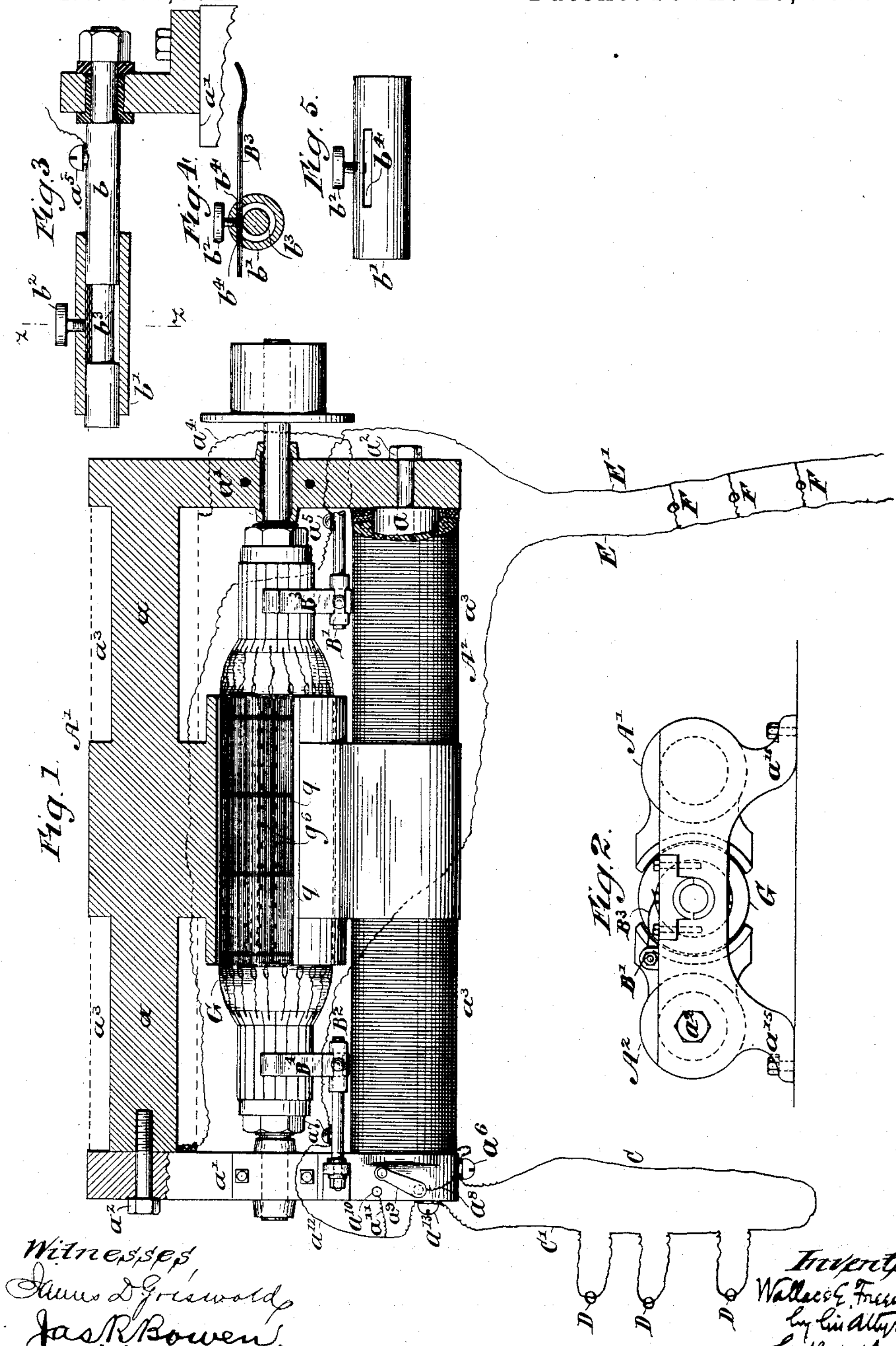
(No Model.) 2 Sheets—Sheet 1.

W. E. FREEMAN.

DYNAMO ELECTRIC MACHINE.

No. 344,801. Patented June 29, 1886.



Witnesses
James D. Griswold
Jas. R. Bowen.

