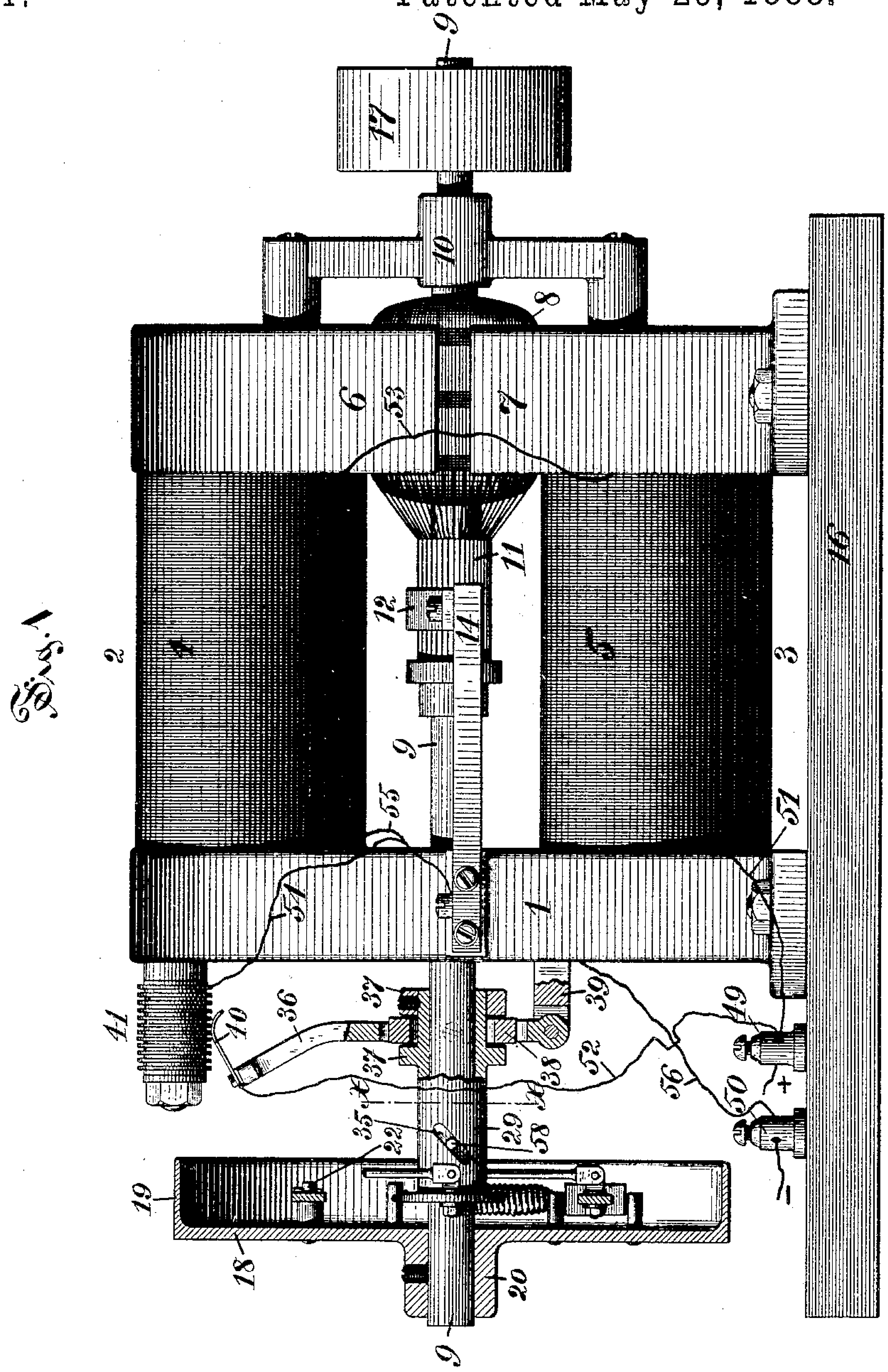
(No Model.) 2 Sheets—Sheet 1.

R. H. MATHER.

GOVERNOR FOR ELECTRIC MOTORS.

