(No Model.) 5 Sheets—Sheet 1.

J. C. HENRY.

ELECTRIC RAILWAY.

No. 424,298. Patented Mar. 25, 1890.

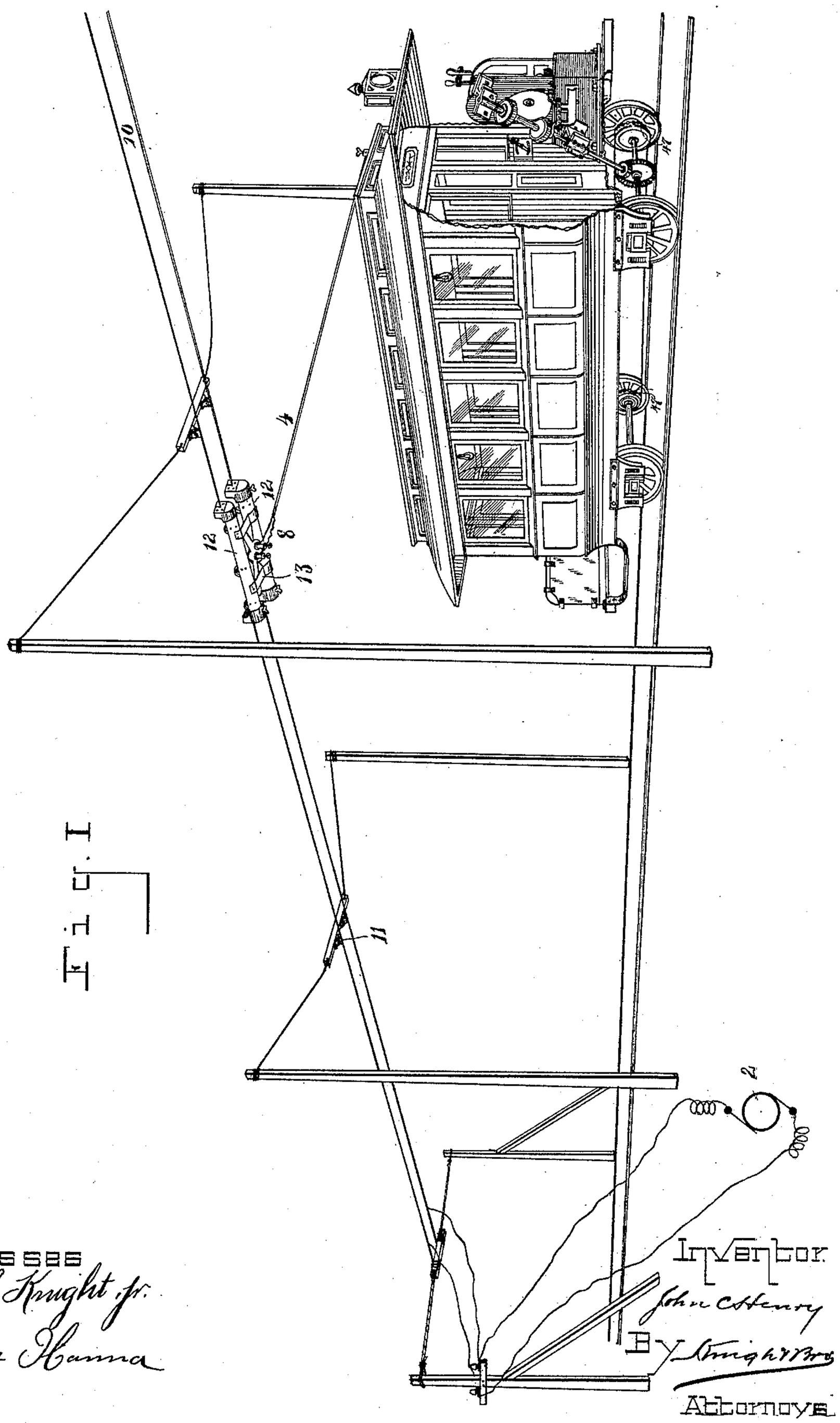

Fig. 1.

