(No Model.) 3 Sheets—Sheet 1.

# F. E. HERDMAN.

## ELECTRIC ELEVATOR.

No. 519,117. Patented May 1, 1894.

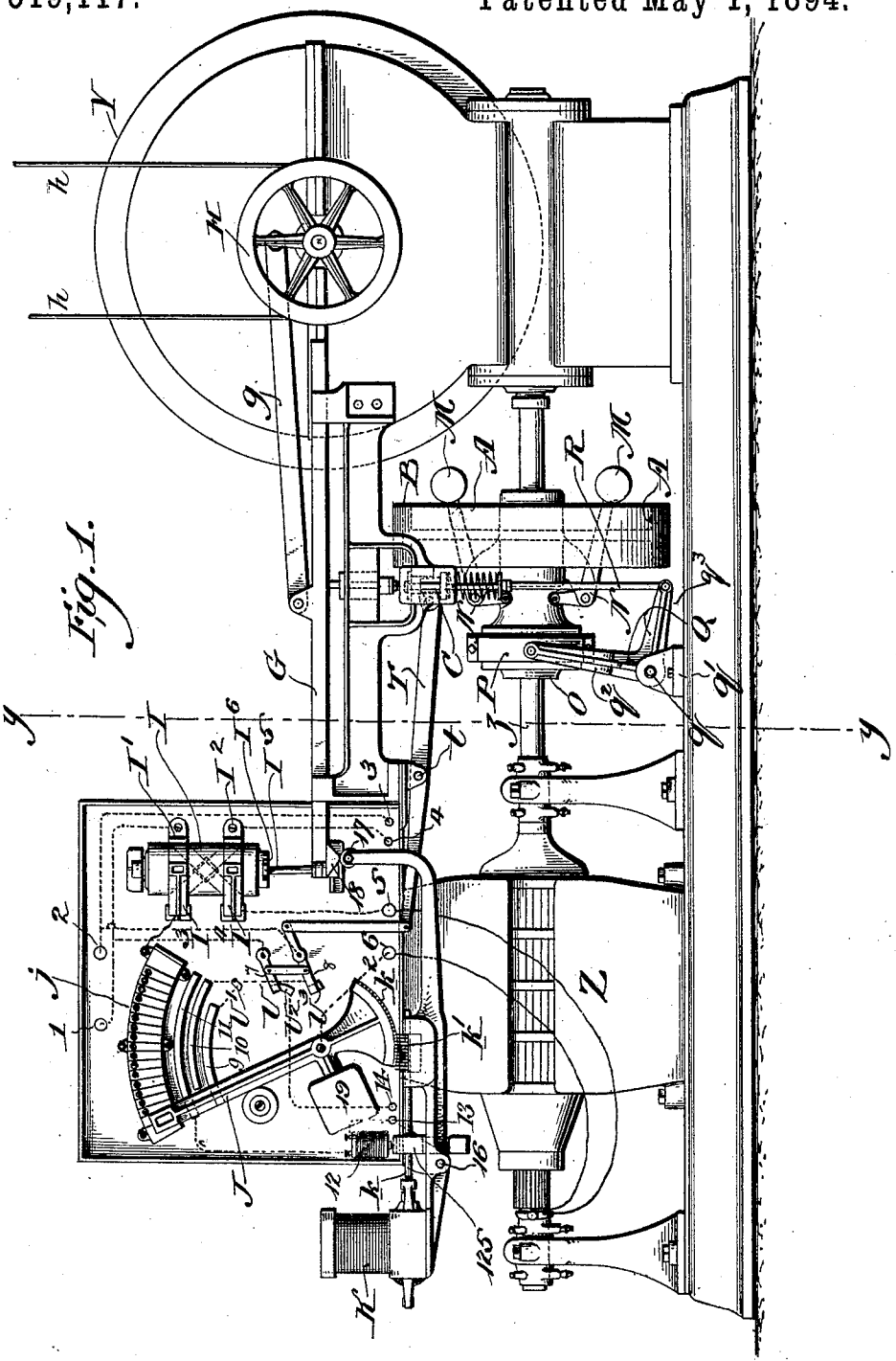

Fig. 1.

