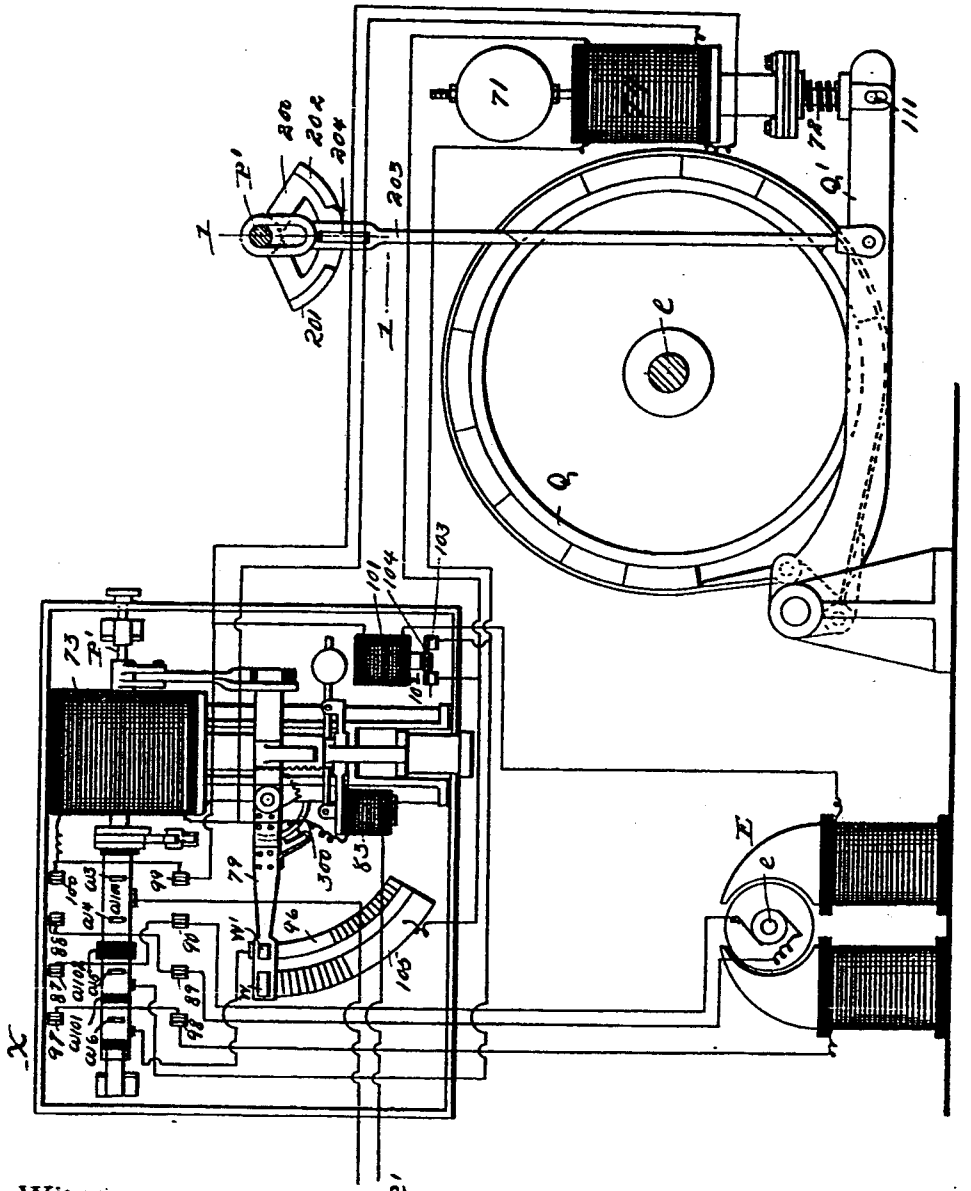
(No Model.)

F. E. HERDMAN.

BRAKE MECHANISM FOR ELECTRIC ELEVATORS.

No. 568,571. Patented Sept. 29, 1896.



Witnesses.
Jesse B. Hellers.
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Fig. 1.

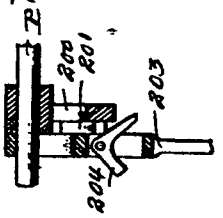

Fig. 2.

