(No Model.) 3 Sheets—Sheet 1.

J. C. HENRY.

ELECTRIC CAR.

No. 561,225. Patented June 2, 1896.

Fig. I.

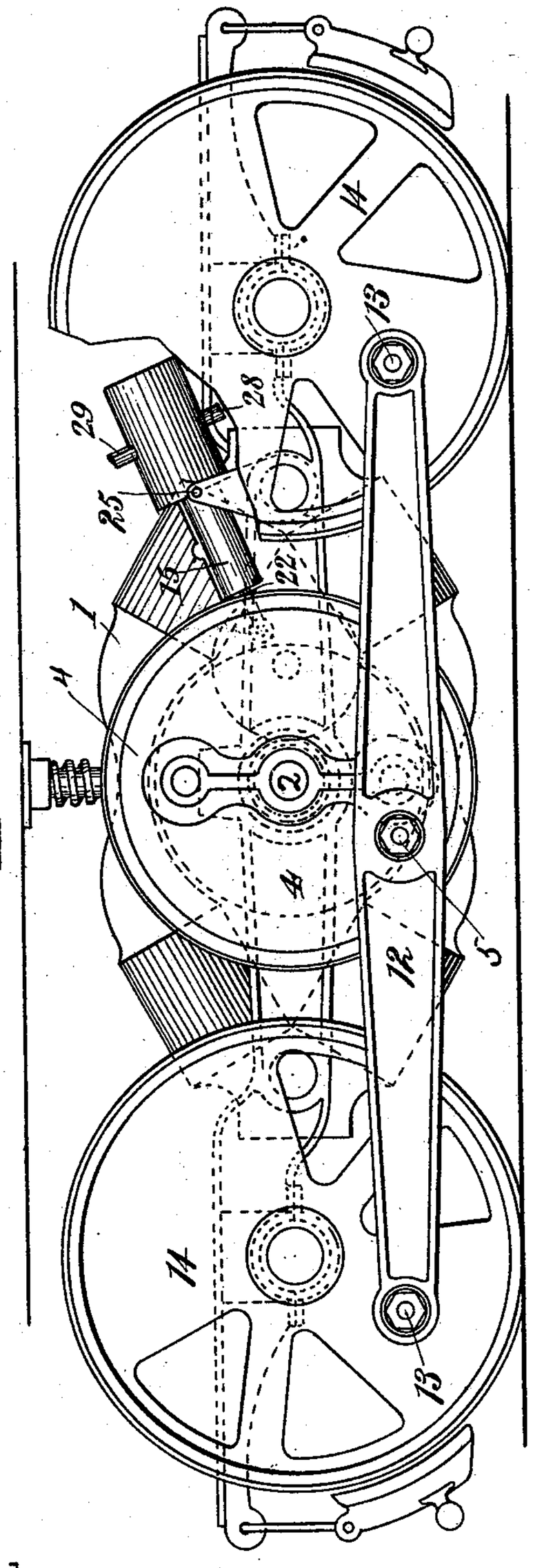
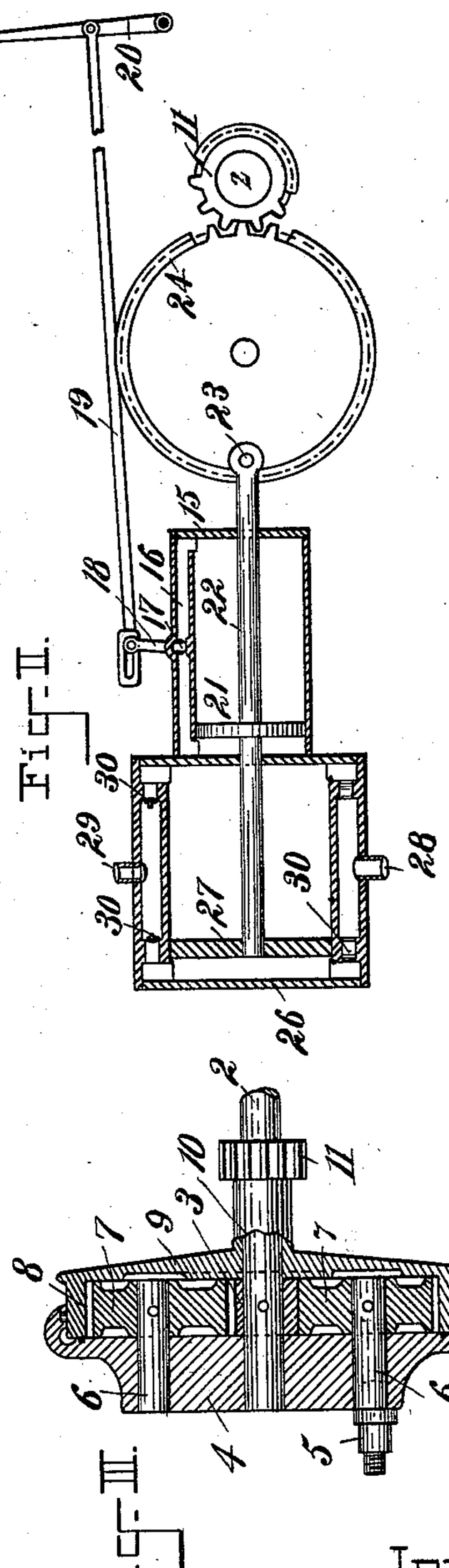