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# F. E. HERDMAN.

## ELECTRIC ELEVATOR.

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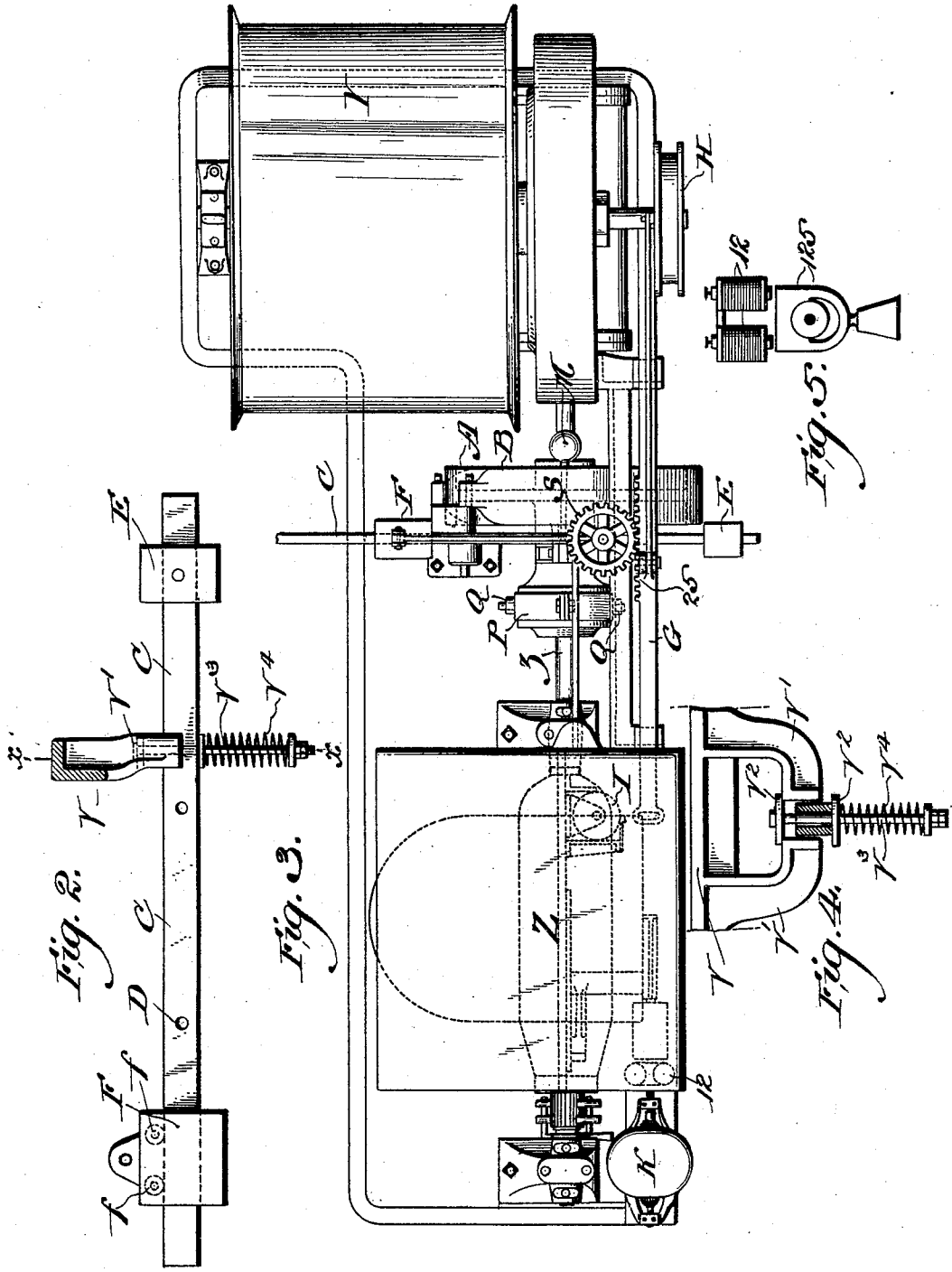

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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# F. E. HERDMAN.