Inventor.
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UNITED STATES PATENT OFFICE.

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BRAKE MECHANISM FOR ELECTRIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 568,571, dated September 29, 1896.

Application filed October 5, 1895. Serial No. 564,736. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Winnetka, county of Cook, and State of Illinois, have invented a new and useful Improvement in Brake Mechanism for Electric 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.

The brake used in my invention is a friction-brake, and it is known that the time in making a stop with a frictional brake is proportional to the speed and load. If the car be descending, if the velocity or load is greater, it takes more time to bring the mechanism to rest, while, on the other hand, if the velocity be less or the load be light, the stop is made much quicker. The purpose of this invention is to obviate this and to make the application of the brake vary as the conditions of speed and load vary, so as to make the stop constant.

I will first describe the construction as illustrated in the drawings and then particularly point out the invention in the claims.

In the drawings, Figure 1 is an electrical diagram. Fig. 2 is a detail section on the line 1 1 of Fig. 1.

Q is the brake-wheel on the shaft of the motor.

E is the motor; e, the shaft of the motor.

Q′ is the brake-lever.

P′ is the operating-shaft through which the operator controls the machine.

74 is a double-wound magnet.

71 is the brake-weight, and 72 is a spring interposed between the connection of the brake-weight with the brake-lever. The core of the magnet 74 is attached directly to the fork, which is connected to the brake-lever Q′. This fork has a slot in it, giving a movement to the fork up and down around the pin 111, which passes through the brake-lever.

Between the brake-lever and the core of the solenoid 74 is placed a spring, this spring being of such length and strength that when the pin through the brake-lever is at the bottom of the fork in the slot this spring is but little or not compressed. When the fork has dropped so that the pin is at the top of the slot, this spring is compressed to the amount of the entire brake-weight, thus giving a gradual application of the brake.

X is a snap-switch controlled by the operating-shaft P′.

$a^3 a^4 a^5 a^6$ are brushes on this switch, brushes a^3 and a^4 being in electrical connection with each other by means of the conductive portion a^{109}. Brushes a^5 and a^6 are insulated from each other by means of the insulation a^{101}, and brushes a^3 and a^4 are insulated from brushes a^5 and a^6 by the insulation a^{102}.

100, 88, 87, and 97 are a series of contacts above the snap-switch, and below are corresponding contacts 99, 90, 89, and 98. In the movement of the switch in one direction from the center, brush a^3 makes contact with contact 100, in the other direction with contact 99. So in reference to brush a^4, which makes contact with contact 88 and contact 90; brush a^5, with contacts 87 and 89; brush a^6, with contacts 97 and 98. Contacts 88 and 89 are cross-connected, and contacts 87 and 90 are cross-connected. The contacts 100 and 99 are also in electrical connection.

The current from one pole of the source of current supply runs to the conductive portion a^{100} of the hub of the snap-switch X, so that the brushes a^3 and a^4 are in direct electrical connection with one pole of the source of current supply, and from thence the current passes either to the contacts 100 and 88 or 90 and 99. The contact 100 is in electrical connection with the resistance-arm solenoid 73. From said solenoid a wire passes to the current-controlling solenoid 83, and from the solenoid 83 a wire runs to the other pole of current supply.

From contact 99 a wire passes to the solenoid 101, and from the solenoid 101 a wire passes to one side of the field of the motor. From the other side of the field a wire passes to the contacts 97 and 98. From contact 90 a wire passes to one side of the armature, and from the other side of the armature the wire returns to contact 89. From thence current passes to brush a^5, and from thence through the wire to one winding of magnet 74, and the return-wire from that winding goes to the armature-resistance 105, from thence through the arm 79 to the contact 300, and from thence to the wire leading from the solenoid 73 to the solenoid 83, through which it returns to

the other pole of the source of current supply. Thus we have one winding of the magnet 74 in series with the armature-circuit. From the other winding of the magnet 74 a wire passes to and connects with the wire leading from contact 99 to solenoid 101. The other wire from that winding leads to the wire leading from the solenoid 73 to the solenoid 83. We therefore have this other winding of the magnet 74 in shunt with the armature. The two wires leading from the upper winding of the magnet 74 are connected to the contacts 102 and 103, which are adapted to be connected by the contacts 104, controlled by the core of solenoid 101, and, when so connected, to cut off the current from that winding of the magnet 74. The return-wire of the field of the motor passes to the contact 97 or 98, and from the brush a^6 a wire leads to the field-resistance 96, and through the arm 79 and contact 300 connection is made with the wiring to the solenoid 83, and from thence to the other pole of the main source of current supply.

