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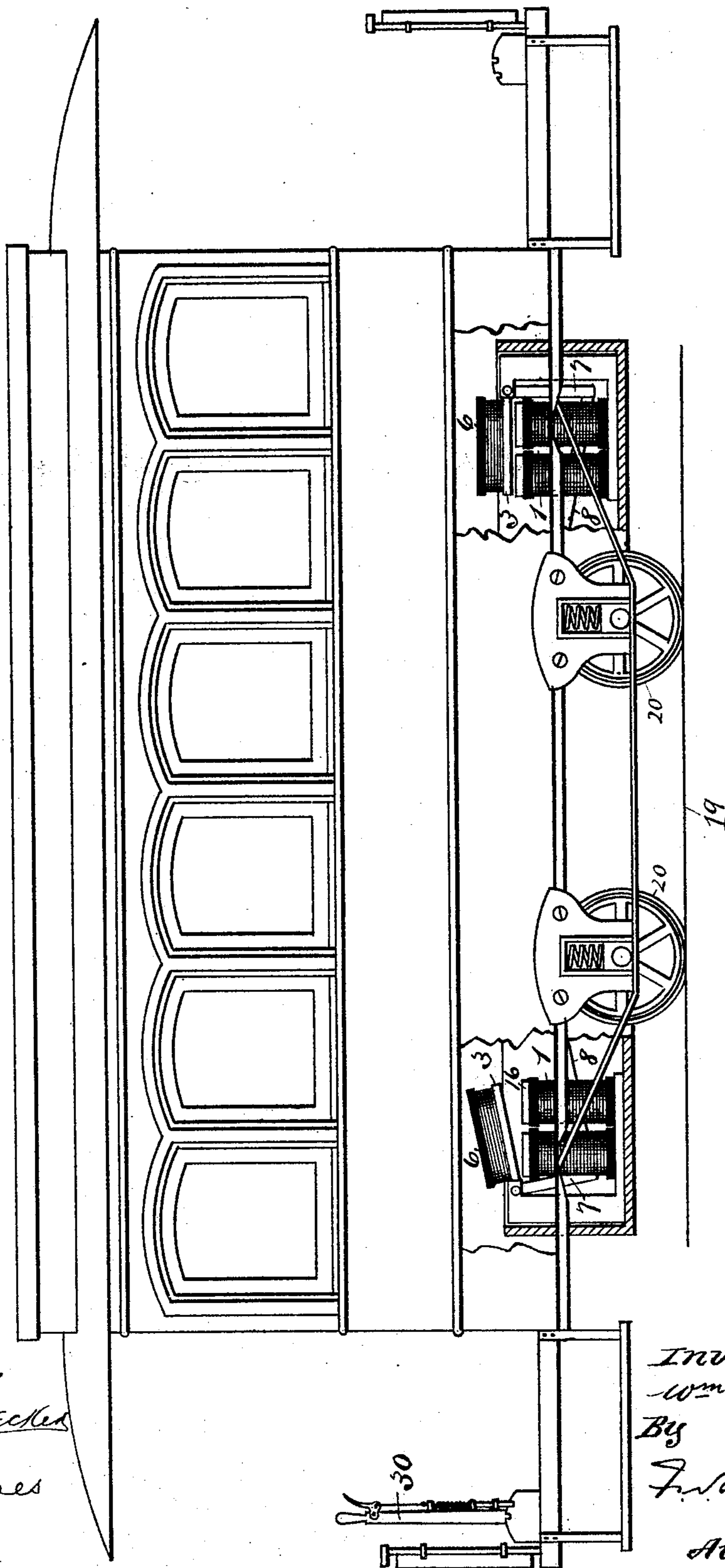
3 Sheets—Sheet 1

W. LAWRENCE.  
ELECTRIC LOCOMOTIVE.

No. 518,006.

Patented Apr. 10, 1894.

*Fig. 1.*



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(No Model.)