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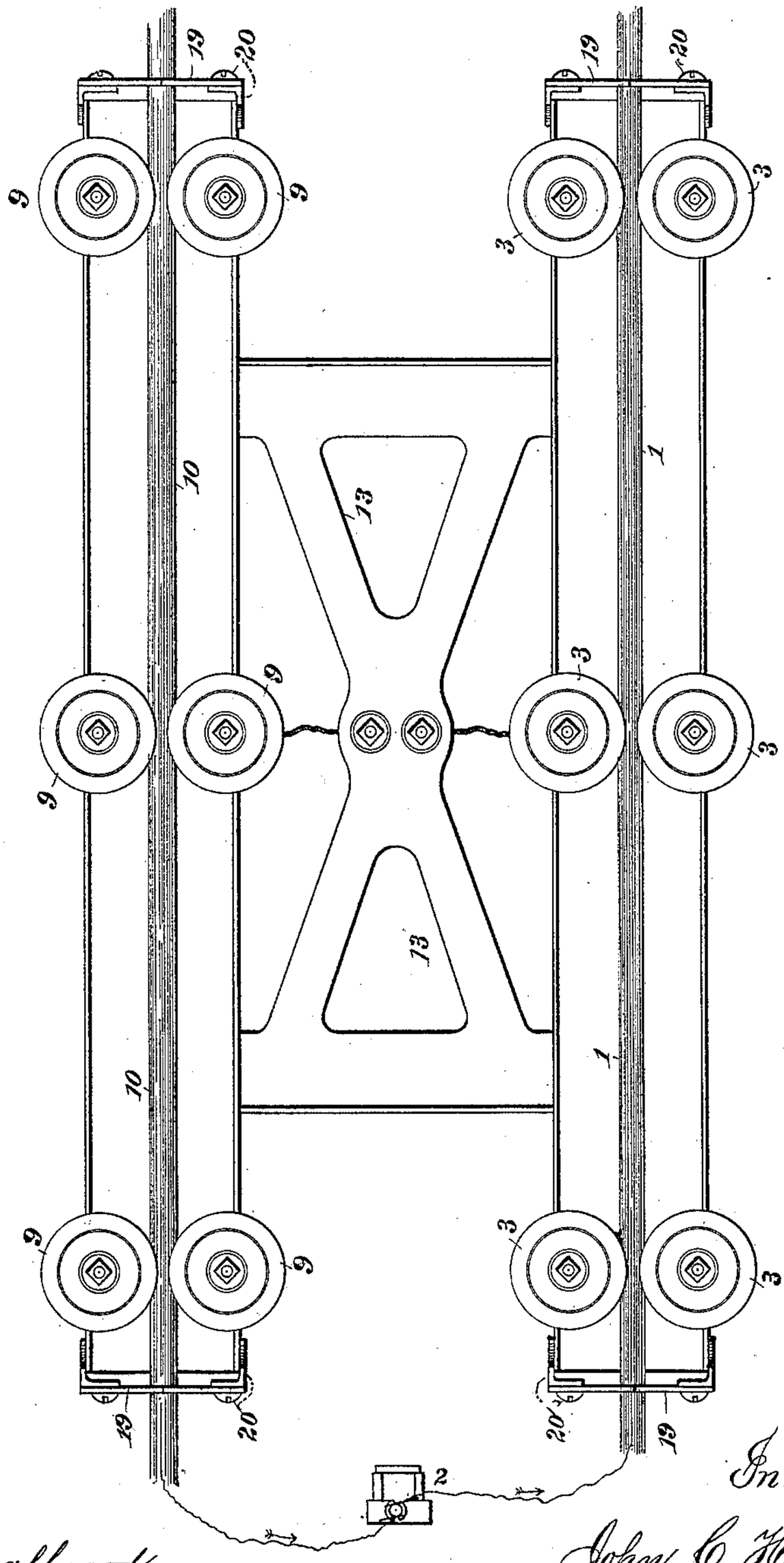
FIG. II



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ELECTRIC RAILWAY.

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FIG. III

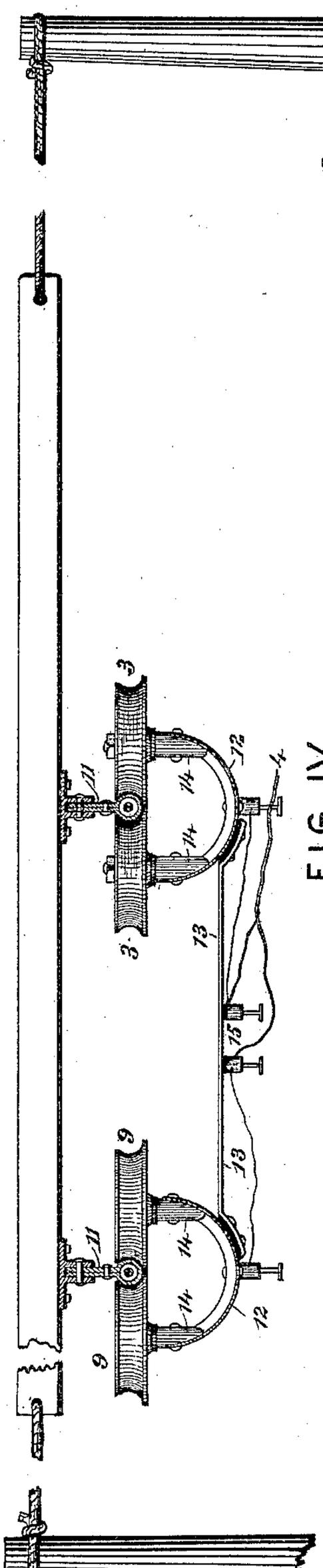


FIG. IV.

