(No Model.) 5 Sheets—Sheet 1.

# E. EGGER & F. A. WESSEL.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

No. 531,366. Patented Dec. 25, 1894.

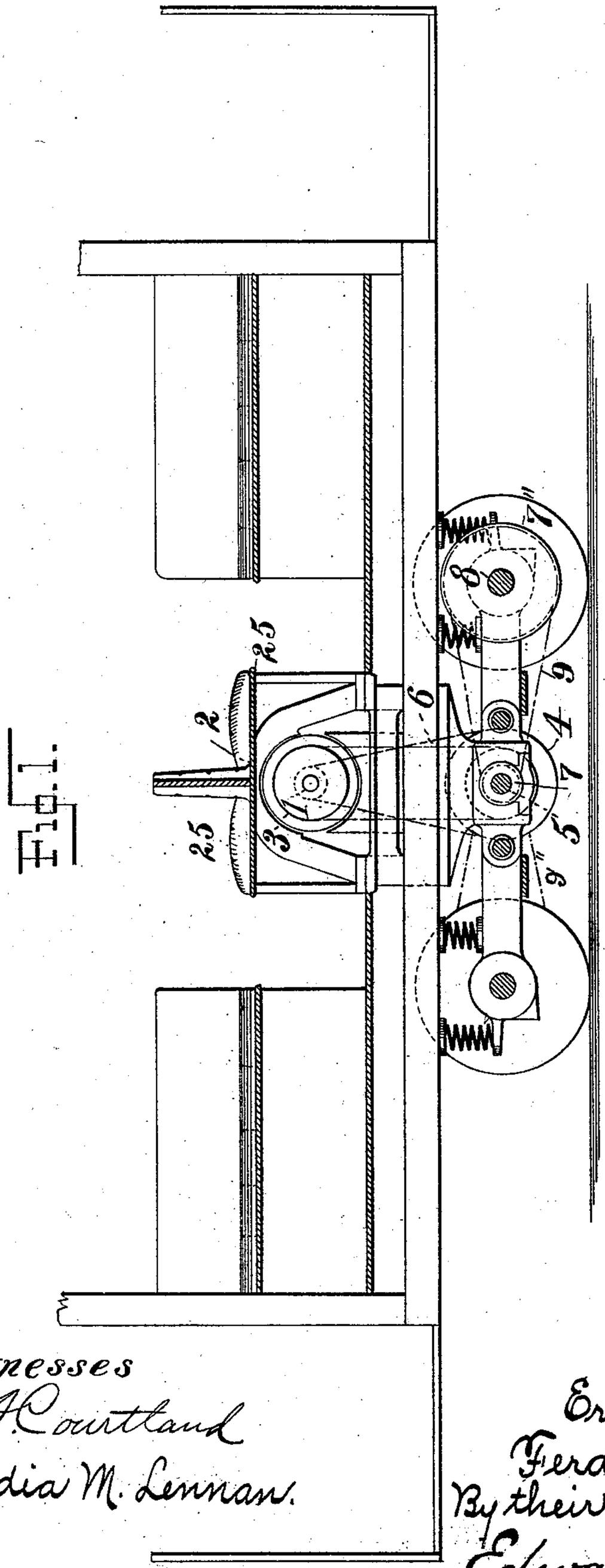



FIG. 1.

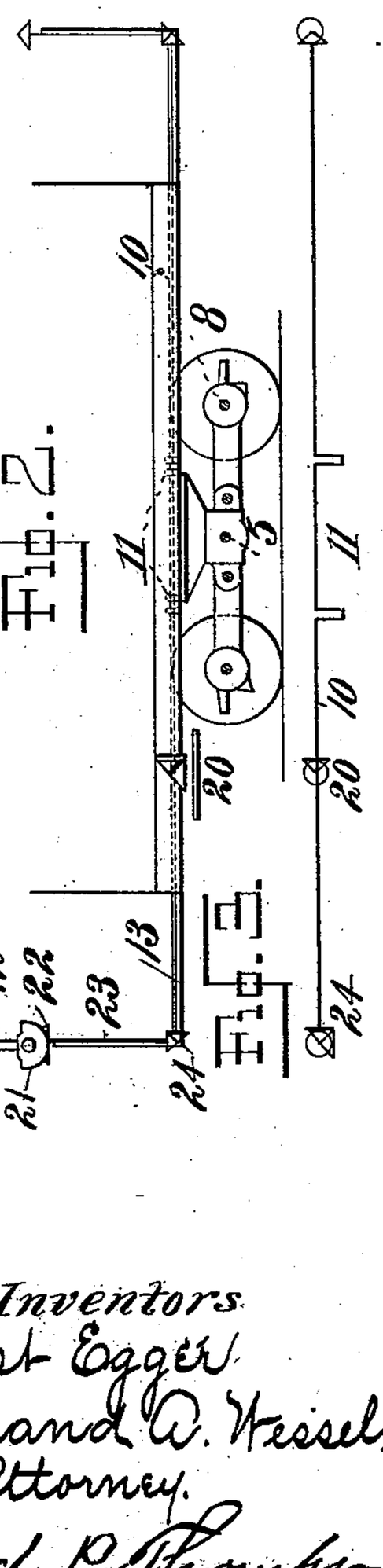



FIG. 2.