When the snap-switch is operated in either direction, the following occurs: Speaking first of the magnet 74 and supposing the switch to be turned in a direction so that the brushes a^3 a^4 a^5 a^6 make contact, respectively, with the contacts 99, 90, 89, and 98, the turning of the switch in the other direction would make no difference from which will hereinafter be described except in the direction of the current passing to the armature. Under these conditions the shunt-winding of the magnet 74 will be in direct electrical connection with the source of current supply and will be at once energized.

So far as the passage of the current to the field is concerned, it will pass from contact 99 to solenoid 101, from thence to one side of the field, from the other side of the field to contact 98, from thence to brush a^6, from thence to the field-brush a', and from thence along the resistance-arm 79 to the contact 300, from thence through the regulating-solenoid 83 to the other pole of the source of current-supply. The passage of current through the solenoid 101 will energize it, lifting the contact 104, so that the connection between the contacts 102 and 103 is broken.

The current to the armature passes from contact 90 directly to one side of the armature, from the other side of the armature to the contact 89, from thence to brush a^5, from thence to the series winding of the solenoid 74, and from the other side of the series winding of solenoid 74 to the armature-resistance 105, from thence along the resistance-arm 79 to contact 300, and thence through the solenoid 83 to the other pole of source of current supply.

As the resistance-arm of the armature-resistance is initially upon the highest resistance, but slight current, if any, passes to the series winding of the solenoid 74. The resistance-arm 79 is operated by means of the solenoid 73, which is connected with the contact 100, so that the current passes to it from said contact. From the other end of the winding of the solenoid 73 the current passes through the contact 300 to the solenoid 83, and from thence directly to the other source of current supply. The solenoid 73, being energized, moves its core, which is connected with the solenoid-arm 79, to move it so as to cut out the resistances in the armature-circuit and cut in resistances in the field-circuit. The purpose of the regulating-solenoid 83 is to regulate the speed with which the solenoid 73 acts, and its operation is clearly described and claimed in a certain patent issued to me, No. 550,773, dated December 11, 1894. As the armature-resistances are cut out, and proportionately to the extent with which the armature takes up its current, so is the series circuit of solenoid 74 energized.

We thus see that when the current is first thrown onto the machine the shunt-winding of solenoid 74 is excited and the series winding is not excited. The shunt-winding of said solenoid in itself is only of sufficient strength to partially relieve the brake, still holding sufficient brake on the machine until the armature takes up sufficient current to operate the machine and raise the load. When the armature is in this condition, there is sufficient current admitted through the series winding of solenoid 74 to energize the same, and the combination of the shunt and series windings of the solenoid 74 excites said solenoid sufficiently to raise the brake off the brake-wheel.

If, with the construction shown in the foregoing drawings and description, the car should be descending with a heavy load, in that case the motor would be turned into a dynamo and the series winding of the solenoid 74 would thus lose its strength, which would result in a tendency for the brake to be applied to a certain extent. To prevent this, I place on the operating-shaft a segment 200, having at each side a projection 201 and 202. On the rod 203, connecting with the brake-lever and having a slot in it around the operating-shaft, (acting as a means of guide,) is placed a ratchet 204. When the operating-shaft is thrown to the right or left, either the projection 201 or 202 is thrown in the path of the ratchet 204. When this movement of the operating-shaft is made, the current is thrown on the machine and the magnet 74 is excited, thereby lifting the brake-lever Q' and causing the ratchet 204 to pass by whichever projection 201 or 202 is in the path of the ratchet. When this ratchet has passed this projection, it locks with it. The result is that when the lever is held in that position the brake is also held in that position, and, even though the current consumed by the armature of the motor should fall, the weakening of the solenoid does not allow the application of the brake.