No. 383,651. Patented May 29, 1888.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3

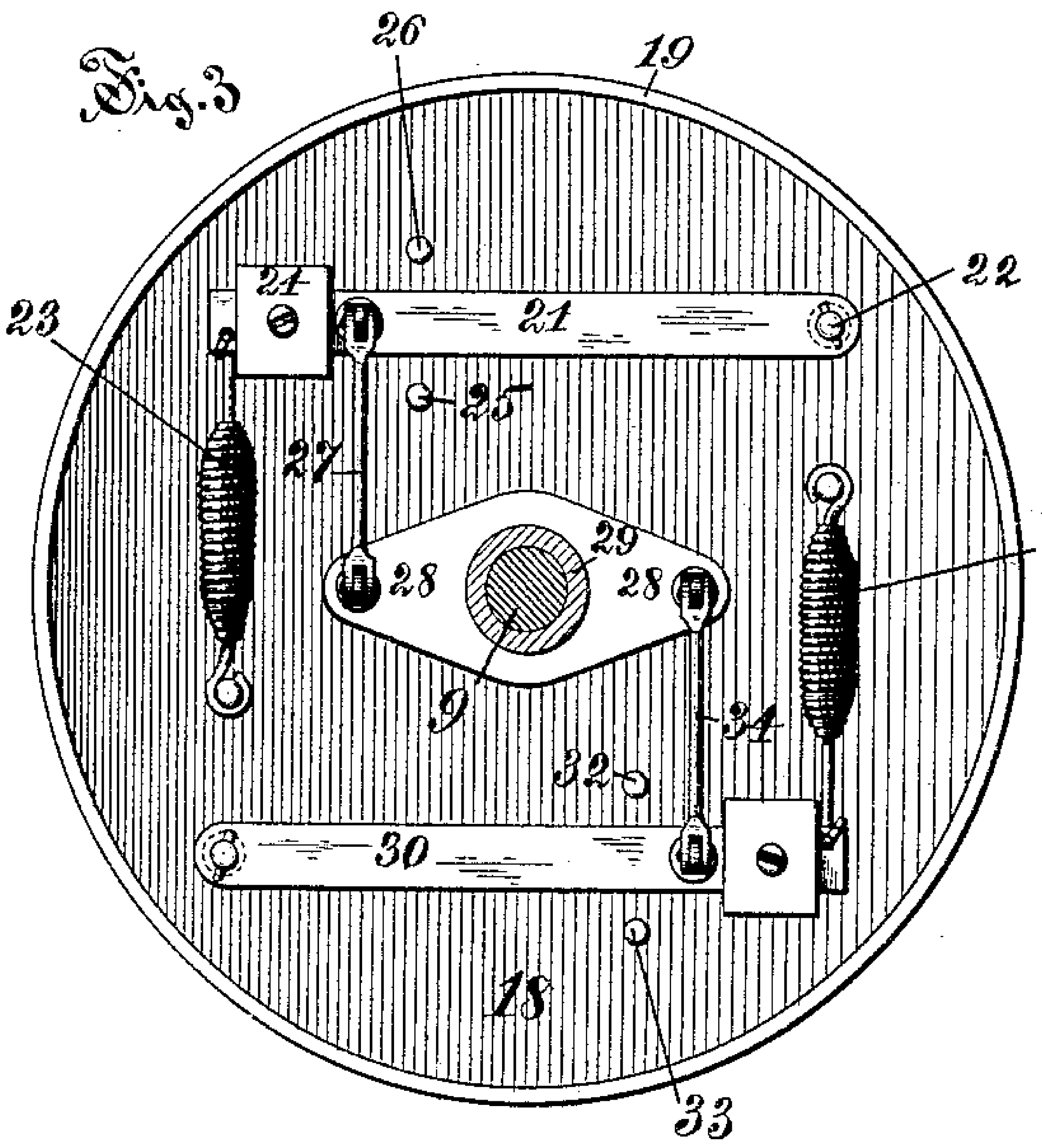

Fig. 2

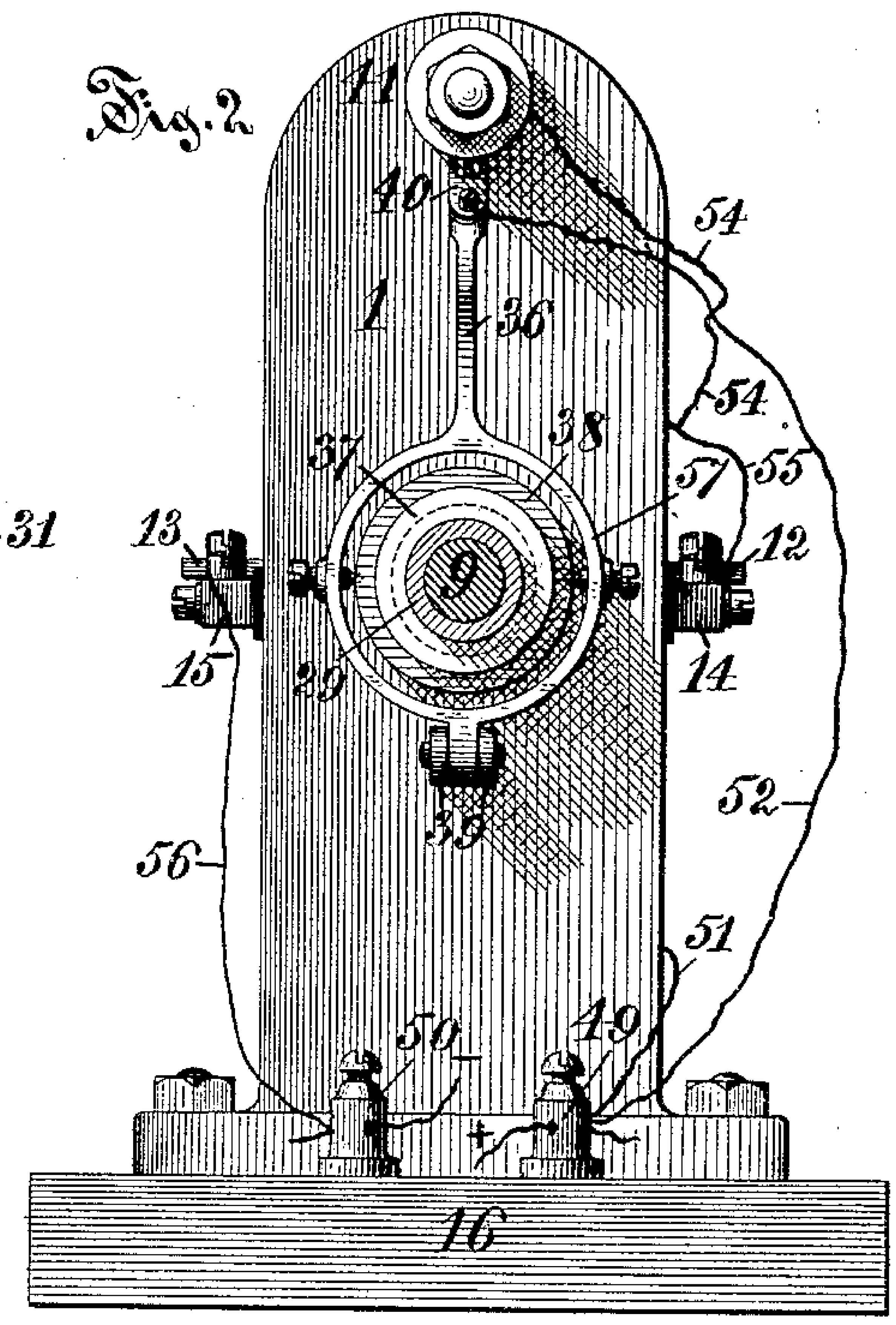

Fig. 4

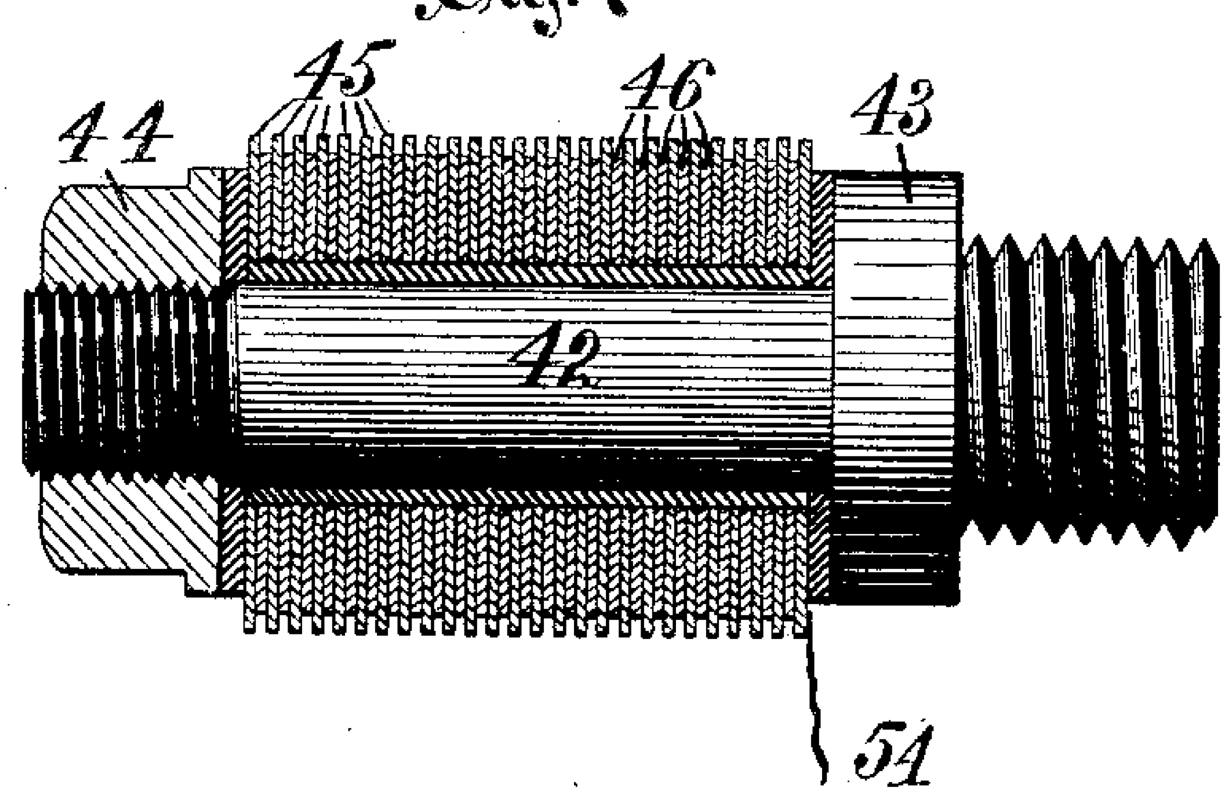

Fig. 5

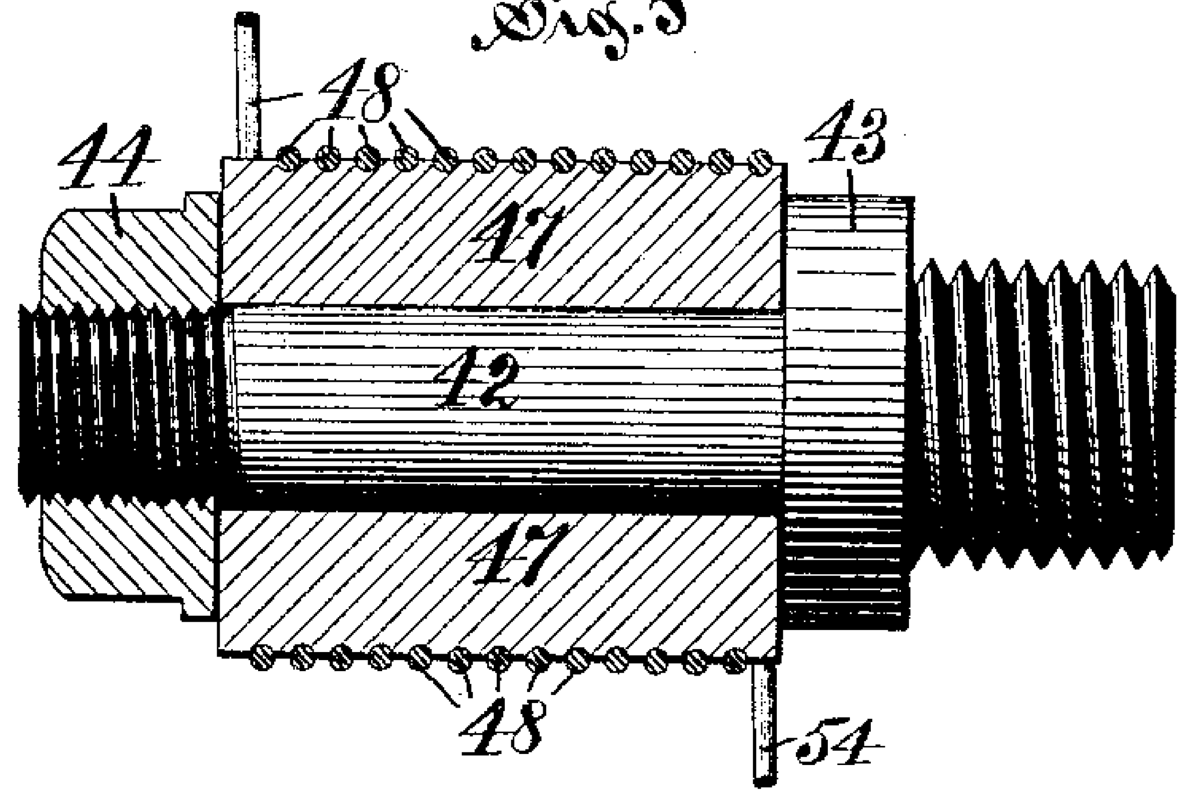

Fig. 6

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UNITED STATES PATENT OFFICE.

RICHARD H. MATHER, OF WINDSOR, CONNECTICUT.

GOVERNOR FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 383,651, dated May 29, 1888.

Application filed December 9, 1886. Serial No. 221,055. (No model.)

To all whom it may concern:

Be it known that I, RICHARD H. MATHER, of Windsor, in Hartford county, Connecticut, have invented certain new and useful Improvements in Governors for Electric Motors, which are described in the following specification and are illustrated by the accompanying drawings.

This invention is an automatic speed-regulator, and is designed to be applied to electric motors which are supplied with constant current. When applied to such a motor, this invention produces constant speed regardless of variations of load. My device for accomplishing this result comprises a centrifugal governor, which is mounted upon the armature-shaft of the motor, a rheostat, which is connected in parallel with the helices of the field-magnet, and intermediate mechanism through which said rheostat is manipulated by said centrifugal governor.

The best manner in which I have contemplated applying the principle of my invention is shown in said drawings, in which—

Figure 1 is a side view of an electric motor supplied with my improved governor, the latter being in partly vertical section. Figs. 2 and 3 are cross-sections of Fig. 1 through line $x\, x$ prolonged. Figs. 4, 5, and 6 are details.

With primary reference to Fig. 1, the numeral 1 denotes the field-magnet of the motor, while 2 and 3 are limbs of said magnet, and are wound with coils 4 and 5, respectively, in the usual manner. Pole-pieces 6 and 7 are adjacent to armature 8. The latter is mounted between said pole-pieces in the usual manner upon shaft 9, which is journaled in magnet 1 and in yoke 10, the latter being bolted to said magnet.

The commutator 11 is mounted upon shaft 9 in the usual manner between limbs 2 and 3 of magnet 1. Brushes 12 and 13 are held in proper positions of contact with commutator 11 by their respective holders 14 and 15, which are bolted to opposite sides of magnet 1, and are insulated therefrom, as seen in Fig. 2. This motor is attached to any suitable frame or base, 16. Said shaft 9, being prolonged to a convenient length, is provided at one end with a belt-wheel, 17, and at the other end with a centrifugal governor, which is now to be described.