FIG. 3.

Witnesses
Wm. A. Courtland
Leocadia M. Lennan.

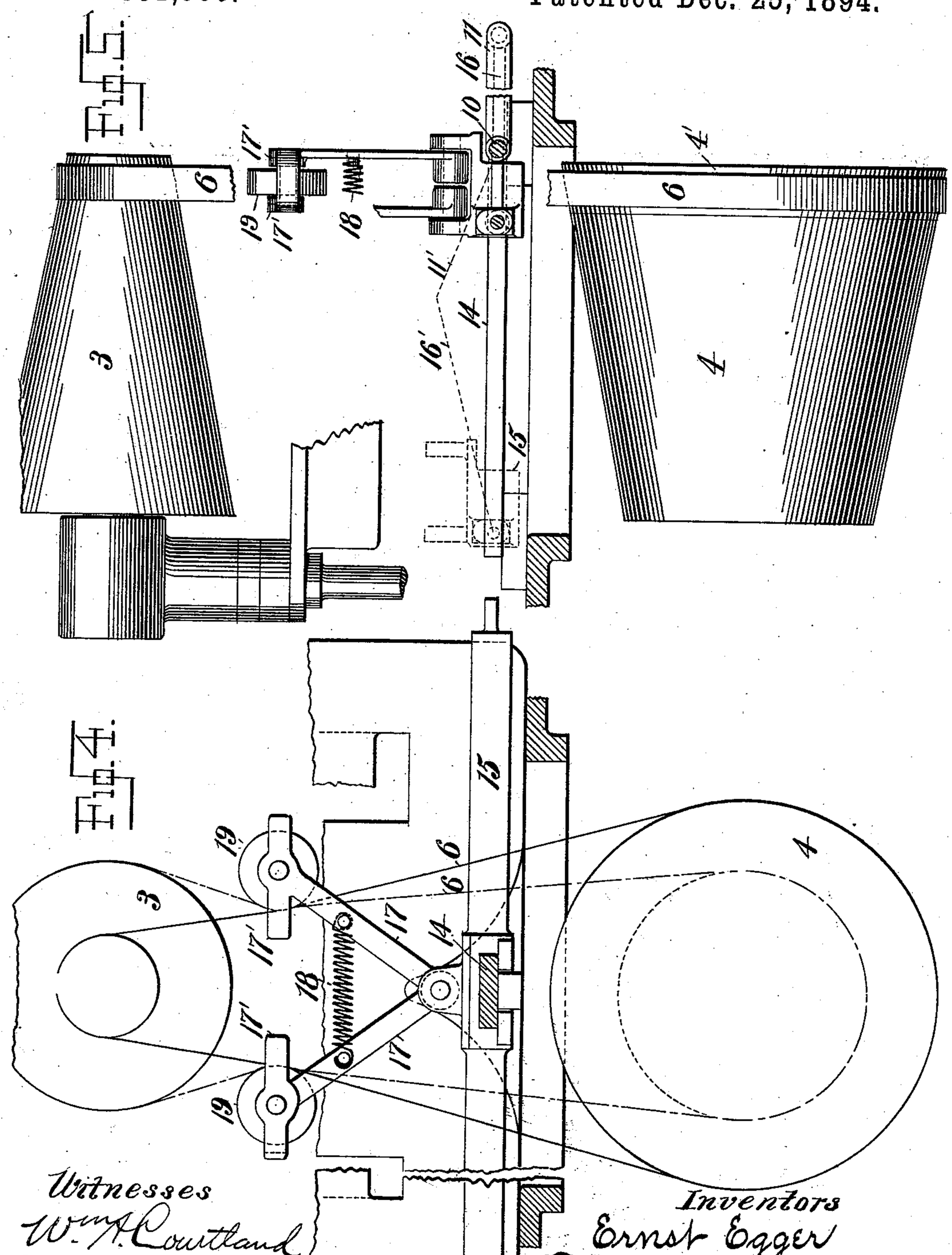
Inventors
Ernst Egger
Ferdinand A. Wessel.
By their Attorney.
Edward P. Thompson

(No Model.) 5 Sheets—Sheet 2.

