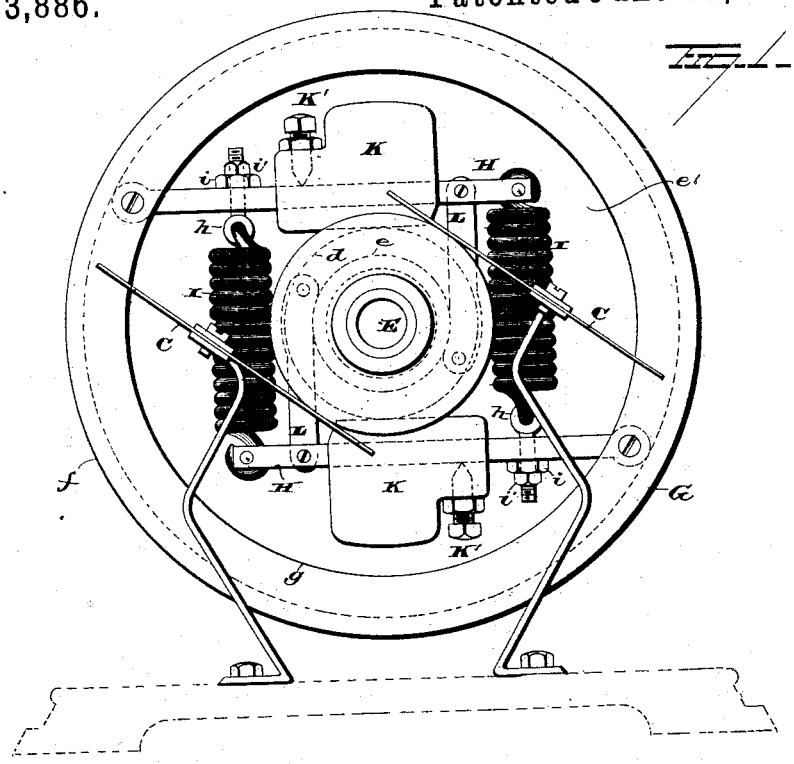
(No Model.) 2 Sheets—Sheet 1.

# C. F. BRUSH.

## GOVERNOR FOR ELECTRO MAGNETIC MOTORS.

No. 343,886. Patented June 15, 1886.

Fig. 1.



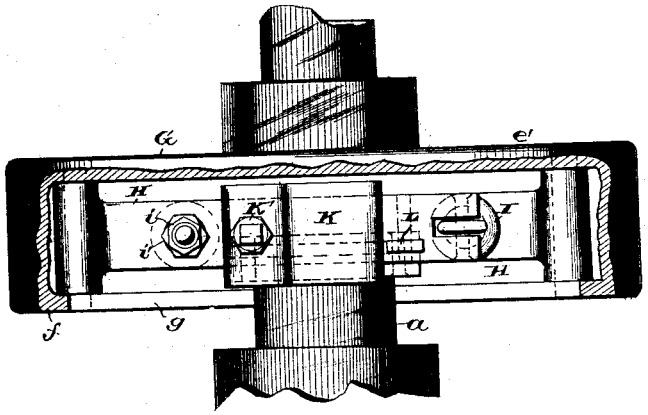




Fig. 2.

WITNESSES

E. Nottingham

G. F. Downing.

INVENTOR

Chas F Brush.

By H A Simmons. Attorney

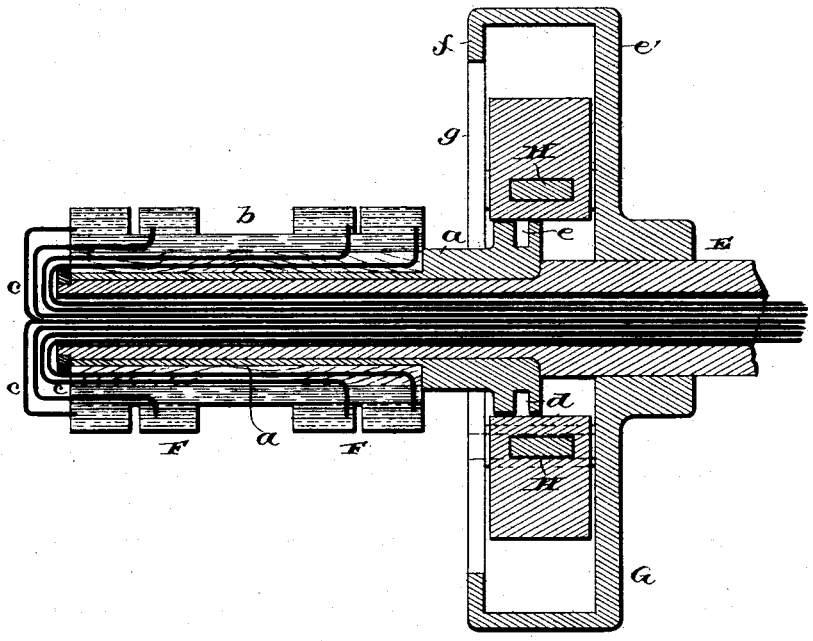
(No Model.) 2 Sheets—Sheet 2.