Fig. II.



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3 Sheets—Sheet 2.

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Fig. V.

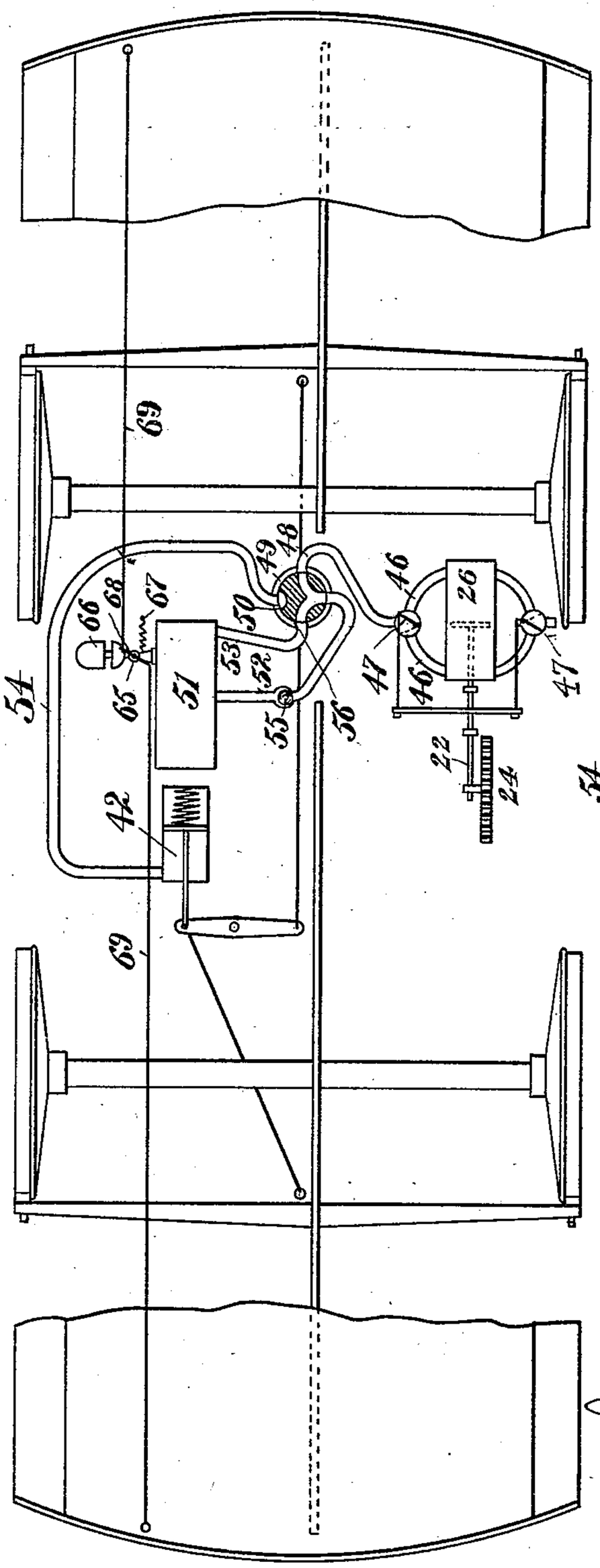

Fig. VI.