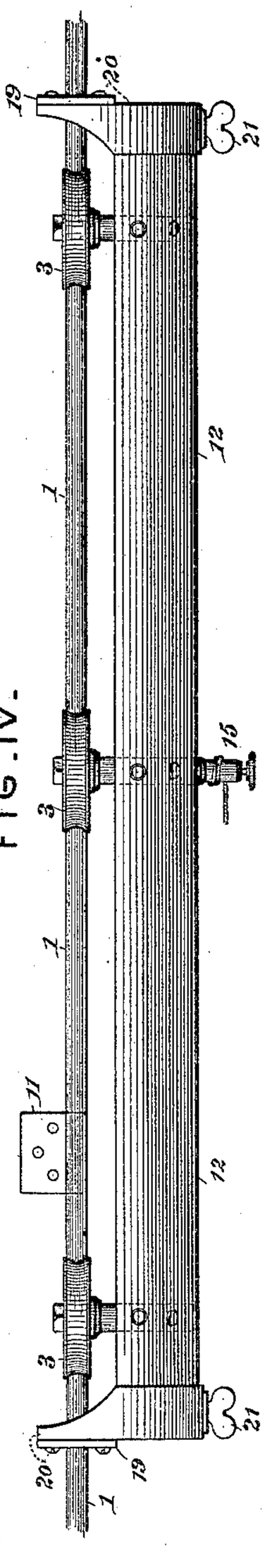
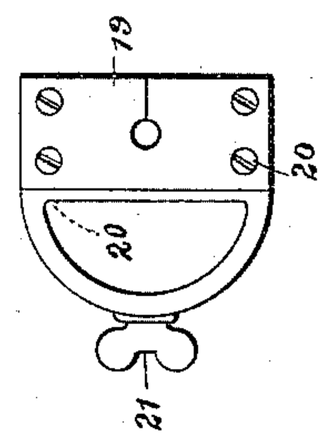


FIG. V.



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ELECTRIC RAILWAY.

No. 424,298. Patented Mar. 25, 1890.