# C. F. BRUSH.

## GOVERNOR FOR ELECTRO MAGNETIC MOTORS.

No. 343,886. Patented June 15, 1886.

Fig. 3.




WITNESSES

E. Mottinghaw

G. F. Downing.

INVENTOR

Chas F. Brush.

By A. Superman.

Attorney

# UNITED STATES PATENT OFFICE.

CHARLES F. BRUSH, OF CLEVELAND, OHIO.

## GOVERNOR FOR ELECTRO-MAGNETIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 343,886, dated June 15, 1886.

Application filed December 28, 1885. Serial No. 186,921. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES F. BRUSH, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Governors for Electro-Magnetic Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in governors for electro-magnetic motors.

The variations or fluctuations of current-strength in the circuit of a dynamo or magneto electric machine due to the varying resistance interposed therein in the form of motors, lamps, &c., and to other causes may be regulated and controlled and the current-strength rendered practically uniform by means of a current-regulator connected with the generator. My preferred form of regulator for this purpose being of the type shown and described in Letters Patent No. 224,511, granted to me February 17, 1880.

In the employment of a motor in a circuit in which the current-strength is or is not governed and controlled and rendered practically uniform some means must be provided for automatically controlling the speed of the motor, because with the parts of the motor adjusted to insure a predetermined speed of the motor when subjected to a certain load, the speed will vary, either being increased or decreased whenever the load or current is varied; and my invention has for its object the automatic regulation of the speed of electro-magnetic motors under the varying loads and currents to which they may be subjected.

With this end in view my invention consists in the combination, with adjustable commutator segments or strips or commutator-sleeve, of a centrifugal governor for automatically adjusting the commutator segments or sleeve to regulate the speed of the motor.

My invention further consists in certain features of construction and combinations of parts as will hereinafter be described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side view of one form of my improved governor. Fig. 2 is a plan view, and Fig. 3 is a longitudinal section.

C represents the commutator-brushes of an electric motor.

E is the armature-shaft, on which is loosely mounted the commutator-sleeve *a*, to enable the latter to be freely turned on the shaft.

F represents the commutator sections or segments, which are insulated from the sleeve *a* by means of the insulating sleeve or cylinder *b*. Commutator-sections F are electrically connected with the armature-bobbins by flexible conductors *c*, to allow of the rotary adjustment of the commutator without impairing the electrical connections of the armature and commutator-sections. Sleeve *a* is provided at one end with an enlarged disk, *d*, provided with grooves *e* for the attachment of the governor-connections, as will be explained.

To the armature-shaft E is secured the shell G by set-screw, bolts, or in any other desired manner. The outer end or head, *e*, of the shell is closed, while its inner end or head, *f*, is open, as shown at *g*, to allow of ready access to the parts of the governor located within the shell for the purpose of inspection, adjustment, or oiling. To the inner periphery of the shell are pivoted on opposite sides of its center the governor-arms H H, the inner and free ends of which are connected to the opposite arms by means of the spiral springs I I, the latter being adjustably secured to the arms by the eyebolts *h* and nuts *i i'*.

On each one of the arms H H is placed a weight, K, which may be longitudinally adjusted and secured to the arm in any desired position by the set-screw K'.

To the arms H H, near their outer or free ends, are pivoted the links L L, the opposite ends of which are pivoted to the enlarged disk or flange *d* and on opposite sides thereof. As the governor-shell rotates with the armature-shaft, carrying with it the parts described, it will be readily understood that the weights K K will at a certain speed be moved by centrifugal action toward the periphery of the shell and away from the armature-shaft, and, through the medium of the connecting-links L L, impart a rotary adjustment to the commutator, varying its position on the armature-shaft.