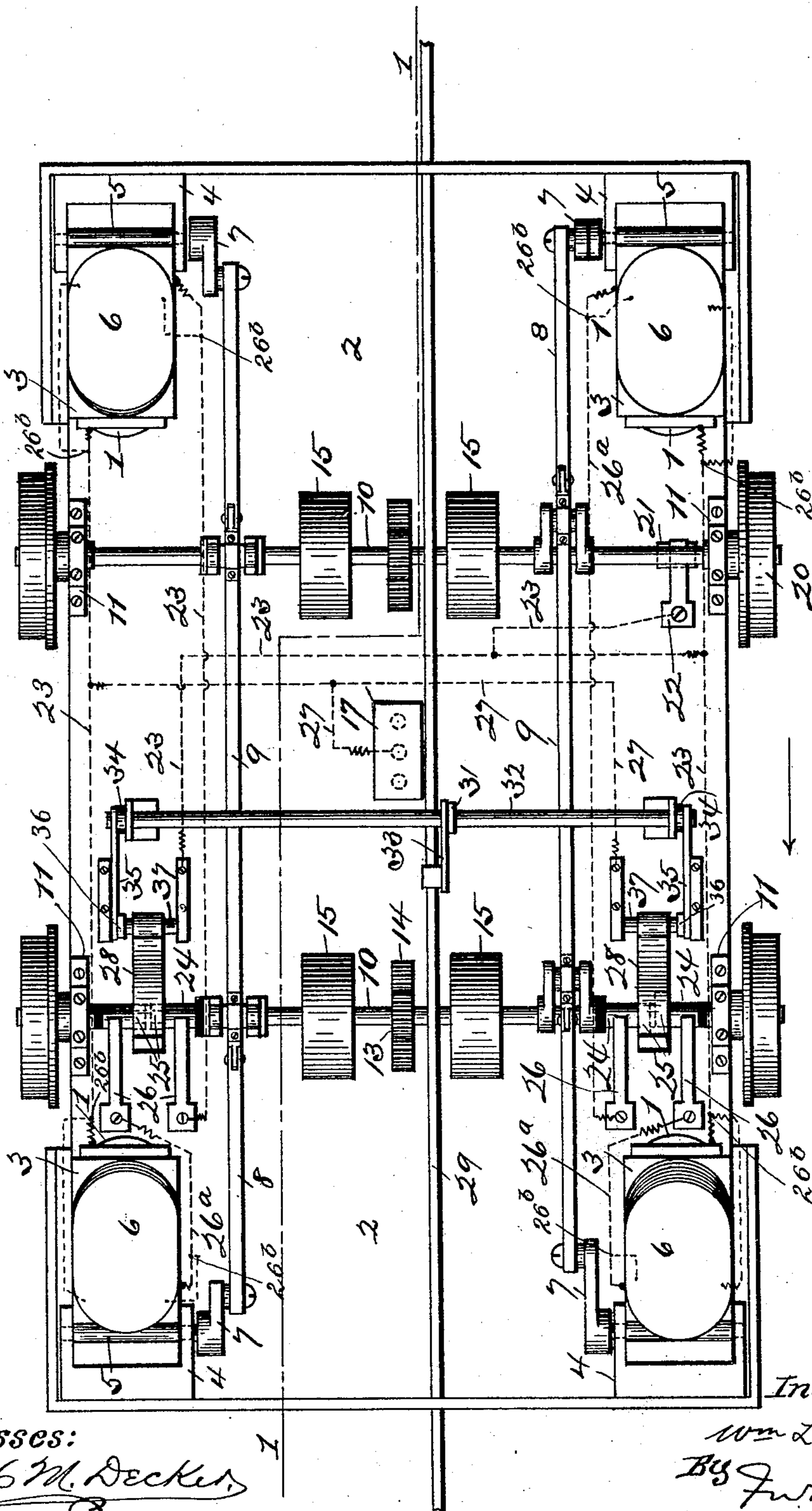
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Fig. 2.



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3 Sheets—Sheet 3.