## ELECTRIC ELEVATOR.

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Fig. 6

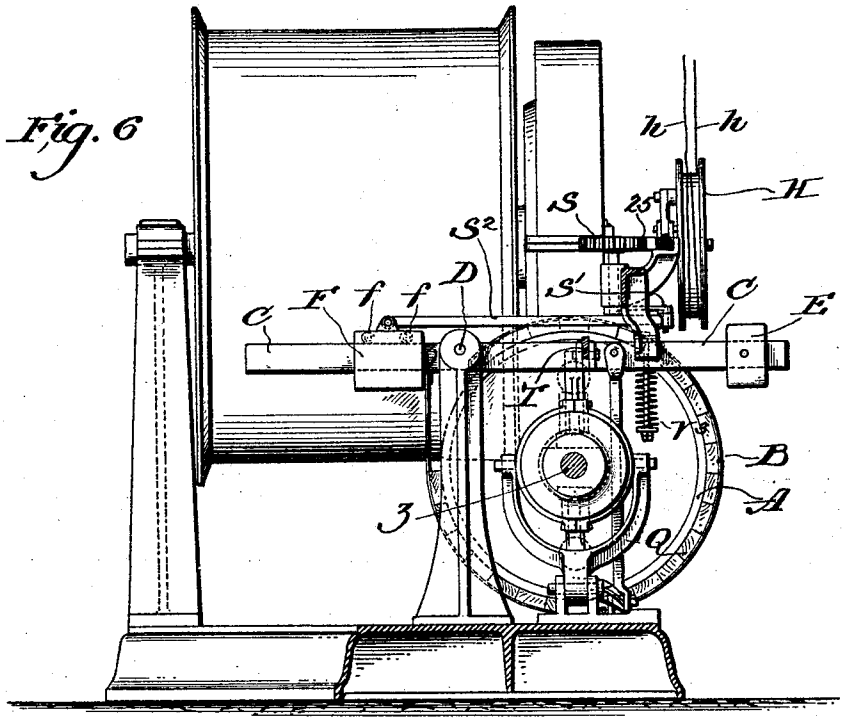



Fig. 7.

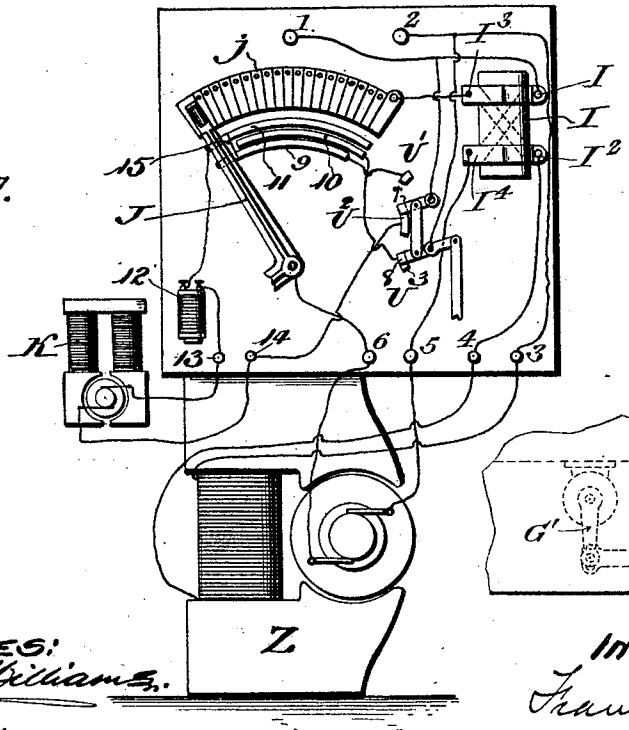
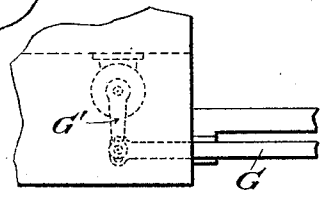



Fig. 8.

