(No Model.)

R. M. HUNTER.

ELECTRICALLY PROPELLED CAR.

No. 425,883. Patented Apr. 15, 1890.

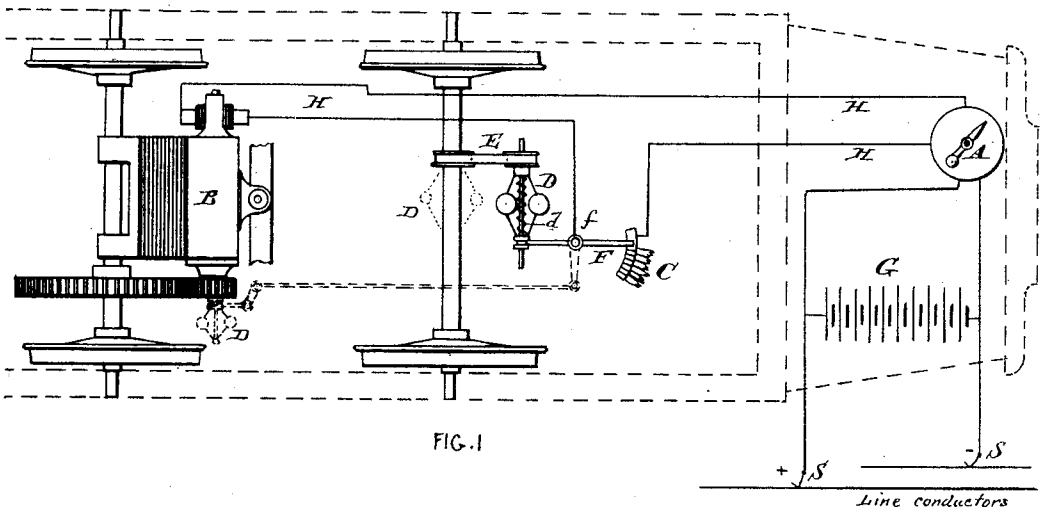


FIG. 1

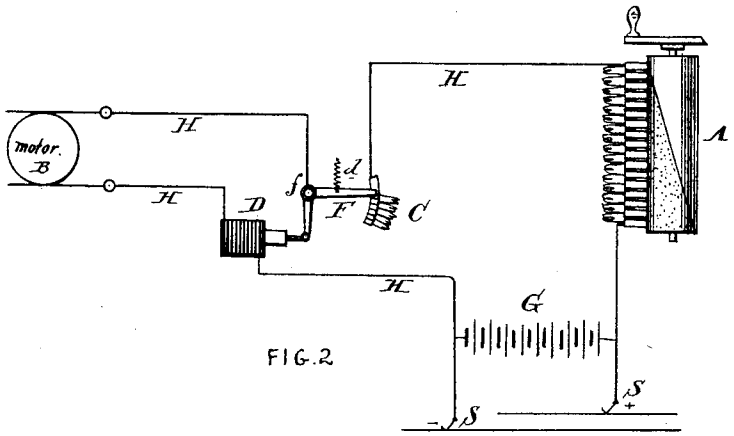


FIG. 2

Attest

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RUDOLPH M. HUNTER, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRICALLY-PROPELLED CAR.

SPECIFICATION forming part of Letters Patent No. 425,883, dated April 15, 1890.

Application filed October 31, 1889. Serial No. 328,876. (No model.)

To all whom it may concern:

Be it known that I, RUDOLPH M. HUNTER, of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Electrically-Propelled Cars, of which the following is a specification.

My invention has reference to electrically-propelled cars; and it consists of certain improvements, all of which are fully set forth in the following specification and shown in the accompanying drawings, which form a part thereof.

This application (Case 119) relates to regulating apparatus for electrically propelling vehicles, and is designed to overcome the dangers which are liable to arise in the operation of electric cars by careless handling of the hand regulator by the operator. In the operation of electric cars the operator, if careless, is apt to throw on excessive current, and thereby not only cause the needless loss of power at the generating-station, but also endangers the insulation of the motor, and otherwise puts a heavy strain upon the machinery. Experience has shown that many motors are destroyed in this manner, and particularly so in the cases where a railway extends over irregular ground and where steep grades are abruptly terminated.

In carrying out my invention I provide the car with an automatic regulator independent of the regulator of the operator, which operates, upon the passage of any abnormal current or of any abnormal speed of the motor and vehicle produced thereby, to shut down the current and prevent the speed increasing beyond a given limit. In this manner it is impossible for the operator to throw on more than a current sufficient to obtain and maintain a predetermined speed, and hence it overcomes the tendency of such operator to play with the electric car or power to such an extent as to endanger the motor.

In the drawings, Figure 1 is a plan view illustrating the construction of an electric car embodying my invention, and Fig. 2 is a general view illustrating a modified arrangement of the regulating mechanism.

The car is provided with one or more electric motors B, which may be mechanically connected with the axle in any suitable manner so as to propel the car. The motor is included in a motor-circuit H, which receives current from a battery G, carried on or moving with the car or from two line-conductors by suitable contact devices S. The motor-circuit contains a hand controller A of any suitable construction for controlling the speed of the motor; also, included in the motor-circuit is a resistance C and a resistance-changing lever F, pivoted at *f* and operated by a governor D to throw in more or less of said resistance automatically upon the speed of the motor increasing beyond a given amount. The governor may be operated by a belt E from the axle, or it might be arranged permanently upon the axle or upon the motor-shaft. In fact, the governor may be operated by any rotating portion of the electric car.