An iron disk, 18, having a circumferential flange, 19, and a hub, 20, is keyed to shaft 9 at a convenient distance from magnet 1, as illustrated in Fig. 1. Upon that side of disk 18 which is adjacent to magnet 1 and is shown in Fig. 3 is mounted a centrifugal weighted lever, 21. By pin 22 one end of this lever is pivoted to disk 18 at a distance from shaft 9. The other end of lever 21 is provided with a spring, 23, which tends to draw that lever toward shaft 9. Stop-pins 25 and 26, upon opposite sides of lever 21, prevent the same from oscillating toward hub 20 or away from it to a greater extent than is required in the due operation of the governor, as hereinafter explained. This lever is connected by link 27 to the adjacent ear 28 of a metallic sleeve 29, which is hereinafter described. A second weighted lever, 30, provided with a like spring, 31, and stop-pins 32 and 33, is similarly pivoted to disk 18 upon the opposite side of shaft 9, and is similarly connected with the remaining ear 28 of said sleeve 29 by link 34. Said sleeve 29 is fitted loosely upon shaft 9, and is movable lengthwise between magnet 1 and disk 18. One end of this sleeve is provided with said ears 28 and 28, which extend radially therefrom in opposite directions. Through the cylindrical wall of sleeve 29, in any convenient part thereof, is a spiral slot, 35, whose length and pitch depend upon the play which is to be imparted to the lever 36, which is hereinafter described. A pin, 58, which sticks out radially from shaft 9, is adapted to travel from end to end of said slot. The other end of sleeve 29 is provided with two fixed collars, 37 and 37, and with an intermediate loose collar, 38, which is pivoted in the ring or eye 57 of lever 36, as seen in Figs. 1 and 2. This lever is pivoted at one end in a standard, 39, projecting from magnet 1, and is armed at the other end with a brush, 40, which is shown in detail in Fig. 6. Within reach of this brush is a rheostat, 41. (Shown in Fig. 1.) The same rheostat is shown in cross-section in Fig. 4, and is shown in a modified form in cross-section in Fig. 5. This rheostat, Fig. 4, consists of a stud, 42, having terminal screw-threads, a fixed collar, 43, a terminal nut, 44, and an indefinite number of copper disks, 45, which are separated from stud 42 by any proper insulating material, and are partly insulated from each other by means of intermediate smaller disks, 46, of sheet-iron or other material of low electrical conductivity. Said iron disks are covered with a scale of ferric oxide.

The modification which is shown in Fig. 5 consists of stud 42, collar 43, and nut 44, as already described, but in place of disks 45 and 46 contains an insulating cylindrical block, 47, which is encircled by separate coils of a continuous wire, 48, of German silver or other high-resistance material.

Binding-posts 49 and 50, being connected with a source of constant current in the usual manner, are the positive and negative terminals of the motor, respectively.

The positive terminal 49 is connected with the helix 5 by wire 51 and with brush 40 by wire 52. Helix 4 is connected with helix 5 by wire 53 and with brush-holder 14 by wire 55, while the latter is connected with one end of rheostat 41 by wire 54. Terminal 50 is connected with brush-holder 13 by wire 56. The remaining particulars of construction of this invention will sufficiently appear from the drawings, and from the mode of operation, which is now to be explained.

When this motor provided with the described governor is at rest, the springs 23 and 31 draw levers 21 and 30 to positions of contact with stop-pins 25 and 32, respectively; and said levers, acting through links 27 and 34 and through ears 28, turn sleeve 29 upon shaft 9 to such a position that pin 22 stands in that end of slot 35 which is farthest from disk 18. Sleeve 29, accordingly, stands close to disk 18, and collar 38, being pressed laterally toward said disk, holds lever 36 in such a position that brush 40 is in contact with those copper disks 45 which are remote from magnet 1.