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# UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF INDIANAPOLIS, INDIANA.

## ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 519,117, dated May 1, 1894.

Application filed October 20, 1892. Serial No. 449,521. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Indianapolis, county of Marion, and State of Indiana, have invented a new and useful Improvement in Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention has for its object certain improvements for regulating and controlling power devices used in operating elevators. Except wherein, as will hereinafter be clearly seen, the devices are adapted to be used with only one particular character of power, they may be used with steam, hydraulic or electric elevators.

I will describe my improvements in connection with an elevator driven by electricity.

In the drawings—Figure 1 is a side view illustrating my improved devices. Fig. 2 is an enlarged side elevation of lever C. Fig. 3 is a plan view. Fig. 4 is a section on the line *x—x*, Fig. 2. Fig. 5 is a detached side elevation of brake and magnets. Fig. 6 is a section on the line *y—y*, Fig. 1. Fig. 7 is a diagrammatic view of switches and electrical connections. Fig. 8 is a detached plan view showing connection between operating bar G and cylinder-switch shaft.

Z is an electric motor.

*z* is the motor shaft.

Y is the lifting cable drum provided with a worm wheel, which meshes with a worm connected to motor shaft *z*.

A is the brake wheel on the motor shaft, B the brake, C the brake lever fulcrumed at D. (See Fig. 2.)

E is the brake weight which holds the brake upon the brake wheel when it is desired to stop the elevator.

F is a weight on the brake lever C opposite to the weight E. And said weight F is so connected to the lever C that it can be adjusted upon it and the weight F is provided with rollers *f* to enable said weight to be readily moved upon the lever C.

H is the operating sheave around which pass the operating cables *h*, *h*, which pass through the car. G is the operating bar connected to said sheave H by link *g*. Through the bar G, the link *g*, sheave H, and the cables passing around it, the car is connected with the power controlling mechanism, which in this case is the switch I as will hereinafter be fully pointed out.

M are the balls of a governor which is attached to shaft *z*, and pivoted to lugs N.

O is a sleeve upon the shaft *z*, which is operated by the balls M. Attached to the sheave O is the collar P which is connected to one end, $q^2$, of the bell crank, Q, fulcrumed at *q* to a support, *q'*, secured to the bed plate of machine. The end, $q^3$, of the bell crank Q, is attached to the brake lever C by means of connecting rod R.

Upon the operating bar is the rack portion 25 (see Fig. 3) which meshes with the gear S to which gear is secured the crank S' (see Fig. 6) which in turn is connected with the weight F by means of the connecting rod $S^2$.

T is a lever fulcrumed on center at *t*, one end being connected to lever C, the other end being connected with the power controlling devices, as will be hereinafter fully explained.

I is a cylinder switch, *j* are resistances through which the current is admitted to the armature circuit, and J is an arm adapted to pass over the resistances *j* to cut the resistances in and out of the armature circuit of the operating motor Z.

K is a small electric motor upon the shaft, *k*, having the worm *k'* meshing with the segmental gear $k^2$ on end of arm J.

I is the armature circuit controlling switch of the operating motor Z.

Upon the shaft I are the brushes I' and $I^2$ in connection with the poles of the current supply and the brushes $I^3$ and $I^4$ are connected in circuit through resistances, *j*, to the armature of the operating motor.