FIG. VI

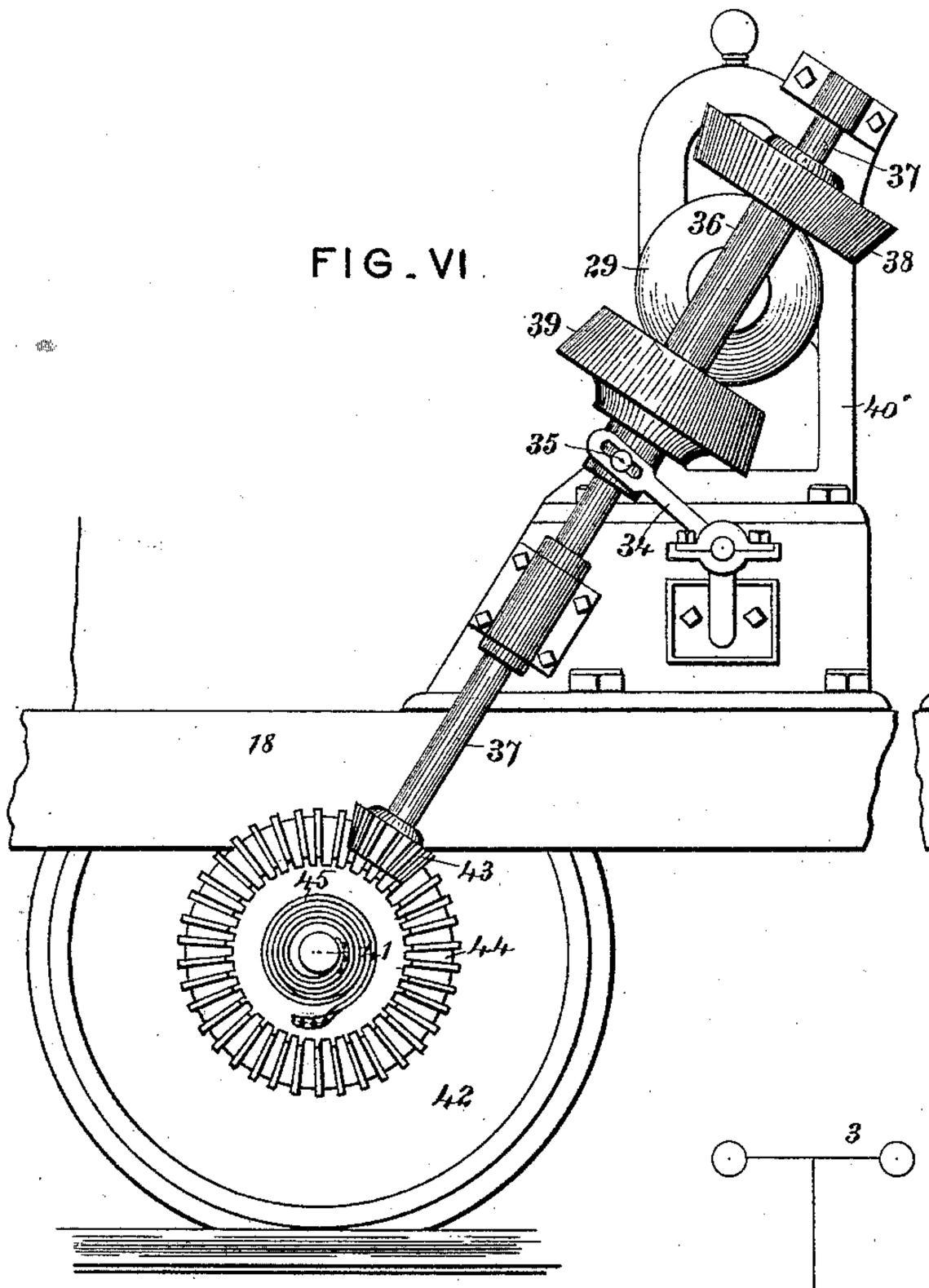


FIG. VIII

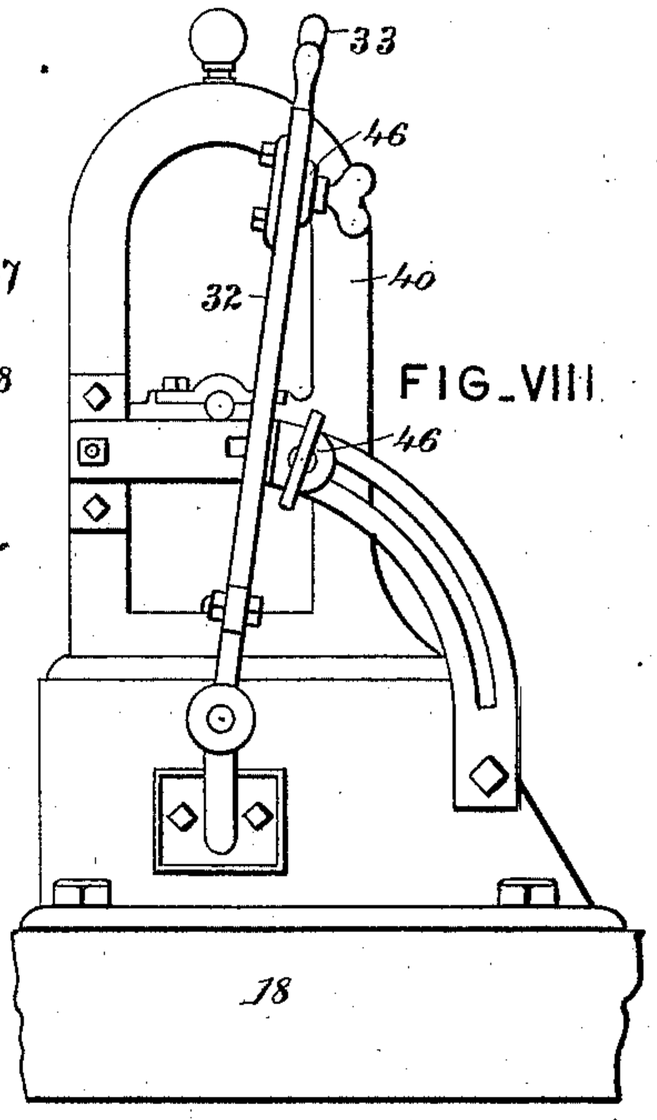