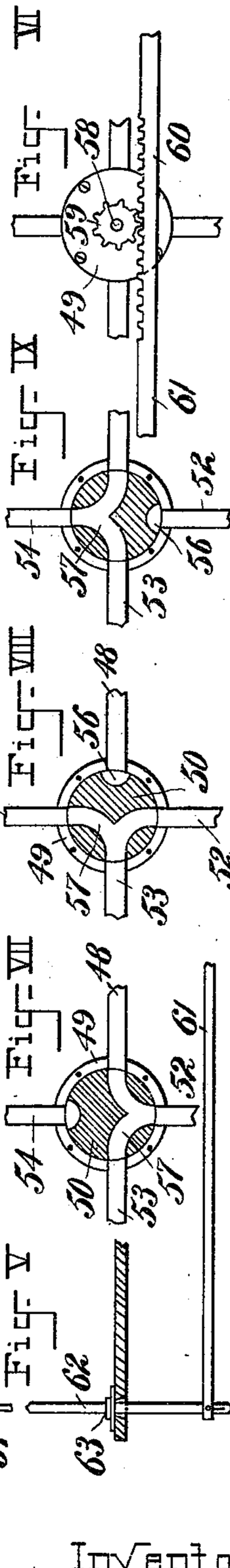

Fig. IX.

Fig. VIII.

Fig. VII.

Fig. V.

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3 Sheets—Sheet 3

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No. 561,225.

Patented June 2, 1896.

Fig. XIII

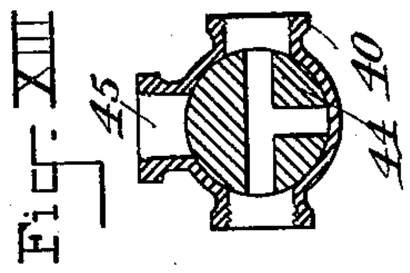
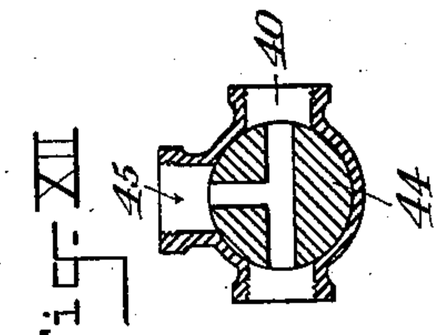
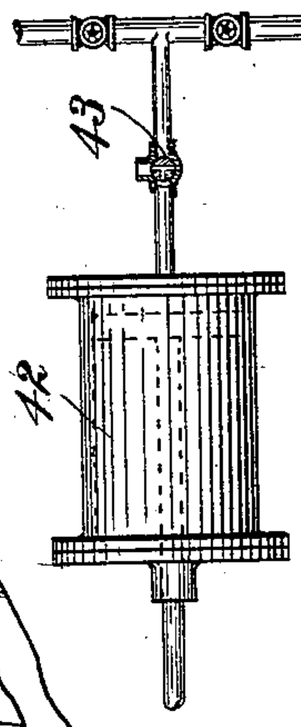