The cylinder switch, I, is provided with two plates crossing each other at the rear and insulated from each other at the crossing point, the ends being extended around the front of the cylinder, and parallel with each other. By throwing the cylinder in one direction the brushes $I^3$ and $I^4$ are brought in contact with these two plates so that the circuit is completed through those parts of the plates at the rear of the cylinder, and by throwing it in the other direction the brushes $I^3$ and $I^4$ are brought in contact with the opposite ends of the plates

so that the circuit is completed through those parts of the plate at the front of the cylinder; the brush $I^3$ being brought in contact with the plate which, when the cylinder was in the other position, was in contact with the brush $I^4$, and vice versa. So that according to the direction the cylinder switch I is turned the direction in which the current passes through the armature is controlled. The cylinder switch I is loose upon its shaft, the shaft having the pin $I^5$ fastened to it,—which works in a slot $I^6$ in said cylinder—the link G′ is pivoted to the cylinder-switch shaft and has at one end the pin working in a slot at the end of the operating bar G (see Fig. 8) whereby, when the operating bar G is moved to the left or right the cylinder switch I is revolved. The lever T is connected to the switch U, said switch being a straight double switch, which by means of the contacts U′, $U^2$ and $U^3$ in electrical connection with the armature of the motor K, controls the motor K in one direction or the other as desired. The current from the source of current supply is connected with the binding posts 1 and 2, the wire connected with the binding post 1 is connected directly with the brush I′ passing through the cylinder I and binding post 2 is connected directly with binding post 3 which in turn is connected with the field of the operating motor. The return wire from the fields of the motor is connected with binding post 4 which in turn is connected with brush $I^2$, also admitting the current into the cylinder I. From this cylinder switch the current is taken from the brush $I^3$ to the resistance coils. Thence by means of the arm J is carried to the binding post 6, and from thence to the armature; the return wire from the armature being connected with binding post 5, and running from there to brush $I^4$. This completes the circuit to the operating motor. Now, for operating the motor K, which in turn operates the arm J the connections are as follows: From the main circuit wires, a shunt is run to the switch U, one wire being connected with brush 7 and the other with brush 8. The contact U′ is connected with the contact strip 9 in the path of the arm J and the contact $U^3$ is connected with contact 10 in the path of the arm J. To arm J is attached brush 15, shown in figure, which is insulated from the arm J, and of sufficient length to extend over the three contact plates 9, 10 and 11. By means of this brush electrical connection is made between contacts 9 and 10 and contact 11. Contact 11 is connected with magnet 12. The opposite pole of this magnet is connected with the binding post 13, which is in turn connected with the armature of the motor K. The opposite wire from this motor is connected with the binding post 14, and from there is connected with the contact $U^2$. The fields of the motor K are connected directly with the main circuit if shunt wound motor is used, so that reversing the circuit through the armature reverses the motor. The throwing of the switch U in one direction allows the current to pass through the armature of the motor K in one direction, as the throwing of this switch in the opposite direction allows it to pass through the motor K in the opposite direction, for the purpose above described.

Magnet 12 through which the current passes, is to operate the small brake 125 on the shaft of the motor K, so that when the current is thrown on the motor, this brake is lifted off the worm shaft, and when the current is broken from the motor, the brake is allowed to drop and immediately check the motor. This brake in detail is shown in Fig. 5. The contacts 9, 10 and 11 are for the following purpose: When the machine is started, the action of the weight F is to throw the switch U in contact with the contacts U′ and $U^2$, in circuit with the motor K. From contact U′ the current passes to the contact 9, and through contact 9, by means of brush 15, on the arm J, to contact 11, and from there is transferred to the motor K. If the motor K is in circuit long enough to carry the arm J to the farther end of the resistance, there must be some means of automatically cutting it out of circuit. By the use of these contacts when arm J arrives at the farther end of the resistance contacts, the brush on the arm J passes off of contact 9, thereby breaking the circuit through the motor. If the current is thrown through the motor in the opposite direction, or in direction to make the arm J move to the left over the resistance contacts, brush U is in position as shown, and at such time contact 9 is not in circuit, but contact 10 is in circuit through its connection with contact $U^3$. When arm J is at the extreme right, the circuit can be made through the motor K by means of the contacts 10 and 11; and when arm J is returned to the extreme left, and the current is cut entirely out of the elevator motor, brush 15 passes out of contact 10, breaking the circuit, through the motor K. Thereby we have a means of stopping the motor K automatically when the arm J has reached the extreme end of either travel. The motor K with its shaft is fastened permanently to the frame which is pivoted at 16. The far end of this frame extends upward, and has at its top end a roller 17, which works with the incline 18 on the operating bar G. When the operating bar is thrown in either direction, the incline is free from this roller, but whenever it is brought to the central position, the incline comes in contact with this roller and throws it down, thereby throwing the worm attached to the motor K out of mesh with the gear on arm J, and under such circumstances the weight 19 brings the arm J to its left position. The idea of using this incline and roller is to prevent the possibility, in case the motor K becomes inoperative of the arm J being left to the right and the current passing through the large motor, which would prevent the stopping of the elevator.

