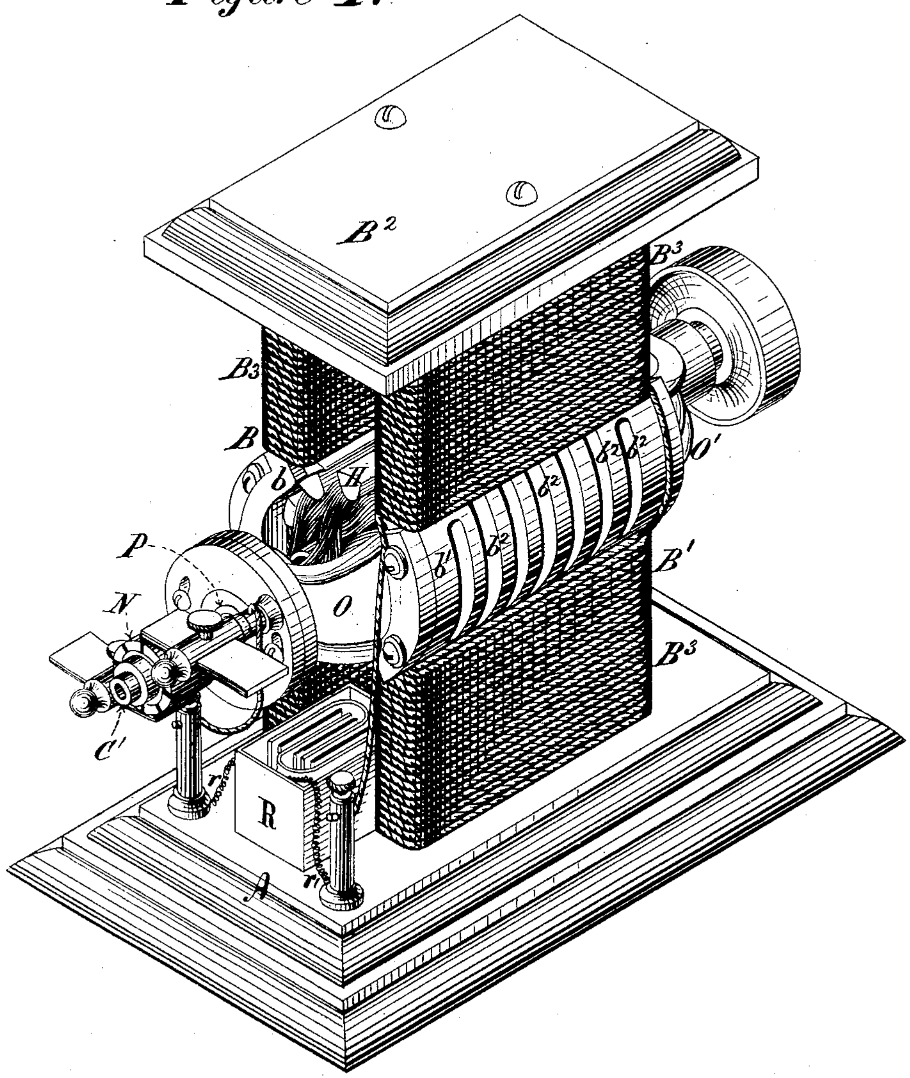
E. WESTON.

Dynamo-Electric Machine.

No. 209,532. Patented Oct. 29, 1878.

Figure 1.



Witnesses:

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Geo. W. Miatt

Inventor:

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Figure 2.

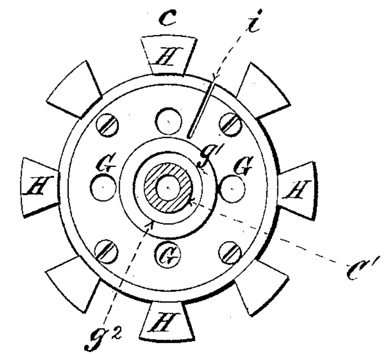

Figure 3.