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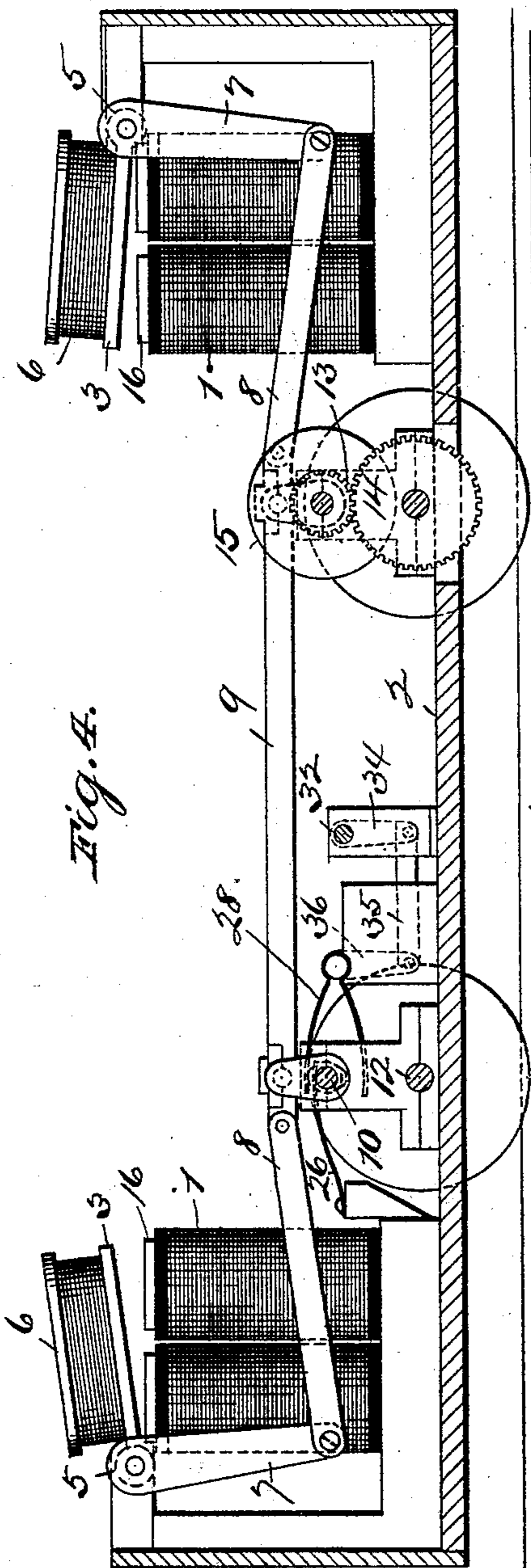


Fig. 4.