By means of this incline and roller, whenever the operating bar is brought to the central position, the worm connected with the motor K is released from its gear, thereby insuring the arm J being returned to the left.

In operating the elevator, the operating bar G by means of the sheave H is thrown to the right or left. When in either one of these directions, it, of course, throws the cylinder I so as to control the direction in which the current passes through the armature of operating motor, also the gear S is moved and by its movement the crank S′ is moved, which through its connection moves the weight F. A movement of the operating bar in either direction from the central position moves the weight F on the brake lever away from the fulcrum D. When it is moved sufficiently to overcome the weight E which holds the brake on the brake wheel, the weight E is raised and in consequence raises the lever T and the switch U is thrown in contact with the contacts U′ and $U^2$, thereby operating the small motor K which motor through the medium of worm *k* and gear $k^2$ moves the arm J over the resistance contacts, thereby admitting the current to the armature of the operating motor. As soon as the elevator is started of course the balls M tend to throw out and the weight F, acts in opposition to the balls of the governor being thrown out, consequently the farther the weight F is thrown out on the brake lever the higher the speed of the armature shaft to cause the governor to act. When the governor does act, its connection with the sleeve O draws it in, and in consequence acts upon the bell-crank Q which in turn draws down the side of the brake arm to which weight E is attached. As it draws it down it of course draws that end of the lever T down, thereby breaking the connection of the switch U with the contacts U′, $U^2$ which stops the motor K, thereby stopping the movement of the arm J over the resistances, and in consequence preventing the admission of any greater current to the operating motor. If the speed which has been obtained is in excess of the amount just sufficient to cause the governor to act, then the balls of the governor throw still farther out, drawing the end of the brake arm to which the weight E is attached still farther down, thereby clamping the brake and at the same time bringing the switch U in contact with the contacts $U^2$ $U^3$, thereby reversing the motor K, so as to bring the arm J to the left and thus throw more resistance into the armature circuit, consequently reducing the speed of the elevator. By this means the operator can operate the elevator at any speed he may desire by simply moving the weight F in or out of the arm of the brake, and thereby adjusting the governor to act at any speed he may desire. When this is done the governor operates the elevator and keeps it to that speed. If the operator desires to slacken the speed he shoves the operating bar G toward the central position, which in turn brings the weight F toward the fulcrum D, thereby lessening the leverage on the governor M and immediately allowing the balls to be thrown out so as to reverse the motor K, and thereby cutting the circuit of the main current out of the armature circuit, and at the same time applying the brake E in proportion to the amount of speed the elevator has, in excess of that desired. If in starting up speed is attained beyond that for which the governor is adjusted, of course it immediately acts and throws the motor K out of circuit; it also immediately reverses the motor K and starts the arm J back over the resistances until the speed is reduced so as to cause the balls of the governor to drop. Then there is a liability of them dropping sufficiently to again reverse the motor K and start the arm J in the other direction, thus keeping the movement of the arm J back and forth to the detriment of the motor. To prevent this I attach to the bracket V the lugs V′, shown in Figs. 2 and 4, one on either side of the brake arm when in its central position; above these lugs I place the plate $V^2$ which is in contact with them, and also above the brake arm. A similar plate is also placed below. Then through these two plates and the brake arm is run the bolt $V^3$ having a light spring $V^4$ upon it and a washer and nut at its farther end. The movement of the brake lever up or down brings it in contact with one or the other of these plates, and its further movement compresses the spring on the rod $V^3$. This spring has simply a slight tension, so that in case the brake arm E is thrown down by the governor obtaining excessive speed, when this speed comes within the bounds of the governor, its balls drop and the brake arm goes to the central position, thereby stopping the motor K. But to reverse the motor K the brake arm would have to pass upward, and thereby compressing the spring $V^3$, which would require more work and greater action of the governor. By this arrangement the governor will not immediately reverse the motor K, nor until there is sufficient difference in the speed of the worm shaft to require it; thus obviating the objection spoken of above.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a segmental gear at the end of said arm, a secondary motor, as K, an armature circuit controlling switch for said motor, a worm driven by said motor meshing with said segmental gear on the resistance arm.