Fig. XII





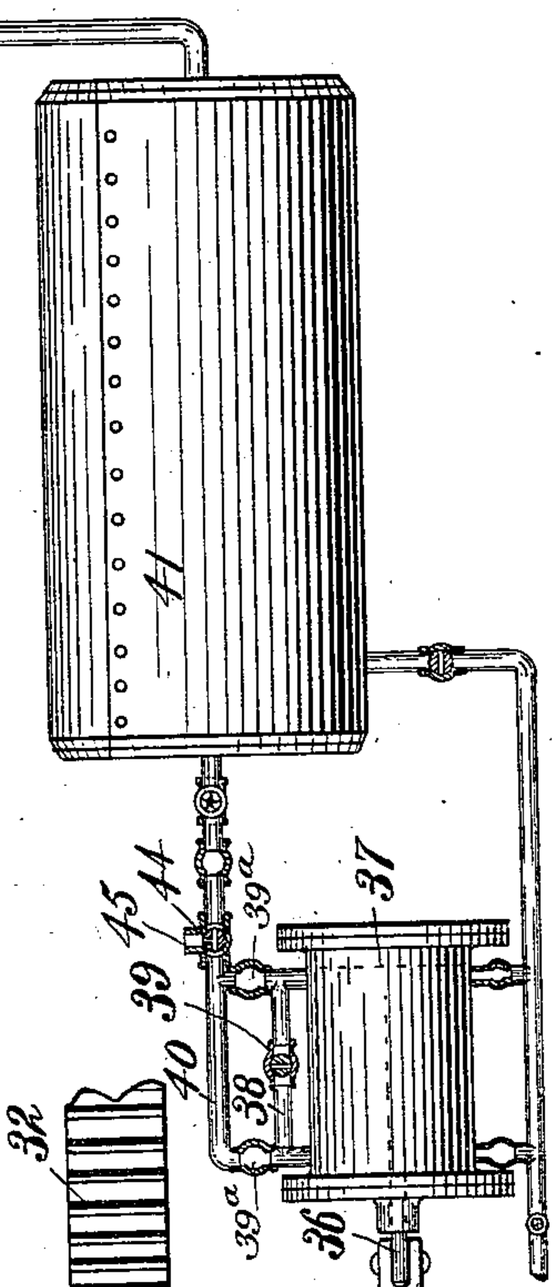


Fig. XI

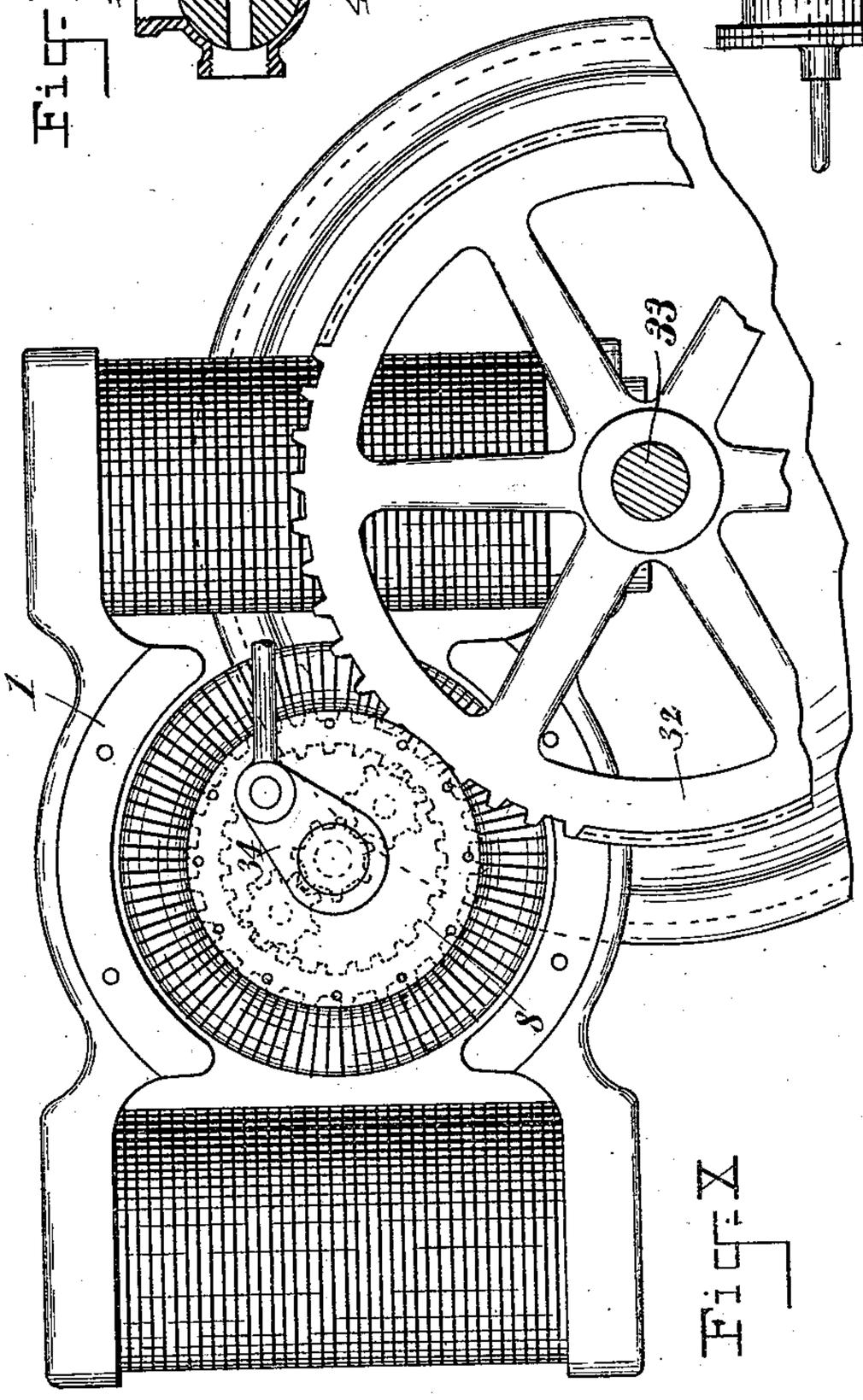


Fig. X

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UNITED STATES PATENT OFFICE.

JOHN C. HENRY, OF WESTFIELD, NEW JERSEY.

ELECTRIC CAR.

SPECIFICATION forming part of Letters Patent No. 561,225, dated June 2, 1896.

Application filed May 9, 1893. Serial No. 473,583. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. HENRY, a citizen of the United States, residing at Westfield, county of Union, State of New Jersey, have invented certain new and useful Improvements in Electric Cars, of which the following is a specification.

The present invention relates to the motive and braking power of electric cars, and the object of the invention is the storing of power during the stopping or slowing up of the car in such manner as to make it susceptible of application for the purpose of applying brakes or of restarting or accelerating the speed of the car.

Referring to the accompanying drawings, which form a part of this specification, Figure I is a side elevation of a car-motor truck bearing the regulating and power-storing cylinders forming part of my invention. Fig. II is a sectional side view of the regulating and power-storing cylinders. Fig. III is a sectional view of the planetary gear. Fig. IV is a plan view of parts of a car, showing the air-circulation-system part of my invention. For sake of clearness the liquid-resistance cylinder is omitted from this view. Fig. V is a sectional elevation illustrating the lever for operating the regulating-valve. Fig. VI is a detail elevational view showing the operating-valve casing and adjacent parts. Figs. VII, VIII, and IX are sectional views of the regulating-valve in three positions. The remaining figures of the drawings show another form of my invention. Fig. X is a side elevation of a part of a motor-truck of different form from that shown in Fig. I. Fig. XI is a plan view illustrating the main parts of a crude form of my invention in which an air-pump or resistance-cylinder alone is used. Figs. XII and XIII are sectional views illustrating two positions of the form of regulating-valve employed with this form of the invention.