The length of projections 201 and 202 is

such that when the operating mechanism is brought toward its central position when the rheostat-arm reaches a point when it is about to pass on the armature-resistance, the projection 201 or 202 is passed from under the ratchet 204, thus permitting the action of the brake from this point according to the conditions of solenoid 74. When the projection has released the ratchet, then the brake acts according to the conditions of solenoid 74. If the car is lifting an excessive load, and in consequence consuming a great deal of current, this current keeps solenoid 74 so energized as to hold the brake off until the current is finally cut off the machine, this being with the idea that the load will reduce the speed of the car rapidly enough without the use of the brake until the last moment. On the other hand, if the car is practically lifting no load, then the armature is consuming little or no current, and in consequence the series coil on solenoid 74 has little or no strength. As a result, the only power by which the brake is held off is due to the shunt-coil of the solenoid 74, this being only sufficient to partially relieve the brake. As a result, the brake is partially applied and the mechanism gradually stopped until the final breaking of the circuit throws on the full strength of the brake. If the elevator is overcounterbalanced and going up light, so that the counterbalance tends to run away with it, then the motor will be acting as a dynamo, and in consequence the current in armature-circuit passes in an opposite direction from that from source of current supply. As a result, the series coil of solenoid 74 would be acting in opposition to the shunt-coil, thus still further weakening solenoid 74 and giving a stronger action of the brake. This is in accordance with the results desired, and thereby gives an accurate stop with or without load.

The purpose of the solenoid 101 and the contact 104 and contacts 102 and 103 is clearly and fully described in a certain application filed by me October 5, 1895, Serial No. 564,735, and may generally be stated here to be that in case the field-circuit should become deranged the solenoid 101, which is in said circuit, will no longer be excited. As a consequence the contact 104, connected to the core, will fall so as to connect the contacts 102 and 103, and thus short-circuit the current from the series winding of the solenoid.

Speaking generally in reference to the invention as described in this specification, it consists, as may be seen from the specification, in controlling the brake upon a brake-wheel of a power-driven motor by the use of a device which, as described in this specification, has a solenoid which is connected with the source of power which operates the motor, which in this case is an electric motor, through the motor itself, so that the amount of power which is supplied to the device controlling the brake-lever bears a certain relation to the amount of power used in operating the motor, so that the amount of power which this device has to expend upon the brake-lever bears a certain relation to the amount of power expended in operating the motor, and, as the amount of power expended in operating the motor bears a fixed relation to the speed and load of the device operated by the motor, so the amount of the power which the device controlling the lever can expend is therefore proportional to the speed and load or weight of the device with its carried load or weight operated by the motor, and therefore the brake is applied and regulated in the amount of its application by the speed and weight of the device operated by the motor.

Furthermore, by the use of the device upon the brake-lever which interlocks with the motor-controlling mechanism, when the motor-controlling mechanism is moved from the center, prevents the brake, after having been once taken off the wheel, from being again applied until the operating mechanism is brought to a point near the central position, where it is desired that the brake shall assist in the control of the motor, which prevents the brake being applied when for any reason during the operation of the motor or the movement of the device operated by the motor the power applied to the device controlling the brake-lever shall fall below a point sufficient to hold the brake-lever off. This might occur, as is described in the specification, in case the car were descending with a heavy load. Then, in that event, the power being supplied to the brake-operating device through the motor and the motor not expending any power, the device operating the lever would receive no power, and therefore the brake would be applied were it not for this locking device.

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

1. In combination, a source of current supply, an electric motor, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, said brake-lever being operated by means of the solenoid a reversing-switch, the electric connections to the series winding being independent of the reversing-switch.

2. In combination with a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, and a spring interposed between the core of solenoid and brake-lever.

3. In combination, a source of current sup-

ply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and the brake-lever.

4. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and the brake-lever, and a spring interposed between the core of the solenoid and brake-lever.

5. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a brake-weight connected to the solenoid-core.

6. In combination with a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a spring interposed between the core of solenoid and brake-lever, and a brake-weight connected to the solenoid-core.

7. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and the brake-lever, and a brake-weight connected to the solenoid core.

8. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and brake-lever, a spring interposed between the core of the solenoid and brake-lever, and a brake-weight connected to the solenoid-core.