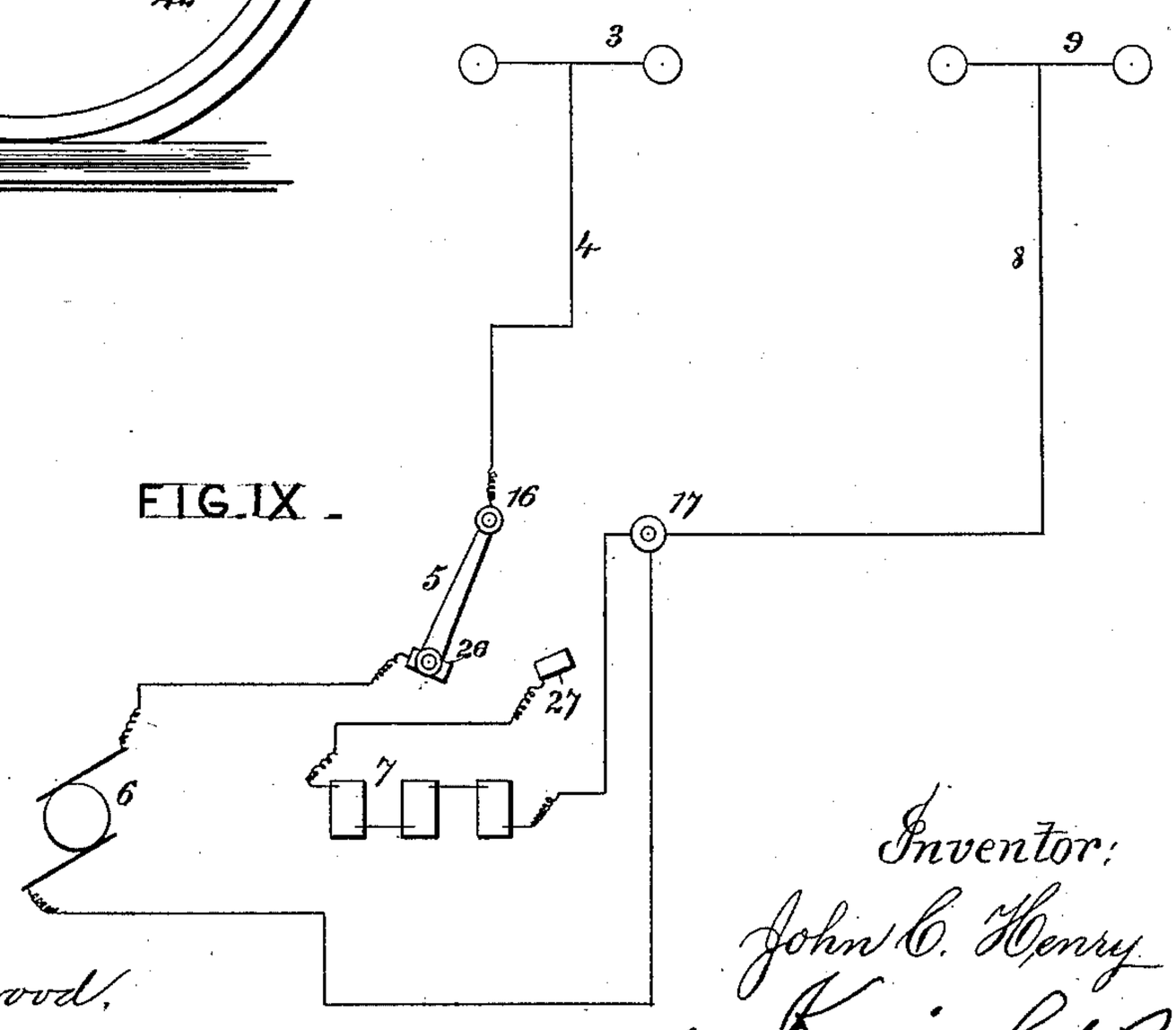


FIG. IX.



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ELECTRIC RAILWAY.