# E. EGGER & F. A. WESSEL.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

No. 531,366. Patented Dec. 25, 1894.




Witnesses
W. F. Courtland
Leocadia Lennan

Inventors
Ernst Egger
Ferdinand A. Wessel
By their Attorney.
Edward P. Thompson

(No Model.) 5 Sheets—Sheet 3.

# E. EGGER & F. A. WESSEL.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

No. 531,366. Patented Dec. 25, 1894.

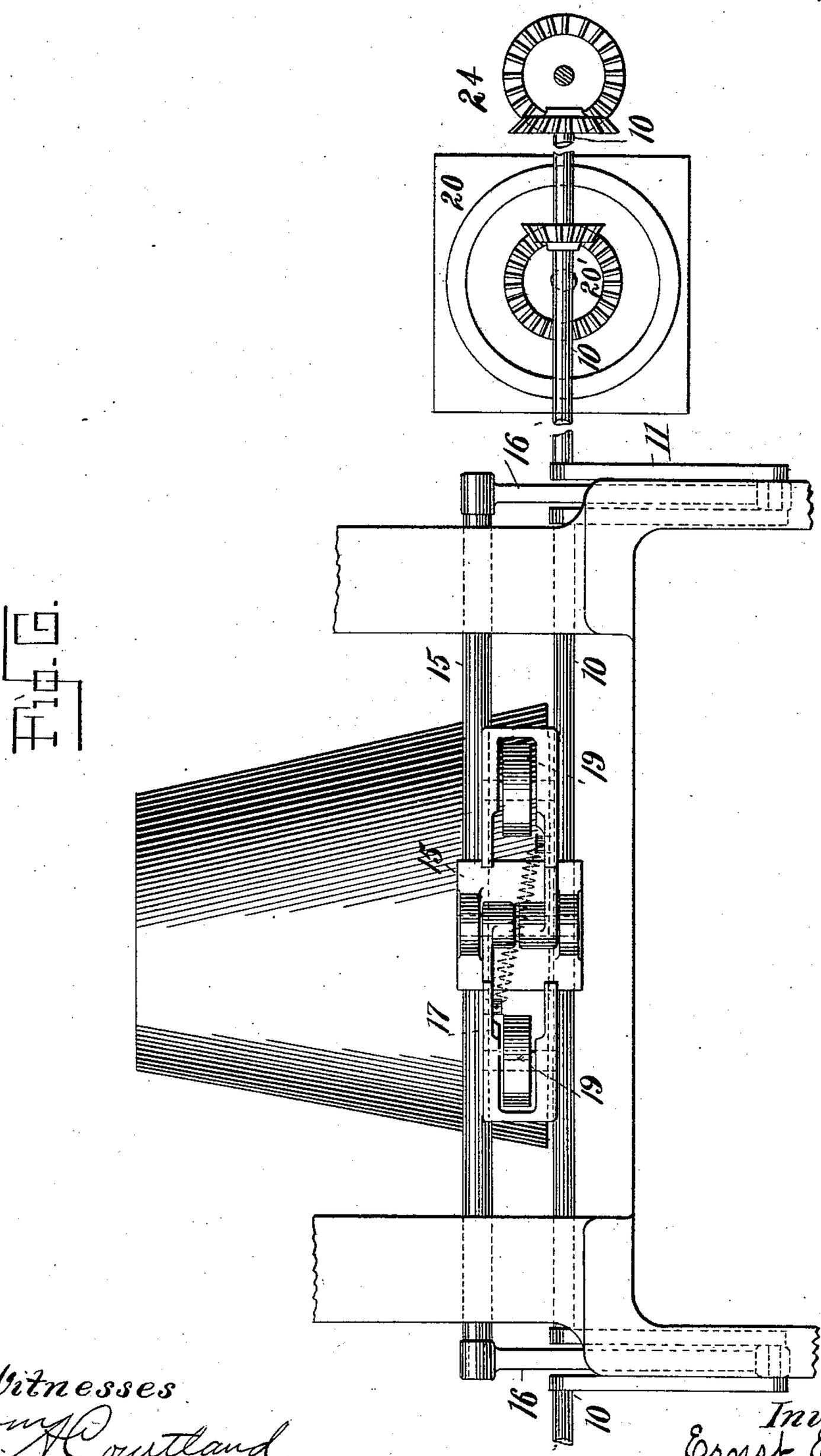



FIG. 5.

Witnesses
Wm. A. Courtland
Levcadia M. Lennan.

Inventors
Ernst Egger
Ferdinand A. Wessel
By their Attorney,
Edward P. Thompson

(No Model.) 5 Sheets—Sheet 4.