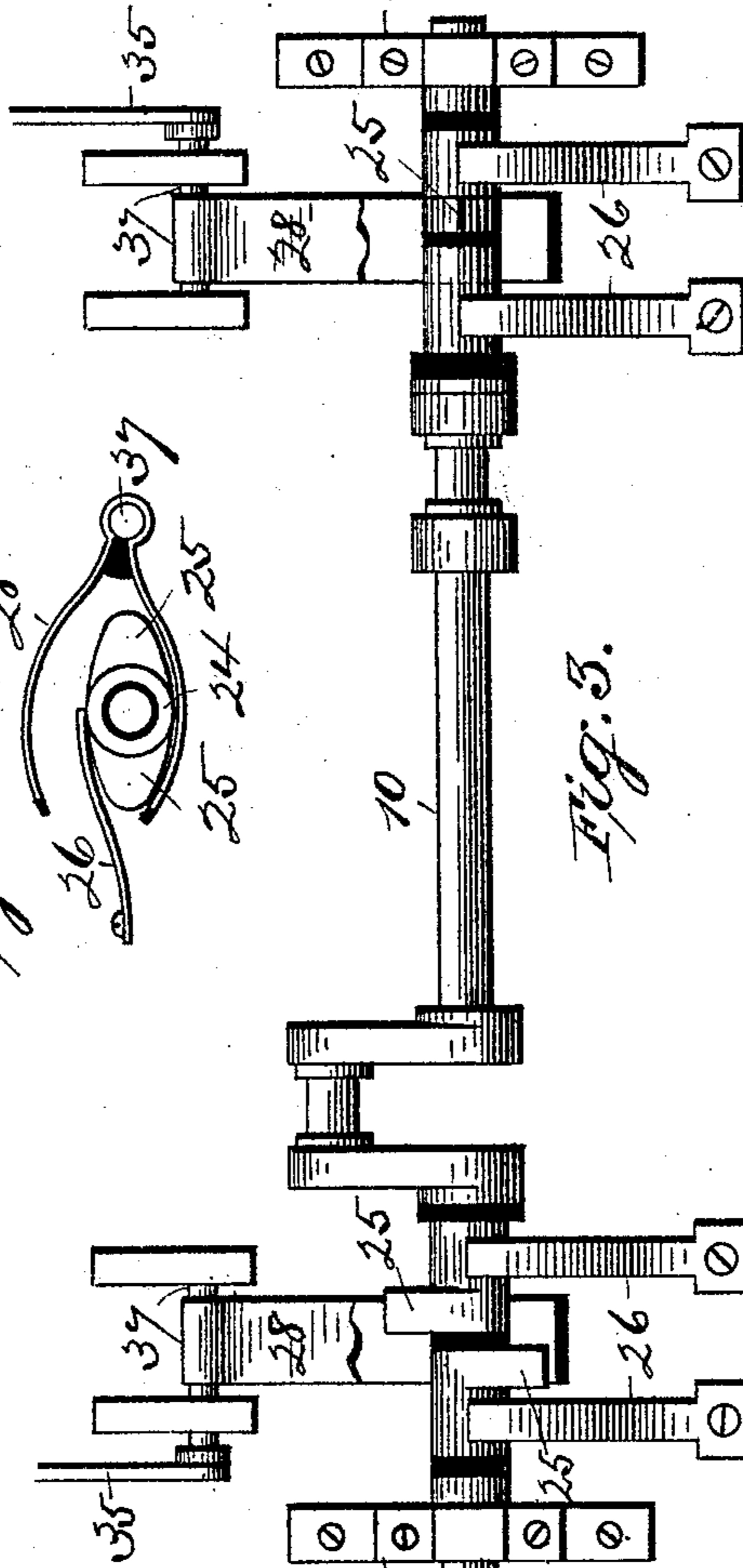


Fig. 5.