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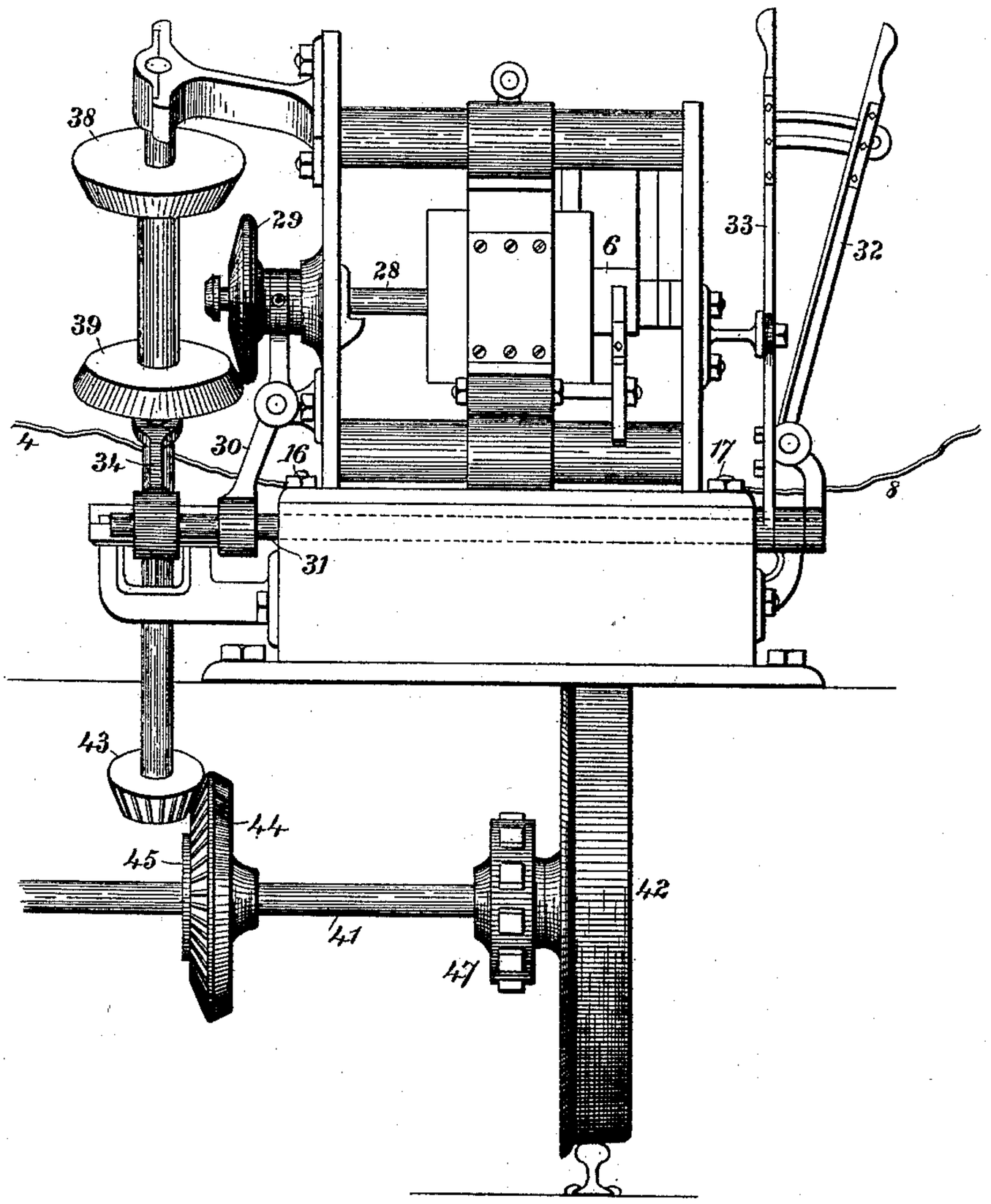
FIG. VII



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Geo. L. Wheelock.

Inventor:

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By Knight Bros.

attys.

UNITED STATES PATENT OFFICE.

JOHN C. HENRY, OF KANSAS CITY, MISSOURI.

ELECTRIC RAILWAY.

SPECIFICATION forming part of Letters Patent No. 424,298, dated March 25, 1890.

Application filed January 16, 1885. Serial No. 153,087. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented new and useful Improvements in Electric Railways, of which the following is a specification.

The present improvements relate as well to devices for making continuous moving contact with the outgoing and return conductors along a line of railway in which the motors are actuated by means of electricity as to improvements in mechanism for transmitting power from the motor on each car to the axle.

To the above ends I mount, preferably centrally above the railway-track, two electric conductors for the outgoing and return currents from and to the dynamo, which is set at any convenient station on the road. Said conductors are, for the purpose of combining strength with conductivity, preferably made with a core of steel and a coating of copper. The contact-carriages are supported by said conductors by means of metallic horizontal wheels having grooved faces to surround said conductors and connected by wires with a switch upon the car, by means of which connection may be made with either the motor or accumulator. The contact-wheels are mounted on spring-frames, to be hereinafter more fully described, which press them into close contact with the conductors, and which carry also a brush of leather or other suitable material for keeping the wire constantly clean and bright. The armature-shaft is connected by reversible friction-gear with a shaft which communicates motion to the car-axle through the medium of beveled or other gear. One or both members of said gear are made of wood, hide, or equivalent yielding material, both to lessen noise and wear of the mechanism and prevent breakage in case of sudden jars due to stopping, starting, jumping obstructions, or slight loss of motion between the parts. The pinion upon the axle is not rigidly fixed thereon, but connected thereto through the medium of a spiral spring, which eases the car in stopping and starting and acts as an accumulator-spring when meeting obstructions.

The fore and rear axles of the car are connected by chain-and-sprocket or other gear, so as to be driven simultaneously, and thus double the traction on the rails.