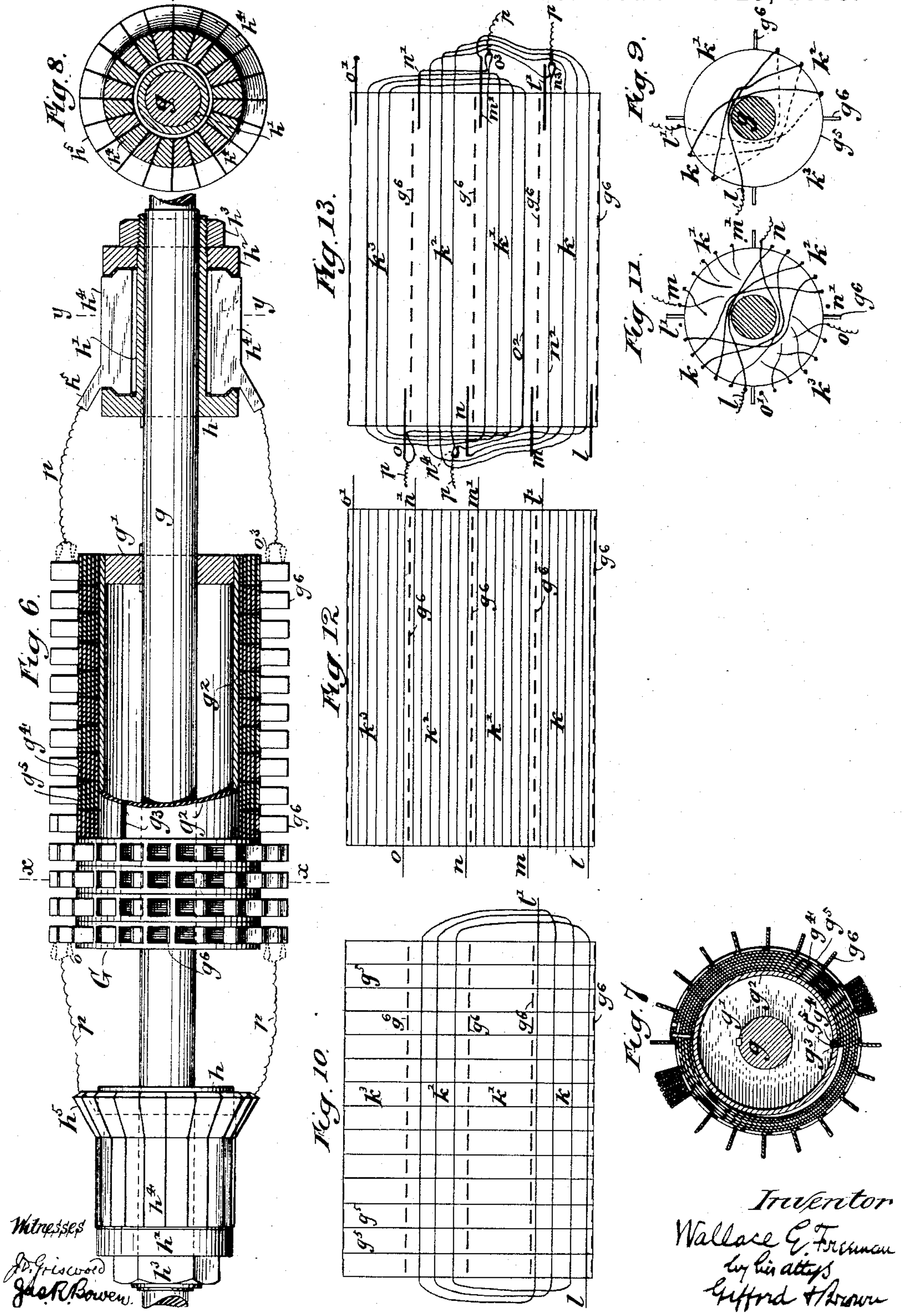
Inventor
Wallace E. Freeman
by his Attys
Gifford & Brown

(No Model.) 2 Sheets—Sheet 2.

W. E. FREEMAN.

DYNAMO ELECTRIC MACHINE.

No. 344,801. Patented June 29, 1886.



Witnesses
J. D. Griswold
Jas. R. Bowen.