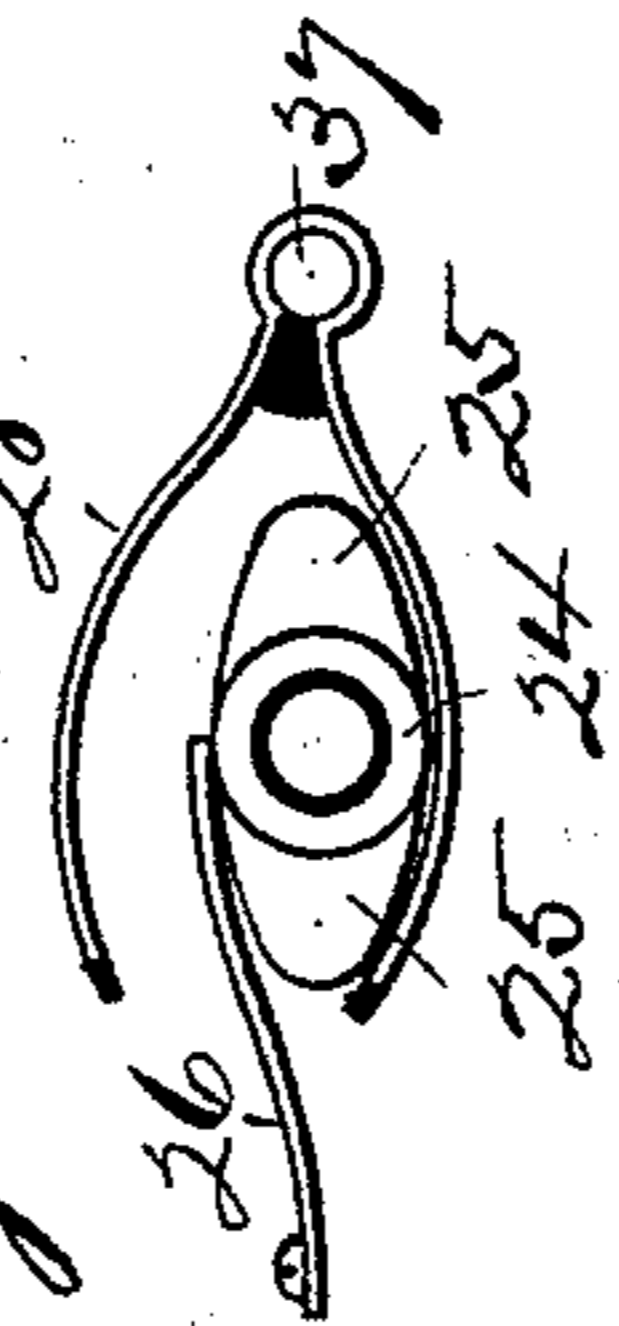


Fig. 6.

Fig. 7.