When the motor is supplied with electric current, the latter divides into two parts, one of which passes from terminal 49 successively through wire 51, helix 5, wire 53, and helix 4 to the junction of wires 54 and 55. The other part of the supplied current passes from the terminal 49 successively through wire 52, brush 40, rheostat 41, and wire 54 as far as said junction of wires 54 and 55. Said parts of the supplied current there reunite and thence pass undivided through wire 55, holder 14, brush 12, armature and commutator 8 and 11, brush 13, holder 15, and wire 56 to terminal 50. As the armature revolves the weighted levers 21 and 30 tend to separate from their respective positions, which are above described, and to move toward positions of contact with stop-pins 26 and 33, respectively. As soon as any such motion occurs, sleeve 29 is thereby turned upon hub 20 in such a manner as to be moved by pin 22 longitudinally upon shaft 9 away from disk 18. This motion is communicated through collar 38 and lever 36 to brush 40, and the latter, moving along the edge of disks 45, cuts out resistance in the usual way. In this manner any increase in the speed of the motor above the normal speed for which it is designed to regulate causes a corresponding increase of current through the rheostat, and consequently a corresponding diminution of current through the parallel connection through the field-magnet helices 4 and 5. By a reverse mode of operation any diminution in the speed of the motor below the same normal speed causes a corresponding increase of current through said field-magnet helices.

The maximum resistance which may be brought into circuit, as described, is sufficient to prevent the passage of any appreciable current through the rheostat and to turn practically the entire supplied current through the helices of the field-magnet, so that the motor, by regulating the intensity of the magnetic field in which the armature revolves, governs its own speed automatically within the limits imposed by the sensitiveness of the regulating mechanism which has been described. The position of the governor, rheostat-brush, and intermediate mechanism, as shown in Fig. 1, indicates that the motor, as shown in that figure, is carrying about half its normal load. In the operation of said rheostat, constructed as shown in Figs. 1 and 4, the unequal size of plates 45 and 46 produces a large radiating-surface, and thereby prevents the rheostat from becoming dangerously hot.

I claim as my invention—

1. A rheostat consisting of an indefinite number of annular disks of copper or other highly-conductive material and an indefinite number of annular disks of iron or other material of comparatively low conductivity, all clamped together upon an insulated core by uniform pressure, in combination with an electric motor whose field-magnet helices are connected in parallel with said rheostat, a centrifugal governor which is mounted upon the armature-shaft of said motor, and a sleeve and brush-carrying lever, whereby said governor may manipulate said rheostat, substantially as and for the purpose specified.

2. A rheostat consisting of a number of perforated plates of copper or other highly-conductive material, a number of like smaller plates of iron or other material of comparatively low conductivity, and an insulated core upon which all said plates are clamped together, in combination with an electric motor, an isochronous governor, which is driven by the armature-shaft of said motor, a slotted sleeve upon said shaft, and a lever which engages said sleeve and is armed with a brush which is adapted to be moved across the edges of said first-mentioned plates, substantially as and for the purpose specified.

3. A rheostat consisting of plates of copper or other highly-conductive material and a number of intermediate plates of less highly-con-

ductive material, all fastened side by side in electrical contact with each other upon a suitable support and insulated therefrom, in combination with an electric motor whose armature-shaft is provided with a radially-projecting pin, a sleeve which surrounds said shaft and is provided with two stop-collars and with a spiral slot for the accommodation of said pin, a lever which carries an electric brush and is provided with an eye, and a loose collar which is pivoted in said eye and between said stop-collars, substantially as and for the purpose specified.

4. As a rheostat, an indefinite number of annular disks of copper or other highly-conductive material, in combination with an indefinite number of annular disks of iron or other material of comparatively low conductivity, all clamped together upon an insulated core by uniform pressure, substantially as and for the purpose specified.

5. As a rheostat, a number of perforated plates of copper or of other highly-conductive material, a number of like smaller plates of iron or of other material of comparatively low conductivity, and an insulated core, upon which all said plates are clamped together, in combination with a brush which is adapted to be moved across the edges of said first-mentioned plates, substantially as and for the purpose specified.

6. As a rheostat, a number of plates of copper or other highly-conductive material and a number of smaller intermediate plates of less highly-conductive material, all fastened side by side in electrical contact with each other upon a suitable support and insulated therefrom, in combination with an electric brush, and with mechanism which is adapted to move said brush across the edges of said first-mentioned plates, substantially as and for the purpose specified.

In testimony whereof I have hereunto set my name in the presence of two witnesses.

RICHARD H. MATHER.

Witnesses:
W. M. BYORKMAN,
WILLARD EDDY.