Inventor
Wallace E. Freeman
by his attys
Gifford & Brown

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

WALLACE E. FREEMAN, OF ASTORIA, NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 344,801, dated June 29, 1886.

Application filed June 2, 1886. Serial No. 203,938. (No model.)

To all whom it may concern:

Be it known that I, WALLACE E. FREEMAN, of Astoria, in Queens county and the State of New York, have invented a certain new and useful Improvement in Dynamo-Electric Machines, of which the following is a specification.

I will describe a dynamo-electric machine embodying my improvement, and then point out the various novel features in the claims.

The accompanying drawings illustrate a dynamo-electric machine embodying my improvement.

Figure 1 is a plan of the machine, a portion being in section, and showing circuits for incandescent and arc lighting. Fig. 2 is an end view of the machine. Fig. 3 is a sectional side view of one of the brush-holders. Fig. 4 is a transverse section, taken at *z z*, Fig. 3, of this brush-holder. Fig. 5 is a side view of a portion of the brush-holder. Fig. 6 is a plan, partly in section, of the armature and commutator cylinders or wheels. Fig. 7 is a transverse section of the armature, taken at *x x*, Fig. 6. Fig. 8 is a transverse section of the commutator at *y y*, Fig. 6. Figs. 9, 10, 11, 12, and 13 are diagrams illustrating the method of winding the armature at successive stages according to my improvement.

Similar letters of reference designate corresponding parts in all the figures.

A' A^2 designate the field-magnets of the machine. Each has a cylindric core, a, made of cast-iron, and a bar, a', formed integral therewith, the latter being at right angles to the core from which it extends. The bar a' of each core a extends over to the adjacent end of the other core a, and is secured to the latter by a screw, a^2, entering a tapped hole with which it is provided. The cores a of these field-magnets have coils of wire a^3 wound thereon in the ordinary or any other suitable manner. The coils of the two cores are at one end connected together. The wire marked a^4 shows this connection. The other end of the coils of wire a^3 of the magnet A' extends to a binding-screw, a^5, extending from a brush-holder, B'. The corresponding end of the coils a^3 of the magnet A^2 is connected with a binding-screw, a^6, which is fastened to the bar a' of the magnet A, but is insulated therefrom. As here shown, a circuit-wire, C, extends from the binding-screw a^6. A wire, a^{12}, extends from a binding-screw, a^7, which is mounted upon a brush-holder, B^2, to a binding-screw, a^{13}. The binding-screw a^{13} is inserted in the bar a' of the magnet A^2, but is insulated therefrom. A circuit-wire, C', extends from the binding-screw a^{13}. The circuit-wires C C' are joined together so as to form a circuit in which are included a number of voltaic arc-lamps, D. From the binding-screw a^6 a wire, a^8, extends to the support of a switch-arm, a^9. The support of this switch-arm is mounted on the bar a' of the magnet A, but is insulated therefrom. This switch-arm is capable of being swung over onto a metallic rest, a^{10}, which is mounted on the bar a' of the magnet A^2, but is insulated therefrom. A wire, a^{11}, extends from the switch-arm rest a^{10} to the wire a^{12}. When a circuit such as the circuit C C' is to be used, the switch-arm a^9 is swung off the rest a^{10}; but when no such circuit is to be used this switch-arm may be swung onto its said rest. A wire, E, is shown as extending from the binding-screw a^7 of the brush-holder B^2, and a wire, E', extends from the binding-screw a^5 of the brush-holder B'. These wires form a circuit in which incandescent lamps F are connected so as to be in multiple-arc circuit.

G designates the armature of the machine. It is of cylindric form, and its journals have bearings provided in the bars a' of the magnets A' A^2. The bearings are lined with Babbitt metal and the journals are insulated from the bars a'. The bars a' of the magnets A' A^2 have feet a^{15} cast with them to form supports for the machine.