In order that the invention may be more clearly understood, I will proceed to describe it with reference to the accompanying drawings, in which—

Figure I is a perspective view of my system. Fig. II is a plan view of my improved contact-carriage for electric railways. Fig. III is a vertical sectional view of the same. Fig. IV is a side elevation thereof. Fig. V is an end elevation of one of the scrapers. Fig. VI is an end elevation of the motor and connections therefrom to the car-wheel axle. Fig. VII is a side elevation of the same. Fig. VIII is another end elevation taken at the opposite end of the motor from that shown in Fig. VI. Fig. IX is a diagrammatic view of the electric circuit.

The electric circuit, as here shown, is through the conductor 1 from the dynamo at 2, through the wheels 3 to the contact-carriage, thence by conductor 4 to switch 5 on the car, by means of which it is directed into the commutator 6 of the motor or into the secondary battery 7 at will, returning thence by conductor 8 to the second set of contact-wheels 9 on the return-conductor 10, and so back to the dynamo.

The conductors are fastened rigidly to insulated standards at the terminals and curves, and are supported from the top by suspension at intervals along the road. In this case the terminals take the strain or tension of the wire, which may be many thousand pounds, and the straps or loops, the weight of which is but a few pounds at each support.

The conducting-wires are preferably made with a core of steel and a coating of copper. Metallic or other straps 11 are let into the surface of and brazed to the conductors, so as to avoid obstructing the passage of the contact-wheels. The straps or loops 11 are suspended from blocks fixed on transverse wires hung from poles along the sides of the roadway.

The contact-carriage consists of two semi-cylindrical shells 12, of spring-steel or other material, held rigidly together by frame 13, and each supporting a double series of horizontal contact-wheels 3 and 9, whose grooved faces are pressed onto the conductors by the

spring-shells, thus at the same time supporting the carriage and affording constant contact with the conductors. It will be observed that while beneath the flanges of the wheels almost come in contact the upper flanges are shortened sufficiently to allow the free passage of the supports 11. The wheels are preferably made of some harder metal than the surface layer of the conductor and are made to revolve freely upon their axles 14, so that instead of scraping said conductor their action will be to compress it equally from all sides and give and maintain the same circular in cross-section.

The arrangement of the supporting-straps of the conductor in vertical position and the wheels of the carriage horizontal presents several advantages over one in which the carriage is made vertical and the wire supported by lateral projections. Not only are greater strength of the support and stability of the carriage secured, but a more perfect and continuous contact is afforded by the continuous pressing of both sets of contact-wheels by gravity on the wire.

Each axle 14 is connected through the medium of the shell 12, or through separate conductors, with a binding-post 15, which are connected by separate conductors 4 8 with their respective binding-posts 16 17 on the car 18. The conductors 4 8 may be insulated and twisted and serve to draw the contact-carriage along after the car.

As the carriage is drawn along the conductors, the latter are cleaned by means of brushes 19, preferably of leather, supported on the ends of the shells 12 and closely surrounding the conductors. Said brushes are fixed by screws to frames 20, so as to be capable of renewal, and the said frames are themselves fixed to the ends of the shells 12 by set-screws 21.

The outgoing conductor 4 may be fixed to binding-post 16, and return-conductor 8 to the binding-post 17. The post 16 is electrically connected to the switch-arm 5, and may be placed in contact with blocks 26, connected with the commutator 6 of the motor, or with block 27, connected with the poles of secondary battery 7. Said battery is arranged to operate a light, brake, bell, and other circuits, and the current from the dynamo is thrown into the same for regenerating whenever desired from the motor on the stopping or checking of the car.

The motor may be of any usual or improved form. Preferably, however, I employ for this purpose a dynamo of the Gramme type. The end of the armature-shaft 28 is provided with a friction-disk 29, mounted on a movable sleeve capable of endwise movement on said shaft through the medium of lever 30, rod or shaft 31, and hand-lever 32. Said lever 32 is fulcrumed on a second lever 33, so as to have not only its independent movement for shifting the disk 29, but a movement at right angles thereto with lever 33 when said lever 33 is employed for reversing the motion of the car. At the end of shaft 31 is a crank-arm 34, slotted to receive a stud 35 on a sleeve 36, connected by tongue and groove with a driving-shaft 37. Said sleeve 36 is provided with oppositely-faced friction-disks 38 39, adapted by the mechanism just described to be brought either one or the other into contact with disk 29, according to the desired direction of motion of the car. It will be observed that by such an arrangement of transmitting-gear the reversing of the motion may be performed or the stopping and starting of the car may be performed with great ease and without any jar. Stops 46 are provided for limiting the motion of levers 32 33.

The mechanism just described is both yielding and adjustable or variable. By projecting the friction-disk 28 more or less the surface thereof brought into action against the vertical disks 38 39 is varied, and it is apparent that the leverage of the transmitting-gear is correspondingly varied or adjusted according to whether the disk 38 or 39 bears against the periphery of the disk 29 or any point within the said periphery. The use of friction-disks for transmitting power imparts a yielding character to the movement, which is of great value in supporting a car having a heavy load and preventing shocks to the machinery.