The operation will now be understood. The current is passed to the motor through circuit H, and the speed of the motor is regulated by the hand regulator A in the usual way. If the speed increases beyond a predetermined point, the governor D operates to shift the lever F, so as to throw in more or less of the resistances C, and thereby automatically shut down the flow of currents through the motor-circuit, causing the speed of the motor to be reduced. As the speed is reduced the governor D cuts out more or less of the resistances C until the maximum predetermined speed or a lower speed is reached and maintained, and which speed may be varied at any time by the operator manipulating the regulator A. By this it will be seen that the operator cannot run the car faster than the given speed, but may have absolute control below that speed.

In Fig. 2 is shown an arrangement whereby the resistances C are inserted or cut out by a switch F, operated by an electro helix and core forming an electric governor D, designed for automatically inserting resistances C proportionally as the operator abnormally reduces the resistance to the current by the hand regulator A. A spring *d* opposes the movement of the switch-lever F, so that it shall not move until an abnormal current is flowing through the motor. This device operates on the same general principle as that shown in Fig. 1, but simply employs an electric governor instead of a centrifugal governor. This electric governor responds quickly to any abnormal current being thrown into the motor suddenly

and before an appreciable counter electromotive force was generated, and thereby insures thorough protection to the motor. It is evident that the switch may be operated to vary the motor resistance in the manner set out in my patents, No. 385,054, dated June 26, 1888, No. 384,912, dated June 9, 1888, in which cases no external resistances of the motor are employed, but in which the coils on the motor are coupled in different manners to vary the resistance of the motor-circuit.

It will be understood that whether the electric governor shown in Fig. 2 is used in place of the centrifugal governor shown in Fig. 1 the automatic regulator is still an electrically-actuated governor. This will be apparent when it is borne in mind that the centrifugal governor depends for its operation on the energizing of the electric motor to vary the speed of the rotating parts, and is essentially, though indirectly, a part of the governing mechanism. The helix in Fig. 2 is only a simple form of motor, and in this case it alone can be depended upon for controlling the current when it is abnormal in motor-circuit.

I do not limit myself to the details herein set out, as my invention comprehends, broadly, any automatic mechanism, combined with a hand current-regulator, which shall operate independently of the hand current-regulator to reduce the current automatically upon the speed of the motor becoming excessive through careless or intentional abnormal manipulation of the hand regulator by the operator.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electrically-propelled vehicle, the combination of the motor, a source of electric energy, a motor-circuit, a hand current-regulator for controlling the speed of the motor, and an independent automatically-operating regulator to reduce the current in the motor-circuit upon the speed of the motor becoming abnormal through the careless manipulation of the hand-operated regulator.

2. In an electrically-propelled vehicle, the combination of the motor, a source of electric energy, a motor-circuit, a hand current-regulator for controlling the speed of the motor, and an independent automatic mechanically-operating governor-regulator connecting with a rotating part of the car and controlled by the speed of the electric motor to reduce the current in the motor-circuit upon the speed of the motor becoming abnormal through careless manipulation of the hand-operated regulator.

3. In an electrically-propelled vehicle, the combination of a motor mechanically connected to drive the axle, a source of electric energy, a motor-circuit to supply current to the motor, a hand current-regulator to control the speed of the motor, and an independent centrifugal regulator controlled by the speed of the motor to reduce the current flowing through the motor automatically upon the speed of the motor increasing abnormally.

4. In an electrically-propelled vehicle, the combination of an electric motor mechanically connected to rotate the axle, a source of electric energy, a motor-circuit and hand current-regulator to control the speed of the motor, a variable resistance, and a centrifugal governor, independent of the hand current-regulator, controlled by the speed of the motor to insert more or less of said resistances upon the speed of the motor increasing above a predetermined point.

5. The combination, in an electrically-propelled vehicle, of a motor mechanically connected to rotate the axle, a source of electric energy, a motor-circuit, a hand current-regulator to control the speed of the motor, a resistance, and a resistance-changing switch independent of the hand regulator to insert more or less of said resistances upon the speed of the motor increasing above the maximum predetermined speed.

6. In an electrically-propelled vehicle, the combination of a motor to propel the vehicle, a source of electric energy, a motor-circuit, a hand-operated current-regulator to control the speed of the motor, and an independent electrically-controlled current-governor for controlling the current passing through the motor to automatically reduce the current when the same shall become abnormal.

7. In an electrically-propelled vehicle, the combination of a motor to propel the vehicle, a source of electric energy, a motor-circuit, a hand-operated current-regulator to control the speed of the motor, and an independent electrically-controlled current-governor independent of the hand regulator for varying the resistance of the motor-circuit and controlling the current passing through the motor to automatically reduce the current when the same shall become abnormal.

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

RUDOLPH M. HUNTER.

Witnesses:
ERNEST HOWARD HUNTER,
S. T. YERKES.