the body

of the car near said center of oscillation, and the automatic reversing-clutch F, substantially as and for the purpose described.

4. In a railway-car having the usual swiveling-trucks and a combination of the car-wheels with an electric-lighting system for said car, the combination of the pulley C on one of the axles of a car-truck, the belt *e*, leading from said pulley toward and near to the center of oscillation between the car and the truck, the guide-pulleys *e'* and e^2, attached to the body of the car near the center of oscillation between the car and its truck, an automatic reversing-clutch F, and a speed-regulator G, substantially as described.

5. An electric-lighting system adapted to be driven from a source of power of varying velocity, in which the power which drives the dynamo K is transmitted through the speed-regulator G and controlled thereby within a predetermined maximum velocity, in combination with an electric switch H, said dynamo K, and a lighting system, substantially as described.

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Witnesses:
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