In operating motors in parallel it is well known that the current increases as the speed decreases. When the armature is choked down by mechanical resistance, its electrical resistance is decreased. The consequence is an abnormal current passes through its coils, producing wasteful and injurious effects. The variable and yielding leverage of the mechanism just described has a valuable feature in controlling the current-supply and preventing such injurious effects. It is further noted that when the car is forced downgrade by gravity, or it is desired to make a quick stop, the disks 38 39 can be reversed and the motor can be driven as a generator at any desired speed, thus acting as a powerful brake and assisting the initial force. The variability of the leverage of the mechanism is of great value in this connection, as thereby the speed at which the armature of the motor is driven while acting as a dynamo in descending grades may be exactly adjusted to generate a current of the same voltage as that produced by the stationary dynamos supplying the line, so that the current supplied by the moving dynamo on the car will supplement instead of counteracting the current of the stationary dynamos. If, on the other hand, the moving dynamo on the car had an invariable connection with its axles, which would necessarily drive it at such speed as to produce a current of higher voltage than that supplied to the line by the stationary dynamos at the central station, the moving dynamo would tend to overcome the current supplied by the stationary dynamos and to drive said dynamos as motors against

the power of the engine with consequent great waste of power. It will be seen that the precise adjustment of the voltage of stationary and moving dynamos is of great importance, and that this is only rendered possible by an adjustable leverage between the car-motor and its axle.

The driving-shaft 37 is mounted in boxes in the motor-frame 40 in an inclined position, so that while the motor may occupy the platform at one end of the car the lower end of said driving-shaft may be approximately over one of the axles 41 of the car-wheels 42. At its bottom said shaft is provided with a pinion 43, preferably beveled and made of a suitable yielding material—such as wood or hide—so as to be at the same time tough and noiseless. The shaft of the armature being exposed to the most intense magnetic field, it is essential that the magnetic lines of force do not escape through it and the connecting mechanism to the wheels and rails. By interposing some strong non-magnetic material—such as rawhide, wood, &c.—this detrimental effect is avoided. The beveled pinion 44, gearing therewith, may be similarly made. It is mounted on the axle 41, so as to have capacity for rotary movement, such movement being, however, limited elastically by a spiral spring 45, whose ends are fixed to the axle 41 and pinion 44, respectively. It will be observed that any sudden jar of the mechanism will be taken up by the spring 45, and the motion of the car thus eased, while if the car meet with any obstruction the spring will act as an accumulator until sufficient head has been obtained to force the car over the obstacle. The effectiveness of this flexible connection is greatly increased by gearing down considerably from the armature-shaft to the car-wheel axle. For this purpose I make the pinion 43 much smaller than pinion 44, the proportion being such that the armature-shaft will make, say, fifty revolutions to one of the car-wheel axle. The increase of storage-power and consequent usefulness of the spring are evident.

The axle 41, actuated directly from the motor, is connected by chain-and-sprocket gear 47 with the other axle of the car, so that the traction of all four wheels upon the rails will be obtained.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

1. In combination with one or more electric conductors, an insulating-block whereto they are connected centrally over the street, and wires supporting said blocks from two sides of the street, substantially as set forth.

2. In combination with one or more electric conductors, straps or loops supporting the same at intervals and let into the surface of the wire, substantially as and for the purposes set forth.

3. In an electric railway, in combination with conductors and a car, a contact-carriage and series of horizontal contact-wheels supporting said carriage and having grooved faces embracing said conductors, substantially as set forth.

4. In combination with electric conductors and hangers or supports therefor, contact-wheels having grooved faces with flanges projecting unequally above and below said conductors, substantially as set forth.

5. The combination of armature-shaft 28, movable friction-disk thereon, driving-shaft 37, with oppositely-faced movable friction-disks thereon, rock-shaft 31, and divided lever 32 33, all arranged and adapted to operate substantially as and for the purpose set forth.

6. In combination with an electrical conductor of an electric railway supported over the street by transverse guy-wires, a traveling contact having grooved faces held by spring-pressure against the sides and bottom of the conductor.

7. In an electric railway, the combination of a source of electricity, a line-conductor connected therewith and supported over the street by pendent supports, one or more contact devices suspended on said conductor and hanging under the same in contact with the bottom and sides thereof, one or more traveling motors, and mechanical and electrical connection from said contact devices to said motors, substantially as set forth.

8. In an electric railway, the combination of a car mounted on the rails on the surface of the street, insulated suspended conductors above the roadway, supported by transverse guy-wires, branch conductors, and a traveling contact having grooved faces held by spring-pressure against the sides and bottom of the conductors.

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F. W. LORD.