The brush-holders B' B^2 are supported by standards arranged on the bars a' of the magnets A' A^2 of the machine. They severally consist of a rod, b, extending into one of the standards, a sleeve, b', fitting upon the rod b, and a screw, b^2. The rod b is insulated from its standard by a bushing of insulating material. A nut engaging with a screw-thread on the end of the rod b that extends through the standard secures the rod thereto. The rod b of each brush-holder has a circumferential groove, b^3, opposite which the sleeve has two slots, b^4. The brushes B^3 B^4 are made of leaves of sheet metal, as usual. They extend through the slots b^4 of the sleeves b' of the holders B' B^2, and across the grooves b^3 of the rod b. The screws b^2 extend through the sleeves b' opposite the grooves b^3 in the rods b, and serve to clamp the brushes in position. The brushes may after these screws are loosened be adjusted longitudinally; or they and the sleeves of the holders may be rocked on the rods into any desired positions. After the parts have been adjusted they may be secured again by the screws. The armature G has a metal shaft, g. Affixed to this shaft are metal disks or heads g'. A metal shell, g^2, surrounds and is secured to these disks. This shell has a longitudinal slot, g^3. Around the shell g^2 are coiled, side by side, strips g^4 g^5, of non-magnetic material and sheet-iron. These strips of each pair are coiled together around the shell, the iron strip of each pair being outermost. The several pairs of strips g^4 g^5 are separated by washers of insulating material located between their edges. The outer coil of the sheet-iron strip of each pair of strips g^4 g^5 has made in it at intervals incisions of such shape that the intermediate portions may be bent outwardly to form radial lugs g^6. These radial lugs are in line, and form ribs between which insulated wire is coiled or wound.

Before describing the winding of wire I will explain the commutator-wheels H, that are affixed to the armature-shaft. Each has a metal head, h, from which extends a sleeve, h', which snugly surrounds the armature-shaft. A head, h^2, is fitted upon the sleeve h', and secured in position by a nut, h^3, engaging with a screw-thread on the sleeve. Between the heads h h^2 metal bars h^4 are secured, strips of insulating material being arranged between them, and washers of insulating material being placed between their ends and the said heads. The inner ends of the bars h^4 have formed on them lugs h^5, which form flaring extensions of the inner ends of the wheels.

The ribs which are formed by the radial lugs g^6 divide the body of the armature, formed as described, into a number of coils. Each spacing between the two adjacent ribs has a corresponding space diametrically opposite to it. The armature in the machine which I have shown will preferably have twenty of these sections.

I will now describe the manner in which the insulated wire is wound or coiled upon the body of the armature. This may be best understood by reference to Figs. 9, 10, 11, 12, 13, Figs. 9 and 11 being end views of an armature, which I have shown as having but four sections, k k' k^2 k^3, in order to simplify it and facilitate an understanding of the winding, and Figs. 10, 12, and 13 are developed plans, or, in other words, represent the exterior of the body of this armature extended out in a straight flat plane.

By reference to Fig. 10 the winding of the first coil of wire may be clearly understood. l represents one of its ends, from which the wire is wound or coiled back and forth any desired number of times (for instance, three times) through one of the sections, k, and a diametrically-opposite section, k^2. Its end l' extends from the same section, k, as its other end, l. Next a coil of wire is similarly wound through the sections k' k^3 of the armature-body, the ends of the coil being extended from both sections k', but at opposite ends of the armature-body, in the same manner as the ends of the coil first mentioned. Another coil is now wound in the same manner over sections k k^2. The ends of this coil, instead of being extended from the sections k, are extended from the section k^2. A coil is now wound, in the same manner as before, over sections k' k^3, except that the ends of this coil are extended from the section k^3, instead of from section k'. This completes the first winding of wire.

The manner in which the coils are wound over diametrically-opposite sections may be clearly seen by reference to Fig. 9, where a single coil only is represented.

In Fig. 11 the armature-body is shown as having all the coils wound upon it, but in order to avoid confusion portions of some of the coils are broken away or removed. Fig. 12 also represents the armature-body as completely wound. In this figure, as well as in Figs. 9 and 10, I have designated the ends of the coils l l', m m', n n', and o o'. In this figure the short heavy lines represent the ribs formed of the lugs g^6, and the intermediate fine lines parallel therewith represent the coils of wire.