2. The combination with an electric operating motor, of an armature circuit controlling switch, resistances interposed between said

switch and the armature circuit, a resistance arm in electrical connection with the armature of the motor and adapted to travel over said resistance, a secondary motor as K, said motor K being supported on a pivoted frame, connection between the shaft of said motor and the resistance arm, an armature circuit controlling switch for said motor, the frame of the motor K being provided with a roller as 17, an operating bar for operating the operating motor armature circuit controlling switch, an incline on said bar pressed against the said roller.

3. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power and operating shaft of a governor operated by said shaft, a lever, a weight upon said lever acting in opposition to the governor, intermediate connection between said lever and the power controlling mechanism and intermediate connection between the governor and the lever.

4. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a brake wheel upon said shaft, a brake upon said wheel, a weight which can be placed in opposition to the action of said brake, a governor operated by and operating the shaft acting against said weight, intermediate connection between said weight and the power controlling mechanism and intermediate connection between the governor and said weight.

5. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a governor operated by said shaft, a lever, a weight adjustable upon said lever and acting against said governor, an operating bar and intermediate connection between said bar and the adjustable weight adapted when said bar is moved to move said weight on said lever, intermediate connection between the lever and the power controlling mechanism, and intermediate connection between the governor and the brake lever.

6. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a governor operated by said shaft, a lever, a weight upon said lever, intermediate connection between said lever and the operating mechanism, a weight upon said lever acting against the governor, a sleeve upon the operating shaft adapted to be operated by said governor, and intermediate connection between said sleeve and brake lever.

7. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a lever, a weight upon said lever, a governor operated by said shaft acting against said weight, intermediate connection between said lever and the power controlling mechanism and intermediate connection between the governor and the lever, a bracket provided with lugs, one on either side of the lever placed above and below said lever in contact with the lugs, a bolt connecting said brakes and a spring arm upon the said bolt.

8. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a lever, a weight adjustable upon said lever, an operating bar, intermediate connection between said bar and the adjustable weight adapted when said bar is moved to move said adjustable weight on said lever, a governor operated by said shaft acting against said adjustable weight, intermediate connection between the lever and the power controlling mechanism and intermediate connection between the governor and the lever, a bracket provided with lugs, one on either side of the lever, plates above and below the lever in contact with the lugs, a bolt connecting said plates and a spring upon said bolt.

9. In an elevating apparatus, the combination with a source of power and mechanism for admitting or cutting off said power, of an operating shaft, a lever, a weight upon said lever, intermediate connection between said lever and the operating mechanism, a governor acting against said weight and operated by the said shaft and sleeved upon said shaft operated by said governor, an intermediate connection between said sleeve and the brake lever, a bracket provided with lugs, one on either side of the lever, plates above and below the lever in contact with the lugs, a bolt connecting said plates and a spring upon said bolt.

10. The combination with an electric operating motor of an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, a governor operated by said shaft, acting against said weight, intermediate connection between said lever and the armature circuit controlling switch of motor K, and intermediate connection between the governor and the lever.

11. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary momotor as K, an armature circuit controlling switch for said motor and connection between the shaft of said motor and said resistance arm, an operating shaft, a lever a weight upon said lever, said weight being adjustable upon said lever, an operating bar and intermediate connection between said bar and the adjust-

able weight adapted when said bar is moved to move said adjustable weight on said lever, a governor operated by said shaft acting against said adjustable weight, intermediate connection between the lever and the armature circuit controlling switch of motor K, and intermediate connection between the governor and the brake lever.

12. In combination with an electric operating motor an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor, and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, said weight being adjustable upon said lever, an operating bar and intermediate connection between said bar and the adjustable weight adapted when said bar is moved to move said adjustable weight of said lever, a governor operated by said shaft acting on said adjustable weight, intermediate connection between the lever and the armature circuit controlling switch of motor K.

13. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor and connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, intermediate connection between the lever and the armature circuit controlling switch of motor K, a governor acting against the weight and operated by the said shaft, a sleeve upon said shaft operated by said governor and intermediate connection between said sleeve and the lever.

14. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, and connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a brake upon said lever, a governor operated by said shaft, acting against said brake, intermediate connection between said lever and the armature circuit controlling switch of motor K and intermediate connection between the governor and the lever, a bracket provided with lugs, one on either side of the lever arm, placed above and below the brake lever in contact with the lugs, a bolt connecting said plates and a spring arm upon said bolt.

15. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, a governor operated by said shaft, acting against said weight, intermediate connection between said lever and the armature circuit controlling switch of motor K, and intermediate connection between the governor and the lever, a bracket provided with lugs, one on either side of the brake arm, plates above and below the lever in contact with the lugs, a bolt connecting said plates, and a spring arm upon said bolt.

16. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, and connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, said weight being adjustable upon said lever, an operating bar and intermediate connection between said bar and the adjustable weight adapted when said bar is moved to move said adjustable weight on said lever, a governor operated by said shaft acting against said adjustable weight, intermediate connection between the lever and the power controlling mechanism, and intermediate connection between the governor and the lever, a bracket provided with lugs, one on either side of the lever, plates above and below the lever in contact with the lugs, a bolt connecting said plates, and a spring upon said bolt.

17. In combination with an electric operating motor, an armature circuit controlling switch to said motor, resistances in the armature circuit, an arm in electrical connection with the armature of the motor and adapted to travel over said resistances, a secondary motor as K, an armature circuit controlling switch for said motor, and connection between the shaft of said motor and said resistance arm, an operating shaft, a lever, a weight upon said lever, intermediate connection between the lever and the armature circuit controlling switch of motor K, a governor acting against the weight and operated by the said shaft, a sleeve upon said shaft operated by said governor and intermediate connection between said sleeve and the lever, a bracket provided with lugs, one on either side of the lever, plates above and below the lever in contact with the lugs, a bolt connecting said plates and a spring upon said bolt.

18. In an elevating apparatus, the combination, with power controlling mechanism of an

operating shaft, a governor operated by said shaft, a weight acting in opposition to and movable with relation to said governor, and connection between the power controlling mechanism and said weight, and between said weight and the governor, whereby when the governor overcomes the weight the power controlling mechanism is operated.

19. In combination with an electric motor, a source of current supply, an armature controlling switch, resistances, a resistance arm in the armature circuit, electrical mechanism for moving said arm over the resistances, a switch to control the admission of current to the last mentioned mechanism, an operating shaft, a governor operated by said shaft, and connection between said governor and the last mentioned switch.

20. In an elevating apparatus, in combination with the elevating car and power controlling mechanism, an operating shaft, a governor operated by said shaft, means to control the adjustment of said governor (from the car) and intermediate connection between said governor and the power controlling mechanism.

In testimony of which invention I have hereunto set my hand.

FRANK E. HERDMAN.

Witnesses:
W. V. MARTIN,
JOSEPH COOK.