No. 639,957. Patented Dec. 26, 1899.

R. E. BALL.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

(Application filed Feb. 13, 1899.)

(No Model.)

Fig. 2.

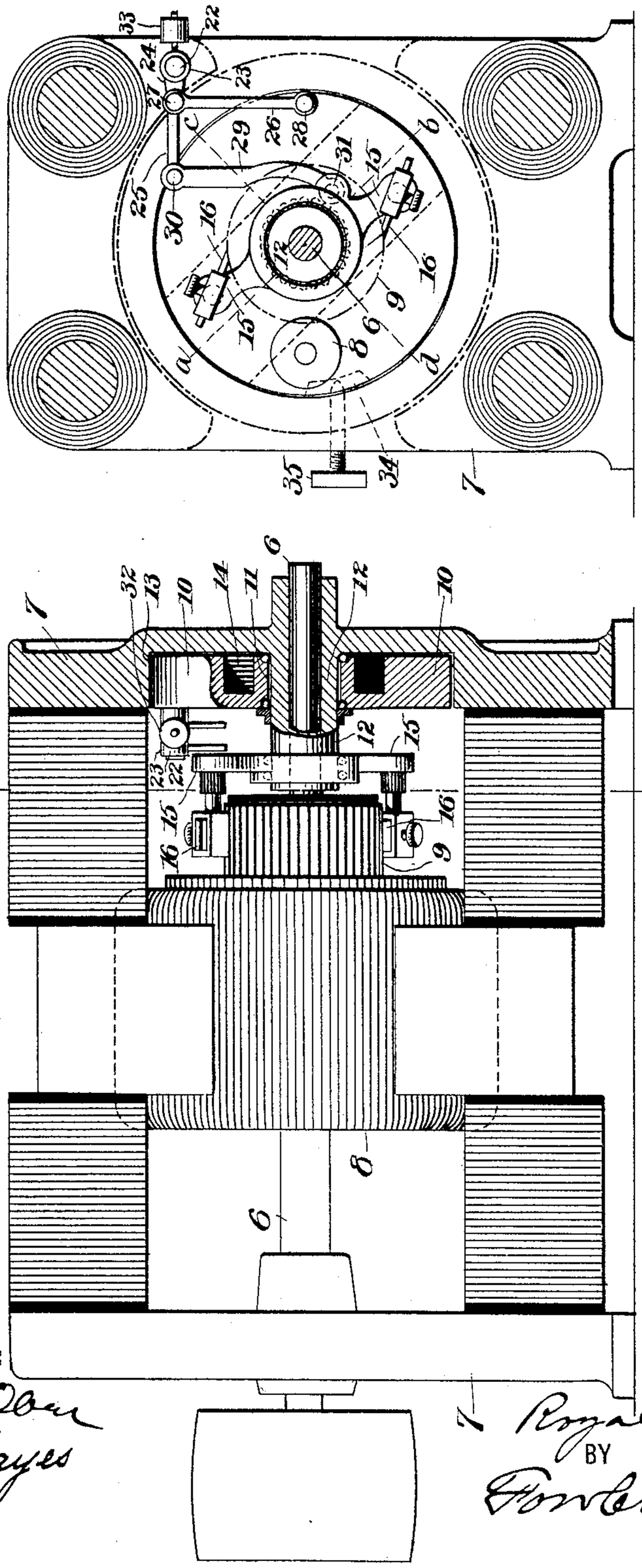

Fig. 1.

WITNESSES:

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ROYAL E. BALL, OF NEW YORK, N. Y., ASSIGNOR TO THE BALL ELECTRIC COMPANY, OF YONKERS, NEW YORK.

REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 639,957, dated December 26, 1899.

Application filed February 13, 1899. Serial No. 705,385. (No model.)

To all whom it may concern:

Be it known that I, ROYAL E. BALL, a citizen of the United States, residing at New York city, borough of Manhattan, county and State of New York, have invented certain new and useful Improvements in Regulators for Dynamo-Electric Machines, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to means for automatically regulating dynamo-electric machines, and it is particularly applicable to the type of regulator set forth in United States Letters Patent No. 444,587, granted to me January 13, 1891, and in which a movable part of the magnetic circuit of the machine is utilized to automatically shift the brushes to vary the pressure or volume of current.

I have illustrated a type of my invention in the accompanying drawings, wherein—

Figure 1 is a side view of a dynamo-electric machine embodying my invention, the right-hand end of the machine being partly broken away and partly in vertical section. Fig. 2 is a vertical transverse section on a plane indicated by line 2 2, Fig. 1.

Referring to the drawings, in which like letters and numbers of reference indicate like parts throughout, 6 is the armature-shaft, mounted in the end pieces 7 of the machine-frame and carrying the armature 8 and the commutator-cylinder 9.