When the motor is at rest, the spiral springs will firmly retain the weights in close proximity to the shaft and the commutator at the extreme limit of its rotary adjustment in one direction, and in this adjustment of parts the commutator-brushes C will bear on the maximum points of the commutator-sections. Current now being switched into the motor through the commutator-brushes, (and this may be done through a graduated resistance connected with the switch, if desired,) rotary motion is imparted to the armature and its shaft, the speed of which gradually increases until the motor has attained its predetermined or normal rate of speed. At this point the governor-weights will begin to recede from each other and move outwardly toward the periphery of the shell and rotate the commutator on the shaft, carrying the maximum points of the commutator away from the contact-points of the brushes and in the direction of rotation of the armature of the motor. This action decreases the effect of the driving-current until a point is reached where the effect of the current is balanced by the load on the motor, and the speed of the latter remains constant. Now, should the speed of the motor be retarded by a decrease of current-strength with no corresponding diminution of load or by an increase of load with no increase of current-strength, the governor-balls will be retracted and drawn toward each other by the spiral springs, and thereby rotate the commutator in a direction opposite to the motion of the armature-shaft, the effect of which is to move the maximum points on the commutator nearer to the brushes, and thereby increase the speed of the motor. On the other hand, should the speed of the motor be increased above the normal rate, owing to an increase of current-strength or to a decrease of load, the governor-balls will be caused to recede from each other and rotate the commutator in the same direction as that of the armature-shaft, and cause the maximum points on the commutator-sections to be moved away from the brushes, and thereby decrease the speed of the motor; hence it will be observed that by my improvement I am enabled to insure a practically-uniform rate of speed under varying loads and varying current-strengths.

By the terms "maximum points," as used in this specification, I mean those points on the commutator where the contact of the brushes will allow the production of maximum effect.

While the construction and arrangement of the parts of the governor may be widely varied without departing from the spirit and scope of my invention, yet the type of governor shown and described has many important advantages in actual practice. The parts composing the governor are few in number, are simple and durable in construction, may be readily adjusted, and are not liable to get out of adjustment or order, and may be manufactured at a small initial cost. The direct connection of the governor with the commutator insures the prompt adjustment of the latter without lost motion and at a minimum expenditure of power, so that the governor is exceedingly sensitive in its action under all circumstances. By locating the parts of the governor in compact form within a rotary shell on the armature-shaft I insure a compact form of machine for shipment, and one requiring but small space for its operation; and, further, such construction and arrangement of parts will offer but little resistance in the rapid rotation of the motor.

While the type of governor shown and described has, when applied to a motor, certain advantages, some of which have been specified, yet I would have it understood that I do not restrict myself to the particular type of governor or to the particular construction and arrangement of parts shown and described.

I am informed that a centrifugal governor has been applied to a dynamo-electric machine for automatically adjusting the commutator segments or sleeve for the purpose of regulating the strength of the current generated by the machine. I am also informed that a centrifugal governor has been applied to an electro-magnetic motor for automatically adjusting the commutator-brushes for the purpose of regulating and controlling the speed of the motor; and hence I would have it understood that I make no claim to such improvements or combinations of parts.

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

1. In an electric motor, the combination, with a commutator, of a centrifugal governor for automatically adjusting the commutator segments or sleeve for regulating the speed of the motor, substantially as set forth.

2. In an electric motor, the combination, with a commutator, of a centrifugal governor for automatically imparting rotary adjustment to the commutator segments or sleeve for regulating the speed of the motor, substantially as set forth.

3. In an electric motor, the combination, with a commutator-sleeve loosely mounted on the armature-shaft, of a centrifugal governor for automatically adjusting the commutator segments or sleeve for regulating the speed of the motor, substantially as set forth.

4. In an electric motor, the combination, with an adjustable commutator, of a centrifugal governor mounted on the armature-shaft, and adapted to regulate the speed of the motor by its automatic adjustment of the position of the commutator segments or sleeve, substantially as set forth.

5. In an electric motor, the combination, with an adjustable commutator-sleeve or commutator-segments, of a centrifugal governor

connected with the commutator-sleeve, and constructed and arranged to automatically impart rotary adjustment to the commutator-sleeve in the direction opposite to that of the rotation of the armature-shaft when the speed of the motor falls below a predetermined rate, and to move the commutator-sleeve in the same direction as the rotation of the armature-shaft when the speed of the motor exceeds a predetermined rate, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES F. BRUSH.

Witnesses:
ALBERT E. LYNCH,
CHAS. H. DORER.