What I term as the "second winding" may be best understood by reference to Fig. 13. I have not in this figure attempted to represent the first winding, for fear of confusion, except that I have indicated by short heavy lines (marked, respectively, l l', m m', n n', o o') the ends of the coils forming what I have termed the "first winding" and previously described. Connected to the end o of one of the first coils of winding is a wire, o^2, which is wound around the sections k' k^3 of the armature-body. It will be seen that the end o of said coil in the first winding extends from the section k^3 of the armature-body. The coil of wire o^2 has formed in it a loop, o^3, at one end of the section k', and from the loop a wire, p, extends to one of the bars h^4 of the adjacent commutator-wheel H. The end of the wire o^2, after being looped, is fastened to the end n' of one of the coils of wire of the first winding, said end n' extending from the section k^2. At the junction of the end o and the wire o^2 is formed a loop whence a wire, p, extends to one of the bars h^4 of the adjacent commutator-wheel H. From the end n of the next coil of the first winding a wire, n^2, extends. This wire n^2 is extended first along the section k of the armature-body. At the end of this section it has formed in it a loop, n^3, from which a wire, p, is extended to one of the bars h^4 of the adjacent commutator-wheel. Beyond this loop n^3 the wire n^2 is coiled around the sections k^2 k. In the last convolution at the end of the section k^2 it has formed in it a loop, n^4, whence extends a wire, p, to a bar h^4 of an adjacent commutator-wheel. Beyond this loop this wire n^2 is extended around section k, and is secured to the end m' of the coil $m\ m'$ in the first winding, said end m' being extended from the section k'. I have only shown two coils of the second winding. The rest I omit to avoid confusion. From the end m of the coil $m\ m'$ in the first winding a wire extends in the same manner as from the end o of the coil $o\ o'$ in the first winding, and this wire that extends from the end m is wound around the armature-body in the same way as the wire o^2, its last end being connected to the end l' of the coil $l\ l'$ in the first winding. From the end l of the coil $l\ l'$ in the first winding a wire extends and is wound around the body of the armature precisely like the coil n^2, the last end of this coil being connected to the end o' of the coil $o\ o'$ in the first winding. There will be loops formed in the two coils of the second winding, which I have omitted to show, exactly in the same manner as loops are formed with the coils $o^2\ n^2$, and from such loops wires will extend to bars h^4 of the commutator-wheels. The wires p extend to the bars h^4 of the commutator-wheels, which are opposite or in line with the sections of the armature-body whence said wires p extend.

The winding which I have described is but a "single layer," as I term it. If I desire, I may superpose upon this layer a similar layer or any desired number of similar layers. Each layer will be composed of a first and second winding, such as I have described. There will not need to be any connection between the several layers, except that corresponding loops extending from two or more layers may be connected with single wires p, extending to the commutator-wheels. I have illustrated in Fig. 6 loops of two layers connected together and with the bars h^4 of the commutator-wheels by single wires p, although I have not in this figure shown any part of the windings, except the loops. The wire wound upon the armature-body, as described, may be bound tightly around the body at intervals by tie-wires q, for the purpose of preserving the cylindrical form of the armature. The field-magnets $A'\ A^2$ are shown as provided with extended pole-pieces adjacent to the armature.

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

1. A dynamo-electric machine having field-magnet cores each provided with a transverse bar extending to the other core and connected with the latter, substantially as specified.

2. A dynamo-electric machine having field-magnet cores each provided with a transverse bar extending to the other core and furnished with supporting-feet, substantially as specified.

3. A dynamo-electric machine having field-magnet cores each provided with a transverse bar extending to the other core and furnished with a bearing for the armature-shaft, substantially as specified.

4. A dynamo-electric-machine brush-holder consisting in the combination of a circumferential grooved rod, a sleeve fitted to the rod outside its groove, and a screw or fastening device, substantially as specified.

5. A dynamo-electric machine having an armature whose body comprises strips of non-magnetic material and iron wound together in pairs in convolute coils, the outermost coil having incisions at intervals, and the intermediate portions bent outwardly, forming longitudinal ribs on the armature-body, substantially as specified.

6. A dynamo-electric machine having an armature-body wound with wire in independent layers, said layers being connected with commutator-wheels in multiple arc, so that any accident to one layer will not incapacitate the other layer or layers, substantially as specified.

7. In a dynamo-electric machine, the combination of an armature having wire wound upon it in independent layers connected in multiple arc, two commutator-wheels arranged on the armature-shaft at the end of the armature-body and connections between the wire on the armature and the commutator bars or plates, each set of coils of the wire on the armature being thus connected to both commutators, substantially as specified.

WALLACE E. FREEMAN.

Witnesses:
GEO. WADMAN,
CHAS. T. WARD.