10 is a circular magnetic plate or disk provided with a central opening 11, by which it is mounted on an inwardly-extending tubular bearing or extension 12 of the frame 7. The magnetic body 10 is set in a recess 13, formed in the inner face of the frame 7, and turns about the same axis as the shaft 6, which extends through the tubular bearing 12, on which the body turns. This magnetic body 10 forms a part of the magnetic circuit of the machine and serves as a regulator upon the principle pointed out in my patent hereinbefore referred to—namely, that if a movable magnetic body be included within a magnetic circuit it will tend to place itself so that its axis of least resistance will become parallel to the resultant magnetic line traversing the magnetic circuit and that the force with which it will tend to take this position will be dependent upon the number of magnetic lines of force passing through it. To obtain the axes of different resistances, I cut away a portion 14 of the body, such cut-away portion being in the form of a wide groove extending diametrically across the inner face of the plate. This gives to the body two axes $a\,b$ and $c\,d$ at right angles to each other and of different resistances. The axis $a\,b$, being parallel with the cut-away portion, constitutes the axis of least resistance. Since the body 10 is magnetic and forms a portion of the magnetic circuit of the machine, it will tend to move so as to place its axis of least resistance—namely, the axis $a\,b$—parallel to the axis of the magnetic circuit of the machine, which is vertical, in accordance with the principle above referred to, and this tendency of force to move the body bears a relation to the strength of magnetic current. I utilize this automatic movement of the magnetic body 10 as a regulating means for the machine by connecting the body with the yoke 15, which is mounted on bearing 12 and is provided with the brushes 16. The magnetic body and the yoke are connected through means and mechanism whereby the angular movement of the magnetic body is imparted to the yoke with multiplied effect and the yoke is given a long range of movement. In the present instance the mechanism for multiplying the movement is constructed as follows: A stud 22, fixed upon the machine-frame 7, carries a loose sleeve 23, which rocks thereon. From one side of the sleeve project two fixed arms 24 and 25, the latter being three times the length of the former and both extending at right angles to the sleeve and in the same direction. A link 26 is connected to pins 27 and 28 on the short arm and the magnetic body, respectively, so that the angular movement of the body is imparted to the rock sleeve or shaft 23. A link 29 is connected loosely to pins 30 and 31, mounted on the long arm 25 and the yoke 15, respectively, so that the motion of the sleeve 23 is transmitted to the yoke and causes it to shift on its axis angularly. The proportional lengths of the arms 23 and 25 being as one to

three, if now the diameters of the yoke and the magnetic body 10 be as one to two the angular movement imparted to the yoke from the magnetic body will be six times as great as that of the body. In this way I am enabled to give a long range of angular movement to the yoke and to greatly exaggerate its movement compared with that of the magnetic body. For example, with the proportion of parts just described an angular movement of the body of, say, ten degrees will cause the yoke to move angularly sixty degrees. As the axis of least resistance *a b* of the magnetic body moves toward the vertical the brushes are shifted accordingly to maintain the requisite lead.

In this construction I use a counterbalancing-weight 18 on the magnetic body 10. I also provide the rock shaft or sleeve 23 with an adjustable weight 32, which is formed with a screw-threaded socket working on a screw-threaded stem 33, which projects from the sleeve 23 in an opposite direction from the arms 24 and 25. By adjusting the weight 32 the counterbalancing is effected more accurately and the mechanism made more sensitive.

The range of angular movement of the magnetic body or disk 10 is limited in each direction by means of a slot 34, formed in the periphery of the disk, and screw 35, projecting from the wall of the recess 13 into said slot. The length of the slot 34 for limiting the angular throw of the magnetic disk 10 is shown as about ten degrees plus the thickness of the screw 35, which projects therein, and I find that this is sufficient to give the yoke the necessary range of movement.

I do not limit myself to the specific constructions herein set forth, as various modifications may be made in the several parts of the device without departing from the spirit of my invention.

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

1. The combination of a dynamo-electric machine provided with a brush-carrying yoke, an automatically-movable magnetic body forming part of the magnetic circuit of said machine and movement-multiplying connections between said magnetic body and yoke for actuating the yoke with multiplied movement, substantially as and for the purpose set forth.

2. The combination of a dynamo-electric machine, a movable brush-carrying yoke, a movable magnetic body forming part of the magnetic circuit of said machine and mounted concentrically with said yoke, and connections between said magnetic body and the yoke for causing the movement of the body to be imparted to the yoke with an increased range of movement, substantially as and for the purpose set forth.

3. The combination of a dynamo-electric machine, a brush-carrying yoke mounted concentrically with the shaft of the machine, a movable magnetic part of said machine mounted concentrically with said yoke, a rock shaft or sleeve provided with two laterally-projecting arms of different lengths, a link connecting the short arm with the movable magnetic part, and a link connecting the long arm with said yoke, whereby the angular movement of the magnetic part on its axis may impart to the said yoke an increased angular movement, substantially as and for the purpose set forth.

4. The combination of a dynamo-electric machine, a brush-carrying yoke mounted concentrically with the shaft of the machine, a movable magnetic disk mounted concentrically with said yoke and having a greater diameter than the yoke, a rock shaft or sleeve provided with two laterally-projecting arms of unequal length, a link connecting the short arm with said magnetic disk, and a link connecting the long arm with the said yoke, whereby the angular movement of the disk may be imparted to the yoke with an increased range of angular movement, substantially as and for the purpose set forth.

5. The combination of a dynamo-electric machine, a brush-carrying yoke mounted concentrically with the shaft of the machine, a movable magnetic part of said machine mounted concentrically with said yoke, a rock shaft or sleeve provided with two laterally-projecting arms of different lengths, a link connecting the short arm with the movable magnetic part, a link connecting the long arm with said yoke, and a counterweight mounted upon said movable magnetic part, substantially as and for the purpose set forth.

6. The combination of a dynamo-electric machine, a brush-carrying yoke mounted concentrically with the shaft of the machine, a movable magnetic part of said machine mounted concentrically with said yoke, a rock shaft or sleeve provided with two laterally-projecting arms of different lengths, a link connecting the short arm with the movable magnetic part, a link connecting the long arm with said yoke, and an adjustable weight mounted upon said rock shaft or sleeve opposite the point where said arms are located, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, this 9th day of February, 1899, in presence of the two subscribing witnesses.

ROYAL E. BALL.

Witnesses:
CARSON C. ARCHIBALD,
ROBERT P. BARNES.