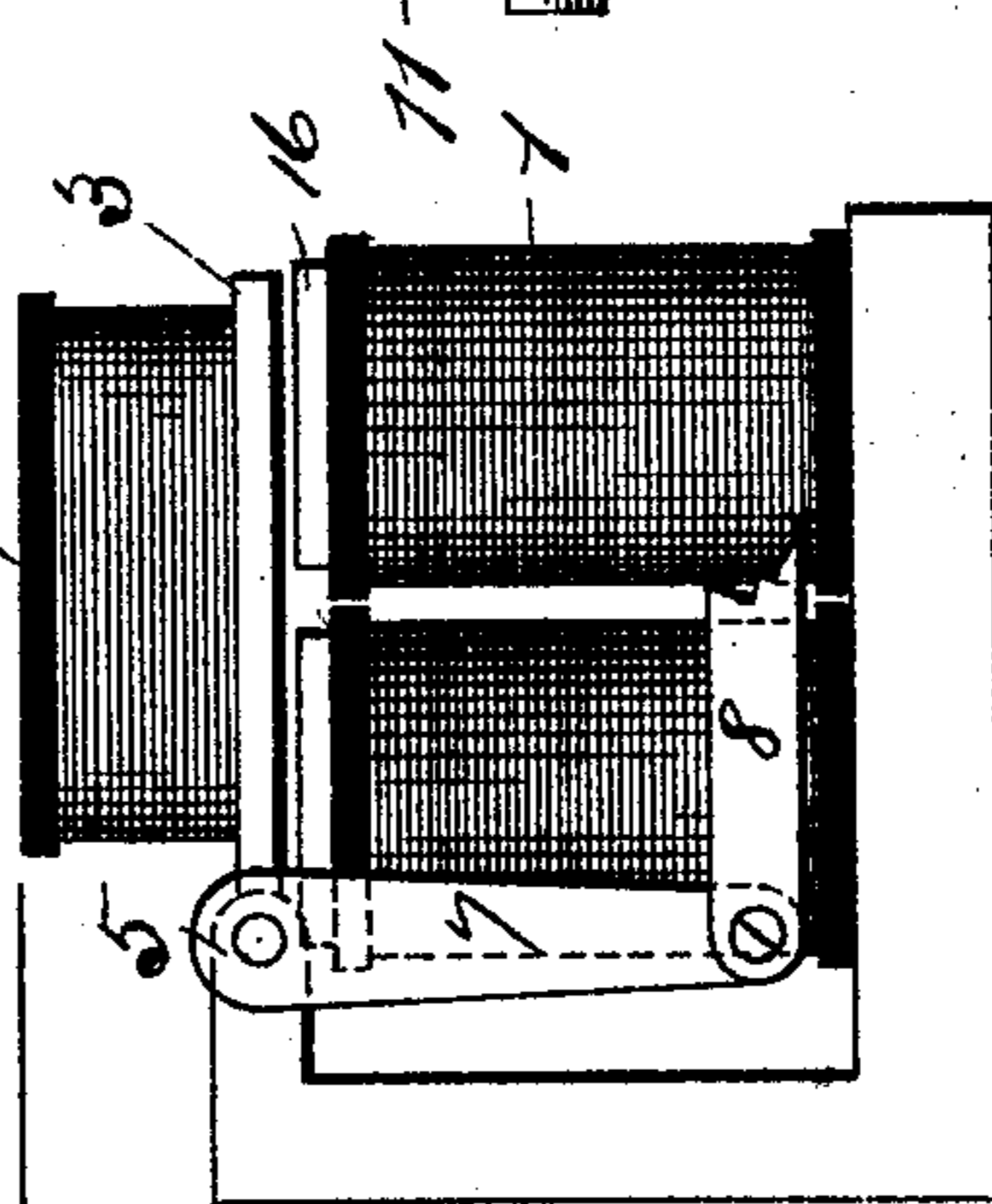
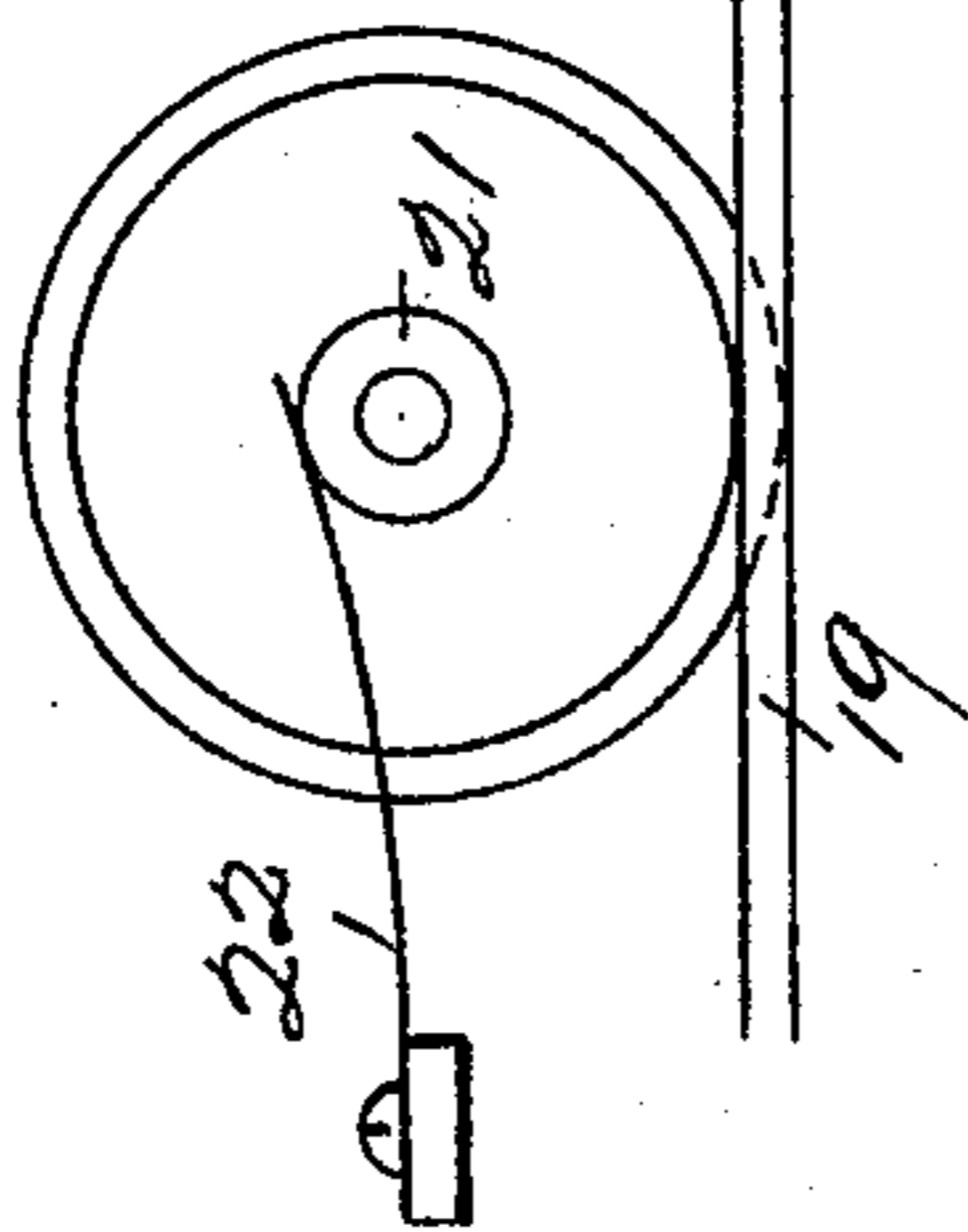


