Governors for Electric Motors.

No. 166,471. Patented Aug. 10, 1875.

Fig. 1.

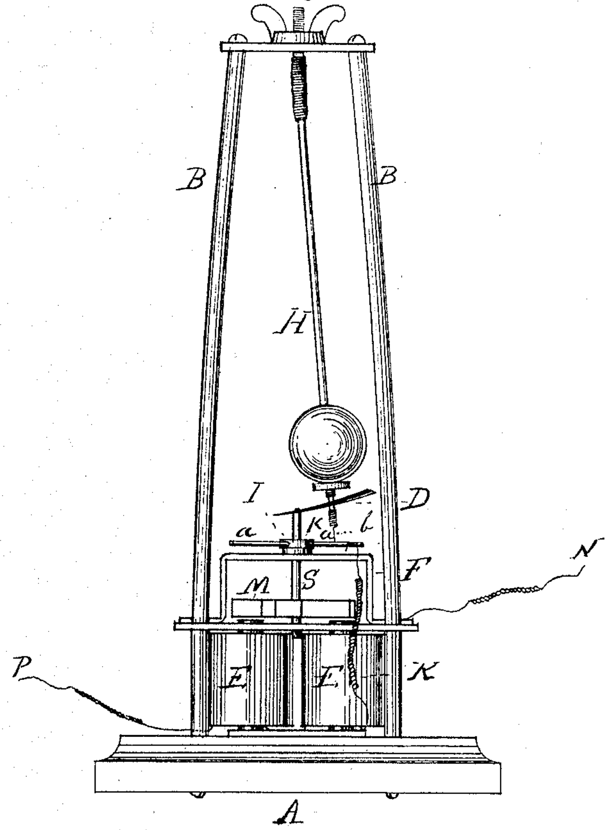
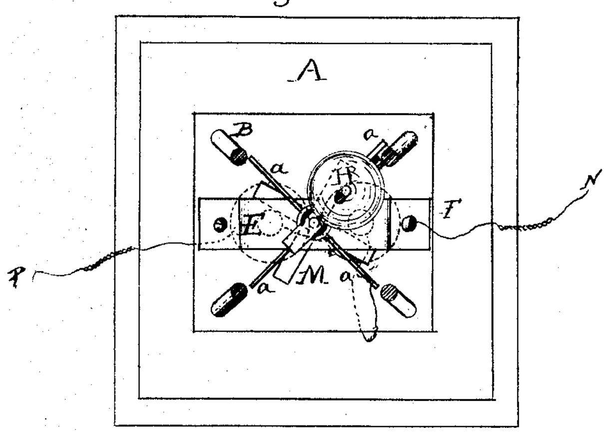


Fig 2.



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AUGUSTUS MAC CONNEL, OF CAMBRIDGE, MASSACHUSETTS.

IMPROVEMENT IN GOVERNORS FOR ELECTRIC MOTORS.

Specification forming part of Letters Patent No. **166,471**, dated August 10, 1875; application filed April 15, 1875.

To all whom it may concern:

Be it known that I, AUGUSTUS MACCONNEL, of Cambridge, in the county of Middlesex, State of Massachusetts, have invented a new and useful Improvement in Governors for Electro-Magnetic Engines, of which the following is a full, clear, and exact description, reference being had to the drawing accompanying and forming part of this specification.

In the drawing, Figure 1 is a view in elevation of the apparatus, and Fig. 2 is a plan view of the same.

In these figures similar letters refer to similar parts.

The nature of this invention consists in the combination, with a rotatory electro-magnetic motor, of a conical pendulum rotating with the shaft of the motor and a suitable circuit-closer, so arranged and constructed, as hereafter described, that on any increase of the amplitude of the rotation of the pendulum beyond a certain limit, owing to an increase in the rate of rotation of the motor, an interruption in the succession of currents through the magnets of the motor will be caused, and its rate of rotation be consequently reduced until the desired limit is reached.

In the accompanying drawing, A is a suitable base-board supporting an ordinary upright electro-magnet, E, and M is the armature of the same, which consists of two bars crossing each other at their centers at right angles, and is mounted upon a shaft, S, properly supported on a frame, F, in such a manner that the armature rotates in a plane at right angles to the axis of the magnet.

Surrounding the shaft, but not rotating with, and insulated from the same by a collar, I, of any suitable insulating material, is a fixed collar of metal, K, provided with four projecting arms, *a a*.

B is the frame inclosing the motor, and attached to the base-board A, and from the frame at C is suspended the conical pendulum H. The lower end of this pendulum rests in a slotted arm, D, which is attached at right angles to the shaft S, and rotates with it. The lower end of the pendulum is also provided with a spring, *b*, having a flexible end, which just touches the arms *a a* as the pendulum rotates.

The current from the battery passes from P by suitable connections through the electro-magnet E to one of the arms of the collar K, which thus acts as a circuit-closer, and thence, when the pendulum is in contact with any one of the arms *a*, by the spring-connection to the frame F, and thence back to the battery at N.

The apparatus operates as follows: When the battery-circuit is closed, and the spring *b* is in contact with any one of the arms *a a* of the circuit-closer K, (which arms must be so situated relatively to the arms of the armature M that this contact takes place when one of the arms of the armature is near one of the poles of the magnet,) the armature will be attracted and the shaft will rotate until the pendulum comes in contact with the next arm of the circuit-closer, when the circuit will be again closed, the next armature will be attracted, and the rotation of the armature will be continued. If, however, the rate of the rotation of the armature increases beyond any desired limit, the amplitude of the rotation will be increased, and it will fail to make contact with the arms of the circuit-closer, and consequently the succession of currents through the electro-magnet will be interrupted, and the rate of rotation of the machine will be diminished until the former rate is reached.

It is obvious that, by means of this governor, the rotation of the engine will be maintained at a uniform rate for the reason the slightest increase in velocity causes an increase in the amplitude of the rotation of the pendulum, and consequently prevents the closing of the circuit by the arms of the circuit-closer.

The arms *a a* are so constructed that by bending the same the point at which the pendulum fails to make contact can be adjusted to any desired rate of rotation, and the pendulum is also capable of vertical adjustment for the same purpose.

In using this apparatus, in combination with an electro-magnetic motor for driving the machinery of a chronograph, it is sometimes desirable, in order to insure a uniform rate of rotation with absolute certainty, to connect a chronometer in the circuit, which chronometer causes the closing of the circuit once in every second in the usual manner, at a time when one of the arms of the armature is approach-

ing the poles of the magnet in advance of the closing of the circuit by the arms of the circuit-closer K, and consequently, if the rate of rotation of the motor should become slightly retarded, the closing of the circuit by the chronometer once every second will cause an acceleration of the rate and keep it uniform.

I can use this form of governor with any form of rotatory electro-magnetic engine, whether the same is provided with one or more magnets, and I do not limit myself to any particular number of arms upon the armature or upon the circuit-closer. I have found that four arms are sufficient to give accurate results.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

The combination of the rotatory electro-magnetic engine, the circuit-closer K having projecting arms *a a*, the slotted arm D upon the shaft S of the motor, and the conical pendulum H, constructed and operating substantially as and for the purpose set forth.

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