# E. EGGER & F. A. WESSEL.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

No. 531,366. Patented Dec. 25, 1894.

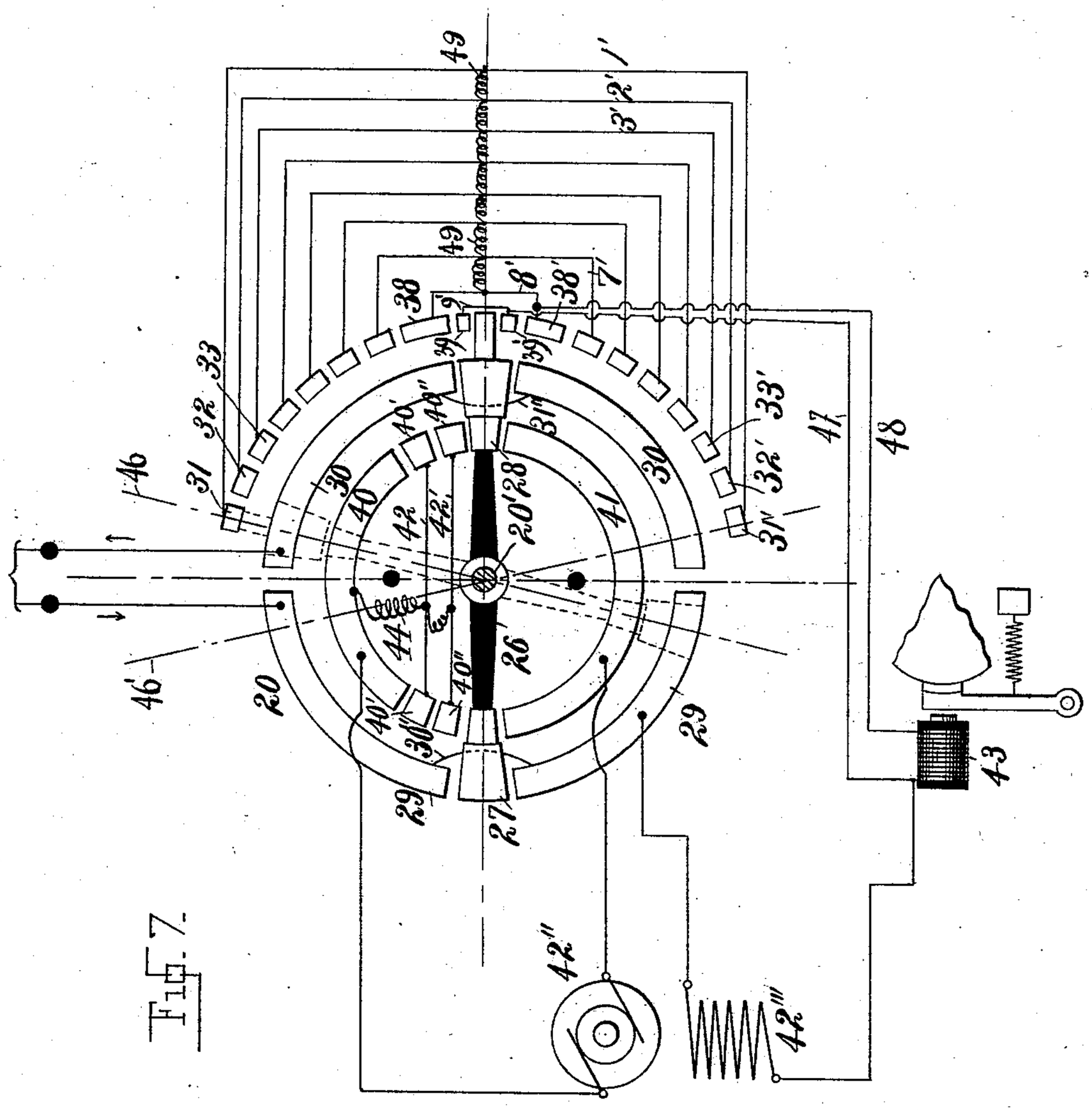



FIG. 7.

