(No Model.)

J. C. DAVIDSON.

REGULATOR FOR ELECTRIC MOTORS.

No. 503,453. Patented Aug. 15, 1893.

FIG. 1.

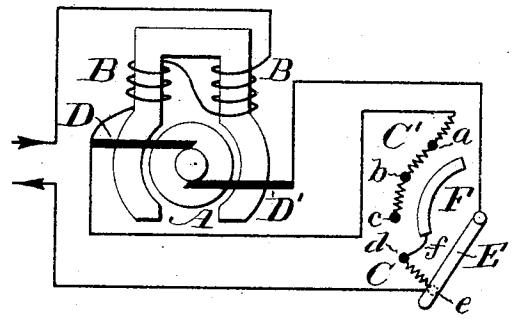
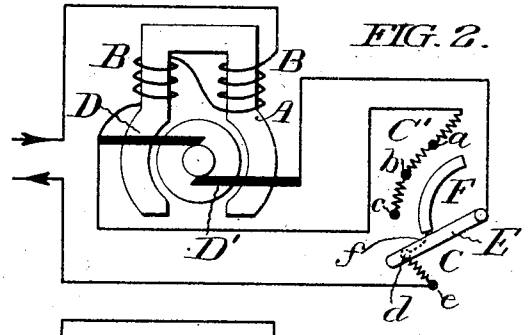


FIG. 2.



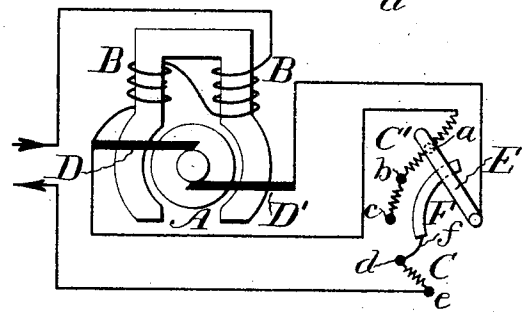


FIG. 3.

WITNESSES:

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UNITED STATES PATENT OFFICE.

JOHN C. DAVIDSON, OF PRINCE'S BAY, NEW YORK, ASSIGNOR TO THE S. S. WHITE DENTAL MANUFACTURING COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

REGULATOR FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 503,453, dated August 15, 1893.

Application filed March 8, 1893. Serial No. 465,123. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. DAVIDSON, of Prince's Bay, in the county of Richmond and State of New York, have invented certain new and useful Improvements in Electric Motors, of which the following is a specification.

My invention relates to means for varying the speed of electric motors. As is well known, to reduce the speed of an electric motor, it is usual to insert a variable resistance in series with the field and armature in the case of a series motor, and in series with the armature in the case of a shunt motor. An objection to these ways of reducing speed is that if sufficient resistance is inserted to give a large reduction in speed the torque or pull of the armature is very much reduced, and the power to perform external work is reduced to the same extent. To overcome this defect I employ resistance partly in series and partly in shunt with the armature, as hereinafter explained.

In the accompanying drawings, Figure 1 is a view in elevation designed to show a motor with my improvements, the switch lever of the resistance being set for the highest speed. Fig. 2 is a similar view with the switch lever set for the first reduction in the speed; and Fig. 3 a like view with the switch lever set for the greatest reduction in speed.

A series motor A of usual construction provided with the ordinary field coils B, is electrically connected to a constant potential circuit through a variable resistance C C′ partly in series and partly in shunt with the motor armature. The circuits through the motor and resistance are as follows:—The current enters at the motor field, passes through the field coils and commutator brush D to the armature, and from the armature by commutator brush D′ to a switch lever E of the combined series and shunt resistance C C′. The variable shunt resistance C′ is connected with the commutator brush D and with contact point *a*, and with additional contact points in number according to the variations in speed desired. Two additional contact points *b c* are in this instance provided. The circuit is completed from the contact point with which the switch lever may be electrically connected, through this lever to contact plate F, and by way of permanent connection *f* and the series resistance C, to main line. The series resistance is shown as provided with two contact points *d e*, but more could be employed.

The operation of the motor with the improved resistance is as follows:—With the switch lever making connection with contact point *e* of the series resistance, the current passes by main line through the field and armature of the motor to the switch lever, and by way of contact *e* to opposite main line. In this adjustment of the switch the shunt resistance is entirely disconnected from the circuit, and the motor receives the full voltage of the circuit and runs at the highest speed. With the switch lever on contact *d* of the series resistance, the first reduction in speed is made in usual way, the shunt resistance still being disconnected. With the switch lever on contact *c*, after the current passes through the motor field and arrives at commutator brush D, it divides, part passing through the armature to the switch lever, from this lever by way of contact plate F and permanent connection *f* to the series resistance and out by main line. That part of the current shunted past the armature, passed through the entire shunt resistance and through the switch to contact plate F where it joins the current from the armature and passes with it out by way of the series resistance. This adjustment produces the second reduction in speed. A further reduction in speed may be made by adjusting the switch lever to contact point *b*, and a still further reduction by adjusting the lever to contact point *a*, in each instance the shunt resistance being reduced.

The improved action of this method of regulation over the ordinary series plan, is as follows:—In the series method the slower speed is obtained by absorbing volts in the series resistance, and the number of volts so absorbed will depend on the current passing through the resistance; consequently a change of load on the motor will alter the current and thus absorb different numbers of volts in passing through the resistance and vary the speed of the motor considerably from no load to full load without changing the switch lever. It

is well known that with a large resistance in series, when the load requires as much or more current as can pass through the resistance with the voltage of the mains, there are no volts left for the motor and it will stop.

With my improved method of reducing the speed of motors, at low speeds with the shunt resistance in circuit the current through the shunt tends to steady the loss in volts in the series resistance whether the armature is taking much current or not; consequently a change of load produces a much less variation in volts and necessarily less change in speed of the motor armature from no load to full load than in the series method as heretofore employed. When the external load tends to slow down the motor armature, the current from the mains is increased, but as the volts at the brushes are reduced by this slowing of speed some of the current from the shunt resistance will now pass through the armature, thus not only giving it the extra current from the mains, but current from the shunt resistance also. This extra supply of current to meet an extra amount of work, I consider a valuable feature of my improvement. As the current in the field is the sum of the currents in the shunt and armature, the field is strongly charged even when the armature is taking little current.

In conclusion, it may be said that my method compared with the old method gives less variation of speed between no load and full load; gives up current to the armature from the shunt resistance when required by more work, and preserves a stronger field than the old method of regulation, all of which is of great advantage in apparatus for the regulation of the speed of motors.

Although I have described my invention as applied to a series motor, it may equally well be applied to a shunt motor. If preferred, when a series motor is employed, the resistance C may be dispensed with and the field coils properly proportioned to take the place of such resistance, while still adhering to the leading feature of my invention, viz: the employment in a motor of resistance partly in series and partly in shunt with the motor armature. When so modified the first reduction in speed obtained by the series resistance as I prefer to employ it would be lost.

I claim as my invention—

1. The combination, in an electric motor, of the motor armature, and the resistance partly in series and partly in shunt with the armature, substantially as set forth.

2. The combination, in an electric motor, of the motor armature, the variable resistance in shunt with the armature, the resistance in series with the armature and shunt resistance, and the switch lever for varying the resistance, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

JOHN C. DAVIDSON.

Witnesses:
SEYMOUR CASE,
BEN. F. STANTON.