9. In combination, a source of current supply, an electric motor, a switch for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever, said rod having a pawl in alinement actuating to the movement of the operative shaft, with one or other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

10. In combination with a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a spring interposed between the core of solenoid and brake-lever, a segment on the operating-shaft, having at each side a projection, a rod connected with the brake-lever, said rod having a pawl in alinement, actuating to the movement of the operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

11. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of

the solenoid and the brake-lever, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to the movement of the operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections is such that when the operating-shaft is moved toward the center sufficiently, so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

12. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft, for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and the brake-lever, a spring interposed between the core of solenoid and brake-lever, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to movement of operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

13. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a brake-weight connected to the solenoid-core, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to movement of operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

14. In combination with a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, the brake-lever being connected to the core of the solenoid, a spring interposed between the core of solenoid and brake-lever, a brake-weight connected to the solenoid-core, a segment on the operating-shaft, having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to the movement of the operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

15. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the core of the solenoid and the brake-lever, a brake-weight connected to the solenoid-core, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to movement of operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projections being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

16. In combination, a source of current supply, an electric motor, a switch device for controlling the admission of current from the supply to the motor, an operating-shaft for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, a slot-and-pin connection between the

core of the solenoid and brake-lever, a spring interposed between the core of the solenoid and brake-lever, a brake-weight connected to the solenoid-core, a segment on the operating-shaft having at each side a projection, a rod connected with the brake-lever and guided on the operating-shaft, said rod having a pawl in alinement, actuating to movement of operating-shaft, with one or the other projection when the rod is down, but out of alinement when the rod is up, whereby when the pawl has passed beyond the projection it locks with it, the length of the projection being such that when the operating-shaft is moved toward the center sufficiently so that the resistances are thrown in the armature-circuit, the projections have passed from under the rod and no longer lock it.

17. In combination, a source of current supply, an electric motor, a brake-wheel for said motor, a brake-lever to operate the brake, an electric device having two windings, one in shunt with the main current supply to the motor, the other in series with the armature-circuit, said brake-lever being operated by means of the electric device, a reversing-switch, the electric connections to the series winding being independent of the reversing-switch.

18. In combination, a source of current supply, an electric motor, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid in shunt with the main current supply to the motor, and a solenoid in series with the armature-circuit, said brake-lever being operated by means of said solenoids, a reversing-switch, the electric connection to the series solenoid being independent of the reversing-switch.

19. In combination, a source of current supply, an electric motor, a brake-wheel for said motor, a brake-lever to operate the brake, an electric device in shunt with the main current supply to the motor, and an electric device in series with the armature-circuit, said brake-lever being operated by means of said electric devices, a reversing-switch, the electric connections to the series device being independent of the reversing-switch.

20. In combination with an electric motor, a source of current supply, and controlling mechanism for the motor, a brake-wheel and brake for the same, an electric device adapted when energized to release said brake, the current to said electric device being controlled by the motor-controlling mechanism, and devices connected with said brake-lever and controlling mechanism adapted to interlock when said operating mechanism is moved to allow said electrical device to act, and said device acts on said brake-lever.

21. The combination with a motor brake-wheel and a weighted brake-lever for the same, of a source of power supply for the motor, and connection between said motor and source of power supply, a device for operating said brake-lever to lift the brake from the wheel, said device being in connection with the motor source of power through the motor.

22. The combination with a motor brake-wheel and a weighted brake-lever for the same, of a source of power supply for the motor, and connection between said motor and source of power supply, a device for operating said brake-lever to lift the brake from the wheel, said device being in connection with the motor source of power through the motor, controlling mechanism for the motor and devices connected with the brake-lever and controlling mechanism, adapted to interlock when the controlling mechanism is moved from the center and the brake is off the brake-wheel.

23. In combination, a source of current supply, an electric motor, a reversing-switch device, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid in series with the armature-circuit and independent of the reversing-switch, said brake-lever being operated by means of the solenoid.

24. In combination with a source of current supply, an electric motor, a reversing-switch device, an operative mechanism for controlling said switch, a brake-wheel for said motor, a brake-lever to operate the brake, a solenoid, in series with the armature-circuit, a solenoid in shunt with the main current supply, the brake-lever being connected with and operated by both the solenoids, the electric connection to the series solenoid being independent of the reversing-switch.

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

FRANK E. HERDMAN.

Witnesses:
C. D. HOYT,
J. J. O'MEARA.