Fig. 8.

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# UNITED STATES PATENT OFFICE.

WILLIAM LAWRENCE, OF NEW YORK, N. Y., ASSIGNOR TO THE LAWRENCE  
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## ELECTRIC LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 518,006, dated April 10, 1894.

Application filed January 21, 1893. Serial No. 459,134. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM LAWRENCE, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Machines for Traction and Stationary Purposes, of which the following is a full, clear, and exact specification.

My invention relates to that class of electrical power apparatus employed for propelling cars, driving machinery, &c., and its object is to provide an apparatus wherein the parts are of simple construction, and in which a greater power is developed than has heretofore been accomplished by any other electrical mechanism; means being also provided for readily reversing the apparatus and conveying the electrical current to the different field and plate magnets by the use of only two brushes, instead of the eight brushes which were required to do the same work in my former invention, for which I have made an application for patent, Serial No. 443,323, filed August 17, 1892.

In order that my invention may be fully understood and explained in detail, I have hereto annexed drawings on which like numerals of reference indicate corresponding parts on all the figures alike.

Figure 1 is a side elevation partly in section of a car having my improved electrical mechanism applied thereto. Fig. 2 is a plan view in detail showing clearly the construction and arrangement of the various operative parts of my apparatus. Fig. 3 is a plan view in detail showing clearly the arrangement of brushes for controlling the currents of electricity and reversing the apparatus. Fig. 4 is a longitudinal sectional view of the lower portion of the car, taken on line 1—1 of Fig. 2. Fig. 5 is a side elevation of my improved form of magnets, and field coils. Fig. 6 is a side elevation of a set of brushes, showing one pair of contact points for conveying the current and completing the circuit; and Fig. 7 is a detail view of a commutator and brush used for conveying the current to the track.

In the drawings the mechanism shown for propelling a car is substantially as will be described hereunder.

The numeral 1, indicates four distinct and separate sets of field magnets secured in the four corners of a frame or bed 2. Each of said sets of magnets is provided with an armature 3 which is supported in a suitable frame 4, on a pivot 5. The armature is provided with a helix 6 rendering it magnetic for the purpose of increasing the attracting power between the field magnets 1 and armatures 3. To the pivot 5 is attached an arm or lever 7, which lever has pivoted to its lower end a connecting rod 8, said rod in turn being connected to a drive rod 9, which drive rod is connected to the two crank shafts 10 of the apparatus. The said shafts 10 are supported in suitable bearings 11 directly over the axles 12, and are geared to said axles by suitable gear wheels 13 and 14; one, or the wheel 13, being in diameter about one third the size of the gear 14. The purpose of the gear 13 being of a smaller diameter than the gear 14 is to allow the crank shaft 10 to make three revolutions to one of the axle. By this means a greater power is attained than would be the case if the connecting and drive rods were secured directly to the axles. Suitable balance wheels 15 are mounted upon the crank shafts 10 for counterbalancing the weight of the connecting and drive rods. I provide on the cores of the magnets 1, plates 16 for affording a larger attracting surface for the armatures 3.