Referring to Figs. I to III, illustrating in part the preferred form of my invention, I employ a constant-running motor 1, whose shaft 2 has pinned or keyed to it a pinion 3. A disk 4, having crank-wrist 5, bears loosely on the end of shaft 2 and has bearings for three or four pins 6, which carry pinions 7, hereinafter referred to as the "intermediate" pinions. 8 is an internally-gear-toothed flange on a disk 9, which runs loosely on the shaft 2 and has a sleeve 10, to which is keyed a pinion 11. The wrist-pin 5 of the disk 4 has bearing in a connecting-rod 12, whose ends surround pins 13 on the car-wheels 14. It will now be apparent that if the internal gear 8 be held stationary the constantly-running shaft 2 of the motor driving the pinion 3 will rotate the intermediate pinions 7, which then revolve around the shaft 2 by reason of intermeshing with the internal gear 8, and carry with them the disk 4, so operating the connecting-rod 12 and the car-wheels; but if the internal gear be allowed to run freely the rotation of the motor-shaft will not be transmitted to the car-wheels. The internal gear 8 has therefore slip-support on the shaft 2—that is to say, it is capable of running freely thereon or of being held stationary. To hold it or release it, I preferably employ a yielding abutment arranged as follows: 15 is a resistance-cylinder adapted to contain a suitable liquid and having a by-pass 16 between its ends capable of regulation by a valve 17 under control of an arm 18, rod 19, and (on either or both platforms of the car) a lever 20. Within the cylinder 15 is a plunger or piston 21, connected by rod 22 with the crank-wrist 23 of a gear-wheel 24, which intermeshes with the pinion 11.