Witnesses

W. A. Courtland

Leocadia M. Lennan

Inventors

Ernst Egger

Ferdinand A. Wessel

Edward P. Thompson

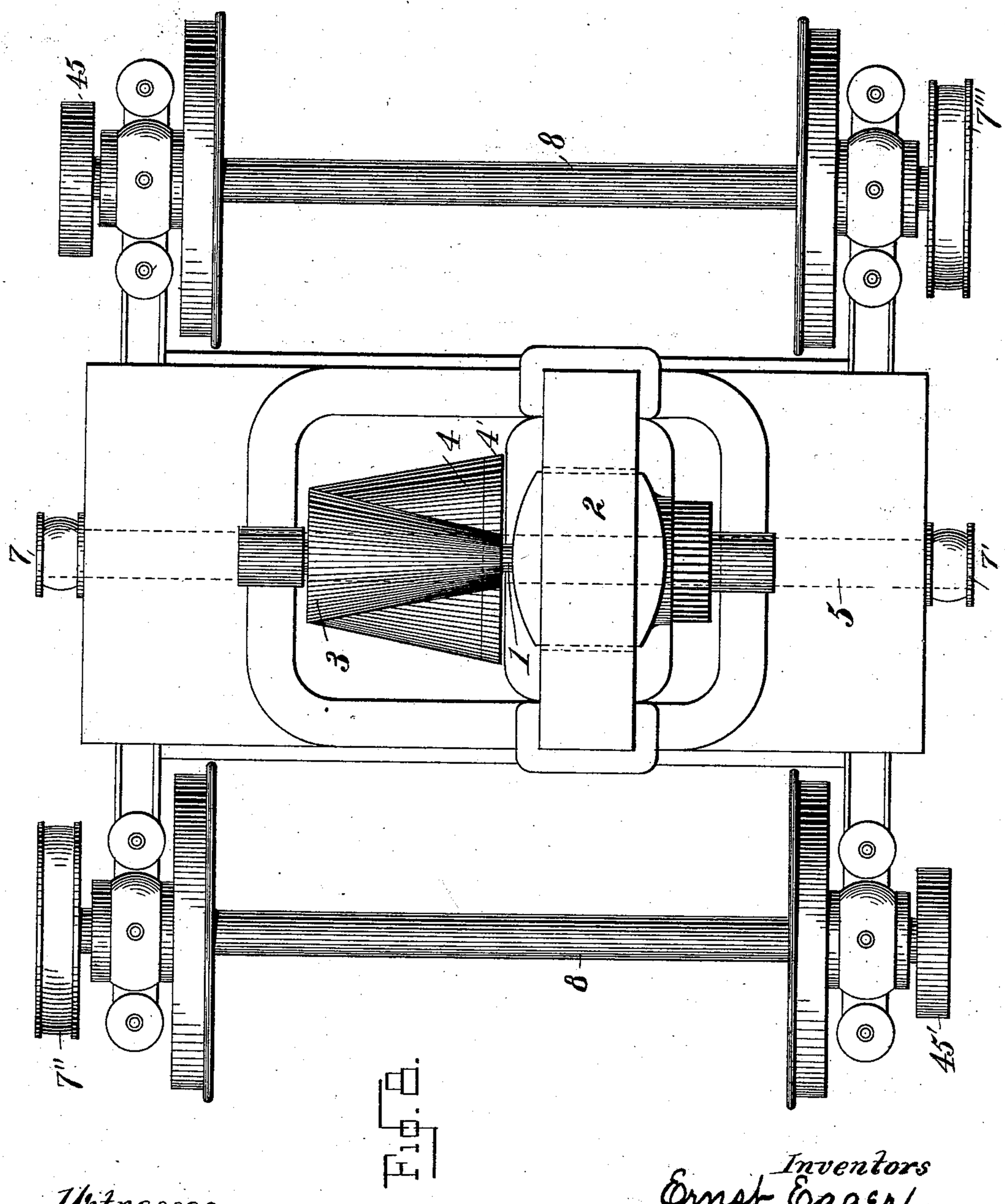
Attorney

(No Model.) 5 Sheets—Sheet 5.

# E. EGGER & F. A. WESSEL.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

No. 531,366. Patented Dec. 25, 1894.




Witnesses
W. A. Routland
Lovadia M. Lennan.

Inventors
Ernst Egger
Ferdinand A. Wessel,
By their Attorney,
Edward P. Thompson

# UNITED STATES PATENT OFFICE.

ERNST EGGER AND FERDINAND A. WESSEL, OF NEW YORK, N. Y., ASSIGNORS OF ONE-FOURTH TO AARON NAUMBURG, OF SAME PLACE.

## MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 531,366, dated December 25, 1894.

Application filed May 17, 1893. Serial No. 474,512. (No model.)

*To all whom it may concern:*

Be it known that we, ERNST EGGER, a subject of the Emperor of Austria-Hungary, and FERDINAND A. WESSEL, a citizen of the United States of America, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Propelling and Controlling Mechanism for Electric Cars, (Case No. 4,) of which the following is a specification.

In electric cars, it is very important to employ constant speed electric motors for both alternate and direct currents; but heretofore difficulties have presented themselves, which we aim to remove by our invention; which invention at the same time involves certain important details as hereinafter pointed out minutely by reference to the accompanying drawings.