The manner of conducting and controlling the electric current to the different sets of magnets is as follows:—Secured to the under side of the bed is a current receiver and distributor 17, which receives the positive current of electricity through a suitable current carrier from a suitable conductor, preferably located under ground.

The current may be conveyed by means of the mechanical parts which are shown in the drawings, in the following manner:—The current is taken from the receiving plate 17 and conducted through a wire 27 to a forked brush 28 which brush in turn conveys the current to commutators 24 which have contact points 25, the commutators being mounted on and insulated from the crank shaft 10. The brushes 26, which are secured to the bed, bear upon said commutators and conduct the cur-

rent to one pole of the magnets 1, by wires 26<sup>a</sup>; the circuits are closed by the points 25 coming in contact with said brush 28 as they revolve with the shaft 10. The current passes  
 5 to the track 19 by means of the car wheel 20, from a suitable sleeve 21 situated on the car axle near the wheel, and passes through a suitable brush 22 and wires 23, (said sleeve and brush being shown in Fig. 7) from the  
 10 opposite pole of each set of magnets.

The manner of energizing the coils of the armatures is as follows:—The ends of the wire of each of the coils 6 are connected at 26<sup>b</sup> to the wires 23 and 26<sup>a</sup> respectively in  
 15 such a manner as to cause said coils 6 and the armatures 3 to be energized at the same time as the magnets 1 are energized; thus increasing the attractive power between said coils, armatures and magnets.

20 The mechanism required for operating the forked brushes 28 consists of a rod 29 which passes lengthwise of the car and is connected to an operating lever 30 (shown best in Fig. 1). The said rod 29 is connected to an arm 31 on  
 25 a shaft 32 by a bar 33. At each end of said shaft 32 are connected similar arms 34, which connect by means of bars 35 with arms 36, which arms 36 are in turn secured to the pivot 37 of the forked brushes 28. By this  
 30 arrangement it will be seen that when the rod 29 is moved longitudinally in either direction, the brushes 28 through the aforesaid mechanism will be moved vertically into or out of engagement with the contact points 25  
 35 of the commutators 24, and the car caused to run in either direction, as desired, or stopped by the centering of the lever. When desired to run the car in the forward direction as indicated by the arrows, Fig. 2, the rod 29  
 40 would be pulled in the same direction caus-

ing the upper fork of the brushes to bear against and come in contact with the contact points 25 of the commutators. To reverse the movement the rod 29 would be pulled in the opposite direction causing the lower fork  
 45 of the brushes to be brought in contact with the contact points 25 of the commutators, thus reversing the mechanism.

Having now fully described my invention, what I claim is— 50

1. The combination of a commutator having contacts 25, with forked brushes 28 adapted to be engaged by said contacts, and means for moving either of said brushes into engagement with said contacts, and with side brushes  
 55 26, substantially as described.

2. The combination of a commutator having contacts 25, with brushes 28, a rocking shaft for moving said brushes into engagement with said contacts, and with brushes 26,  
 60 substantially as described.

3. The combination of a commutator having contacts 25, with brushes 28, a shaft connected therewith for operating them, a rod connected with said shaft, a lever for operating  
 65 said rod, and with brushes 26, all arranged substantially as shown and described.

4. The combination of a commutator, contacts 25, and brushes 26, with forked brushes 28, arm 36, connected therewith by pivots 37,  
 70 rod 35, arm 34, shaft 32, arm 33, rod 29, and lever 30, all arranged and operating as and for the purposes specified.

In testimony that I claim the foregoing I have hereunto set my hand this 18th day of  
 75 January, 1893.

WILLIAM LAWRENCE.

Witnesses:

F. W. BARKER,  
 E. E. MEASER.