To shorten and simplify the arrangement, I prefer to use the single stiff rod 22 and mount the cylinder 15 pivotally, as shown at 25 in Fig. I, and to allow for the cylinder's oscillation without affecting the position of the valve 17 I prefer to make the connection of the rod 19 to the arm 18 by means of pin and slot, as shown.

Referring to Fig. II, in which the valve 17 is shown transverse of the by-pass 16, it will be seen that the water filling the cylinder will be blocked, the piston 21 will be held stationary, and the gear 24 and pinion 11 will therefore be locked, holding the internal gear 8. Thus the rotation of the motor-shaft will, in the manner already described, be imparted at reduced speed to the car-axles; but by shifting the valve 17, by means of the lever 20, the water will be allowed to flow back and forth through the by-pass 16. The extent of the opening of the valve 17 regulates the

positiveness of the connection of the motor-shaft to the car-axle, and by opening the valve entirely the motor-shaft is entirely disconnected from the car-axle and the motor runs freely without driving the car.

In the form of my invention shown in Figs. I and II, I have supplemented the action of the liquid-pump by an air-pump whose cylinder is shown at 26. The piston 22 is continued into the cylinder 26 and bears a second and larger plunger 27. 28 is an inlet-pipe which admits atmospheric air, and 29 an air-discharge pipe, the latter leading to a suitable air-reservoir. Valves 30 are arranged in the usual manner to permit the pumping of air through the cylinder 26 when the piston is in action.

In Figs. IV to IX, I show the carrying out of the air-circulation system more fully, and for clearness I omit from this view the liquid-resistance cylinder and show the piston 22, driven by gear 24, working in the air-compressor cylinder 26 only. Here the air-compressor 26 is shown connected by branch pipes 46, under the control of automatic reversing-valves 47, with a pipe 48, which leads to the casing 49 of a four-way valve 50. Valves 47 are reversed at the end of each stroke, and during the running of the pump-piston a practically constant compression of air through the pipe 48 is effected. The reservoir is shown at 51, an inlet-pipe at 52, and a combined inlet and discharge pipe at 53. The brake-cylinder is shown at 42 and has an air-supply pipe 54. The pipes 48, 52, 53, and 54 all communicate with the casing 49 of the four-way valve. On turning the valve to the position shown in Fig. VII, (which is the same as that shown in Fig. IV,) the air-pump 26 pumps air through the pipe 48, through the four-way valve, and through the pipes 52 and 53 into the reservoir 51. A check-valve 55 in pipe 52 prevents a return movement of the air therethrough. In this position the brake-cylinder 42 is open to the external atmosphere through pipe 54 and the port 56 of the four-way valve. In the position of the four-way valve shown in Fig. VIII air is pumped through pipe 48 and port 56 into the external atmosphere again. Pipes 52 and 53 are connected by the pipe 54 and port 57 of the four-way valve with the brake-cylinder. In this position the brake is on and the pump is working freely in the atmosphere without resistance. After the car has stopped with the four-way valve in this position, by turning the valve to the position shown in Fig. VII and releasing the brakes the back pressure of the compressed air in reservoir 51 is caused to react through pipes 53 and 48 on the piston of the pump, and so accelerate the starting of the car by causing a reverse movement of internal gear 8.

In the position shown in Fig. IX the pump is connected by the port 57 of the four-way valve with both the air-reservoir 51 and the air-brake cylinder 42, so as to supply air directly to both simultaneously, while the pipe 52, although arranged opposite the open port 56 of the three-way valve, discharges no air therethrough, owing to its retention by check-valve 55. With the four-way valve in this position the back pressure of the reservoir-air acts automatically to start the piston of the pump in action on the releasing of the brakes after the stopping of the car, and so, by reversing the movement of internal gear 8, accelerates the starting of the car. The means for turning the four-way valve to either of these positions are exhibited in Figs. V and VI. The valve-stem 58, (see Fig. VI,) extending through the top of its casing 49, has a pinion 59 engaging with a rack 60 on a rod 61, which runs from end to end of the car and is connected (see Fig. V) at each end to a lever 62, pivoted on the car-platform at 63 and adapted to be oscillated by handle 64, which may be removed and carried from one end of the platform to the other.