Figure 1 is an elevation of an electric car partly in section and showing the constant speed electric motor and some of the mechanism between the same and the wheels. This figure shows particularly the relative location of the motor and the seats, and indicates the location of the conical pulleys and driving belts. Fig. 2 shows the mechanism on a small scale and in mere out linesbetween the handle on the platform of the car and the cranks for operating the belt shifter. It shows the location of the circuit controller and the whole is an elevation. Fig. 3 is a plan view of some details shown in Fig. 2. Figs. 4, 5, and 6 are views in different directions of the conical pulleys, the belt, thereon, the belt shifter, the cranks for operating the same. Parts are broken away here and there. Some parts are in section, and dotted lines assist in showing what is behind another part or different phases of some of the movable parts. Fig. 7 is a diagram of the electric features and circuits. Fig. 8 is a plan of Fig. 1 in a larger scale, showing the driving parts of the car and certain parts being omitted.

The apparatus and mechanism embodying our invention consists of the combination with the rotary shaft 1, of a constant speed electric motor 2, in this particular case a direct current shunt motor; of a conical pulley 3, on said shaft; a tight conical pulley 4 and a loose conical pulley 4′ forming together one cone on the shaft 5; a driving belt 6 shown in both extreme positions, connecting the pulleys 3 and 4′; pulleys 7 and 7′ on the shaft 5; and pulleys 7″ and 7‴ on the car wheel axles 8; a driving belt 9 connecting the pulleys 7 and 7″; and a driving belt 9″ connecting the pulleys 7′ and 7‴; a rotary rod 10, having cranks 11, passing under the car, and geared to a handle 12, on the platform 13; a guide bar 14 arranged between the pulleys and parallel with the axes thereof; a slide 15, movable on said bar, connecting rods 16, pivoted to said slide and said cranks; levers 17, connected by a spring 18, and pivoted on the slide 15; and carrying rollers 19, which bear against the belt 6, in such a direction as to tighten the same by the action of the said spring; a circuit controller 20, geared to the rod 10, and other details as hereinafter explained.

45 and 45′ are the brake wheels.

The levers 17, carry not only the rollers 19, but also projecting arms 17′, forming a belt shifter in the shape of a fork between whose tines or arms is the belt 6. The axis of the cone 3 is parallel to those of 4 and 4′, and to the car wheel axles, and the cones or conical pulleys are opposite each other, and so arranged that the small end of either faces the large end of the latter. When the belt is at the large end of the pulley 3, it is at the small end of the pulley 4, and when the belt is on the small end of the pulley 3, it is on the loose pulley 4′, so that the motor is running idle, without moving the car. The spring 18, serves to maintain the belt taut for apparent reasons and purposes.

The handle 12, is in its zero position when upright as seen in Fig. 2. Referring to Fig. 5, it may be observed that the zero position of the cranks 11 is horizontal, and that, whether the same are turned downward or upward, the belt becomes shifted from one end of the conical pulleys to the other, as indicated by the dotted slide 15, and dotted lines 11′ and 16′ indicating the new positions respectively of the crank 11, and rods 16. The upright handle 12 projects from a bevel gear sectional wheel 21, which gears with the bevel wheel 22, on the shaft 23. At the lower end of the shaft 23, is a pair of wheels 24, respectively on said shaft 23 and the crank rod

10. When the rod 12, is pulled to either side, the belt 6, is shifted along the pulleys 3 and 4. The motor 2, extends into the car-body and seats 25, are built over the same to economize space.

The bevel wheels at the circuit controller 20, operate the said controller to start the car, to stop it, to regulate it to different speeds and to apply and release the brake, the whole being accomplished by the mere movement of the handle 12, in one or the other direction. This is fully explained as follows:

The horizontal bevel wheel is on the shaft 20′ seen in Figs. 6 and 7. In virtue of the mechanism, when the handle 12, is pushed one way, the shaft 20′, turns in a certain direction, and when the handle 12, is moved in the other direction the shaft 20′, moves in the opposite direction from that first named.

In describing the diagram in Fig. 7, the shaft 20′, may therefore be taken as the starting point. It is screwed to the insulator 26, whose ends carry conductors 27, 28, which as shown in full lines are in their zero position;—*i. e.*, with the electric motor in open circuit. The center lines of the insulator 26, in its extreme position in both directions are shown by the dotted lines 46 and 46′. In the path of the conductors 27, 28, are arc shaped conductors arranged in three separate paths. The conductors 29, 30 form the two poles of the main line. They are each in pairs connected by wires 30″, 31″, passing under the conductors 27, 28, without touching the same. The conductors 27, 28, do not touch the conductors 29, 30, except when turned to the right or left. On opposite sides of the conductor 28, are members of pairs of short arc shaped conductors 31, 31′, 32, 32′, 33, 33′, &c., which are connected in pairs by conductors 1′, 2′, 3′, &c., which in turn are connected by resistances 49 except the conductors 8′ and 9′, which are connected by means of the wire 48, brake magnet 43 and the wire 47. There are arc shaped conductors 40 and 41, on opposite sides of the insulator 26. The ends of conductor 40, are divided up into insulated sections 40′, connected by a conductor 42, and sections 40″, connected by a conductor 42′. The terminals of the armature 42″, of the car motor are connected to the conductors 40, 41, respectively. The field magnet terminals 42‴ of the same motor are connected to the conductors 29 and to the wire 47 respectively, which connects it with the conductors 39, 39′.

To start the motor in one direction, the shaft 20′ is turned slightly to the left, so that the conductors 27, 28 are in contact with the first conductors met. The current from the main line, therefore, may be followed from and through conductors 29, 27, 41, armature 42″, conductor 40, resistances 44 (which connects conductors 40, 42 and 42′) 42′, 40″, 28 and finally to the opposite pole conductor 30 of the main line. The armature is thereby thrown into the main line. The field magnet is thrown in the following outlined circuit: From conductor 29, field magnet 42‴, wire 47, wire 9′, conductor 39, 28 and 30, which last is the opposite pole of the main line. No resistance nor the brake magnet is now in the field circuit. This will start the motor, which will drive now the loose pulley 4′ only, because the crank 11 is still near the dead center and therefore moving the connecting rod 16 and the belt-shifter 15 but very little. The reason of this is that the one rod 10 operates both the circuit controller and the belt shifter. At the same time the brake remains on the wheels, because no current energizes the brake magnet 43.

If the insulator 26 is moved farther, until the conductor 28 connects the conductors 30 and 38, the following change in the field circuit will happen: The current will pass from conductor 29 through field magnet 42‴, brake magnet 43, wire 48, wire 8′, conductors 38, 28, and 30, which last is the opposite pole of the main line, as before. This action throws in, as seen, brake magnet 43 in circuit, which will release the brakes. In this position the belt remains still on the loose pulley. If now the insulator 26 is moved farther, the belt 6 also will move on the tight pulley 4 and therefore start the car, which will run then at its lowest speed.

When the conductors 27 and 28 reach their farthest position as shown in dotted lines, it may be noticed that all the resistances 49 are included in circuit with the field magnet, and the motor is running then at maximum speed. By this means the motor is running at a fixed constant speed for every position of the insulator 26. Conjointly with this electrical regulation, the belt 6, has moved to the opposite ends of the pulleys 3, 4, whereby the car is propelled at the maximum speed with the constant speed motor. What has been explained about the limits of minimum and maximum speed is true between the limits; *i. e.*, as more and more resistance is included in the field magnet circuit, the belt 6, is more and more shifted to increase the speed of the car.

To stop the car for short intervals, for instance, for taking up passengers, it is sufficient, to shift the belt 6 on the loose pulley 4′. If it is necessary, as for instance, going down hill, the rod 12 may be moved still nearer to the zero position, until conductor 28 is on conductor 39, whereby the brake magnet 43 is brought out of circuit and the brake works. To stop the motor the handle 12, is put vertical and the conductors 27, 28, move to their zero position. By an opposite motion, the motor is reversed and the car moves in the opposite direction, because the current then passes from the conductor 29, to conductors 27, 40″, 42′, 44 40, armature 42‴, conductors 41, 28, and 30. The conductors 44 are preferably resistances so that when the motor is first started there may be resistance in circuit with the armature 42″.

We claim as our invention—

1. The combination with a constant speed electric motor, and with the wheels of an electric car, of conical pulleys on the motor axle and car axle respectively and connected by a driving belt, a belt shifter for adjusting the belt along the lengths of the pulleys, and means carried by the belt shifter for automatically tightening the taut and loose portions of the belt as the load increases.

2. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, and means for tightening and shifting the belt along the lengths of the said pulleys, said means consisting of a slide movable along a guide bar, levers pivoted to said slide and carrying rollers which bear upon said belt, a spring connecting the levers, a handle, and gearing connecting the handle to the slide.

3. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and said circuit controller.

4. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller.

5. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, said circuit controller consisting of means for including more and more resistance in circuit with the field magnet of the motor, when said handle is turned farther and farther in either direction, and for reversing the motor when said handle is turned in opposite directions.