The valve 65, which controls the whistle 66, (adapted to receive air from the reservoir 51,) is held normally in closed position by a spiral spring 67 and has a handle or lever 68, whose opposite ends have connected to them rods 69, leading to the opposite platform of the car and there brought under the control of the operator by a lever similar to that shown in Fig. V or by other means.

In Figs. X to XIII of the drawings I have shown a crude apparatus for using the air-resistance cylinder without the liquid-resistance cylinder. As such a device, owing to the elastic nature of the medium employed, would not be sufficiently prompt in operation it would be necessary to supplement it by using ordinary hand or other brakes. As shown in these drawings, the means of transmitting motion from the planetary gear is different from that shown in Figs. I and II. The motor is shown at 1, its armature-shaft at 2, and internal gear at 8, while the member driven by the differential mechanism within the gear 8 is a pinion 31, which intermeshes with a gear-wheel 32 on the car-axle 33. The internal gear 8 bears a crank 34, which is coupled by connecting rod 35 with the piston-rod 36 of an air-pump cylinder 37. The by-pass of the pump-cylinder is shown at 38, and it has a valve 39, capable of regulation from the car-platform. In addition to the by-pass 38 a second pipe, 40, is connected to both ends of the cylinder 37 and also to an air-reservoir 41. Check-valves are located in pipe 40 at 39^a 39^a.

42 is an air-brake cylinder adapted to receive air from the reservoir 41 under control of a valve 43, which is operated from a car-platform. In pipe 40 is a three-way valve 44. (Shown to a large scale in Figs. XII and XIII.) If the valve 39 in by-pass 38 be turned in line with the by-pass, the air will be pumped back and forth from end to end of the cylinder without affording perceptible resistance. If the valve 39 be turned crosswise of the by-

pass and at the same time the valve 44 be so turned as to prevent passage of air to the air-reservoir, the air-pump will slow down the movement of the internal gear 8 with a yielding resistance. If the valve 39 be left crosswise of the by-pass and the valve 44 be turned in position shown in Fig. XIII, the operation of the air-pump will act to fill the reservoir 41. It will furthermore be seen that the valve 44 can be turned to such position as to cause the air-pump to draw in and discharge air with each reciprocation through the opening 45, or by turning it to the position shown in Fig. XII it will exhaust air both from the air-pump and the reservoir.

I have not shown the means for operating the several valves 39, 43, and 44 from the car-platform. They could be operated by separate levers, or by making them in the form of a single four-way valve, as in Fig. IV, they could be operated by a single rod.

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

1. In an electric-railway car, the combination of the motor thereon, power-transmitting mechanism connecting the shaft of said motor, to the car-axle, an air-brake system including an air-reservoir and an air-pump suitably connected to the motor, and means under control of the operator for varying the positiveness of the connections with the axle and air-pump, substantially as set forth.

2. In an electric-railway car, the combination of a motor thereon, an air-brake system, including an air-pump and means under the control of the operator for connecting said motor operatively with either the car-axle or the air-pump or both, substantially as set forth.

3. In an electric-railway car, the combination of a motor thereon, differential power-transmitting mechanism connecting the same to a car-axle, an air-pump having its moving member connected to one element of said differential mechanism and valves for controlling said pump, as set forth.

4. In an electric-railway car, the combination of a motor thereon, an air-brake system comprising an air-reservoir and an air-pump, power-transmitting mechanism operatively connecting the pump to a car-axle and said motor to both the car-axle and pump and reversible valves controlling said pump, whereby the air stored by the operation of the motor, is utilized in starting the car, substantially as set forth.

5. In an electric-railway car, the combination of a motor thereon, power-transmitting mechanism connecting the shaft of said motor with a car-axle, an air-brake system including an air-pump having operative connection with said transmitting mechanism and a liquid abutment controlling the operativeness of said connection, substantially as set forth.

6. In an electric-railway car, the combination of a motor, power-transmitting mechanism therefrom to a car-axle, one element of which mechanism may run free or be arrested to control the movement of the car, an oscillating pump connected to said element and suitable controlling-valves, substantially as set forth.

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