6. The combination with an electric motor having a conical pulley and with a car having a conical pulley arranged parallel to the first, of a belt connecting the pulleys, a belt shifter for the belt, a swinging handle on the platform of the car carrying a bevel gear, an upright shaft carrying a bevel gear which gears with the first gear, a horizontal shaft gearing with the upright shaft, cranks belonging to the horizontal shaft and having pivoted rods, a slide connecting said rods, and carrying said belt shifter and a guide bar upon which the slide is movable.

7. The combination with an electric motor having a conical pulley and with a car having a conical pulley arranged parallel to the first, of a belt connecting the pulleys, a belt shifter for the belt, a swinging handle on the platform of the car carrying a bevel gear, an upright shaft carrying a bevel gear which gears with the first gear, a horizontal shaft and having pivoted rods, a slide connecting said rods, and carrying said belt shifter, and a guide bar upon which the slide is movable, and a circuit controller in circuit with said motor and geared to said horizontal shaft, for the purpose as set forth of throwing more and more resistance into the circuit with the field magnet of the motor as the belt shifter is thrown farther and farther along the pulleys by the mere operation of the said swinging handle.

8. The combination with a constant-speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, and means for tightening and shifting the belt along the lengths of said pulleys, said means consisting of a slide movable along a guide bar, levers pivoted to said slide and carrying rollers which bear upon said belt, a spring connecting the levers, a handle, and gearing connecting the handle to the slide, and a loose pulley at the end of one of said conical pulleys.

9. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, and a loose pulley at the end of one of said conical pulleys.

10. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, and a loose pulley at the end of one of said conical pulleys.

11. The combination with a constant speed electric motor and with the wheels of an elec-

tric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, said circuit controller consisting of means for including more and more resistance in circuit with the field magnet of the motor, when said handle is turned farther and farther in either direction, and for reversing the motor when said handle is turned in opposite directions, and a loose pulley at the end of one of said conical pulleys.

12. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, said circuit controller consisting of means for including more and more resistance in circuit with the field magnet of the motor, when said handle is turned farther and farther in either direction, and for reversing the motor when said handle is turned in opposite directions, a brake magnet in circuit with said circuit controller, and with the field magnet of said motor, and a loose pulley at the end of one of said conical pulleys.

13. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys respectively therefor connected by a driving belt, a belt shifter for tightening and shifting the belt along the lengths of said pulleys, a circuit controller, and means for operating, simultaneously, the said belt shifter and the said circuit controller, said means consisting of a handle, on the platform of the car, a shaft extending under the car having cranks, and geared to said handle, pivoted rods connecting said cranks to said belt shifter, and gearing connecting said shaft to said circuit controller, said circuit controller consisting of means for including more and more resistance in circuit with the field magnet of the motor, when said handle is turned farther and farther in either direction, and for reversing the motor when said handle is turned in opposite directions, a brake magnet in circuit with said controller, and with the field magnet of said motor.

14. The combination with an electric motor having a conical pulley and with a car having a conical pulley and a loose pulley arranged parallel to the first, of a belt connecting the pulleys, a belt shifter for the belt, a swinging handle on the platform of the car carrying a bevel gear an upright shaft carrying a bevel gear which gears with the first gear, a horizontal shaft gearing with the upright shaft, cranks belonging to the horizontal shaft and having pivoted rods, a slide connecting said rods, and carrying said belt shifter, and a guide bar upon which the slide is movable.

15. The combination with an electric motor having a conical pulley and with a car having a conical pulley and a loose pulley arranged parallel to the first, of a belt connecting the pulleys, a belt shifter for the belt, a swinging handle on the platform of the car carrying a bevel gear, an upright shaft carrying a bevel gear which gears with the first gear, a horizontal shaft and having pivoted rods, a slide connecting said rods, and carrying said belt shifter, and a guide bar upon which the slide is movable, and a circuit controller in circuit with said motor and geared to said horizontal shaft, for the purpose as set forth of throwing more and more resistance into the circuit with the field magnet of the motor as the belt shifter is thrown farther and farther along the pulleys by the mere operation of the said swinging handle.

16. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys on the motor axle and car axle respectively and connected by a driving belt, a belt shifter movable along the direction of the length of the pulleys, and means for automatically tightening the taut and loose portions of the belt as the load increases.

17. The combination with a constant speed electric motor and with the wheels of an electric car, of conical pulleys on the motor axle and car axle respectively and connected by a driving belt, a belt shifter movable in the direction of the length of the said pulleys and consisting of pivoted arms with projections extending beyond the edges of the belt and an automatic belt tightener consisting of pulleys carried by said arms and a spring connecting the arms for pressing the last named pulleys against the belt.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 12th day of May, 1893.

ERNST EGGER.
FERDINAND A. WESSEL.

Witnesses:
LEOCADIA M. LENNAN,
WM. A. COURSEN, Jr.