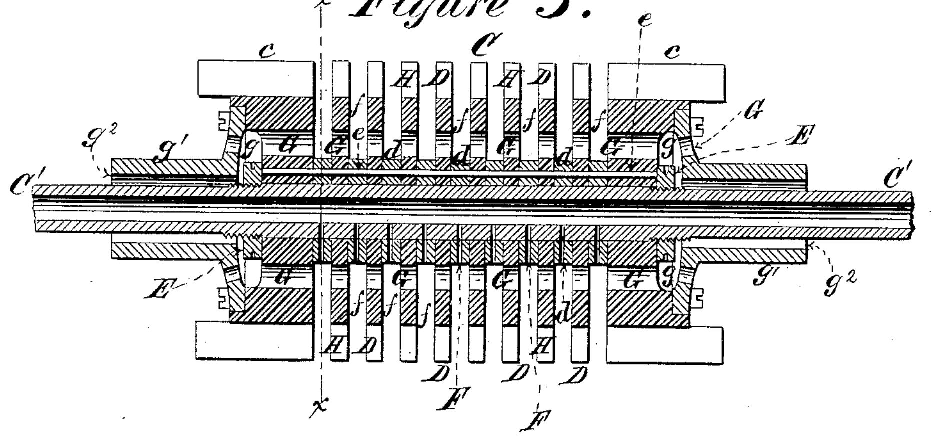

Figure 4.

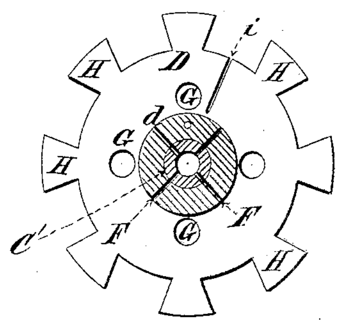

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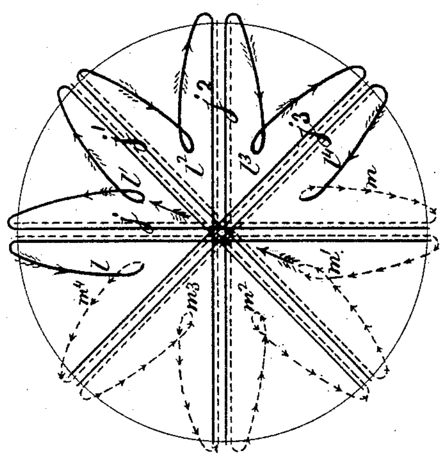
Figure 6.



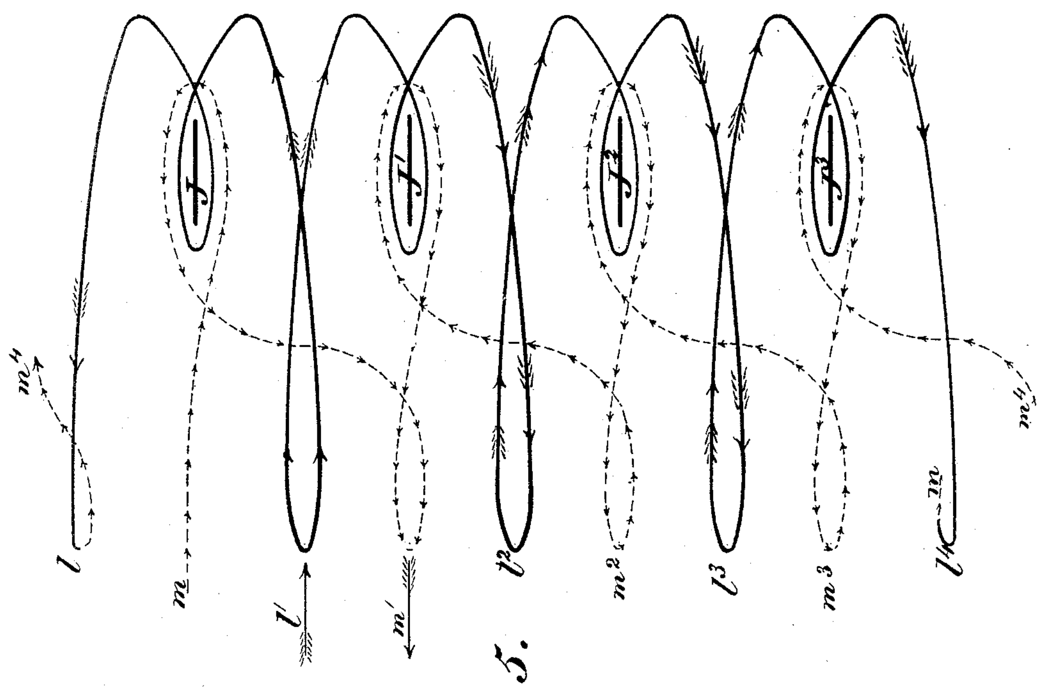


Figure 5.

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E. WESTON.

Dynamo-Electric Machine.

No. 209,532. Patented Oct. 29, 1878.

Figure 7.

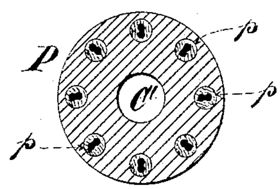
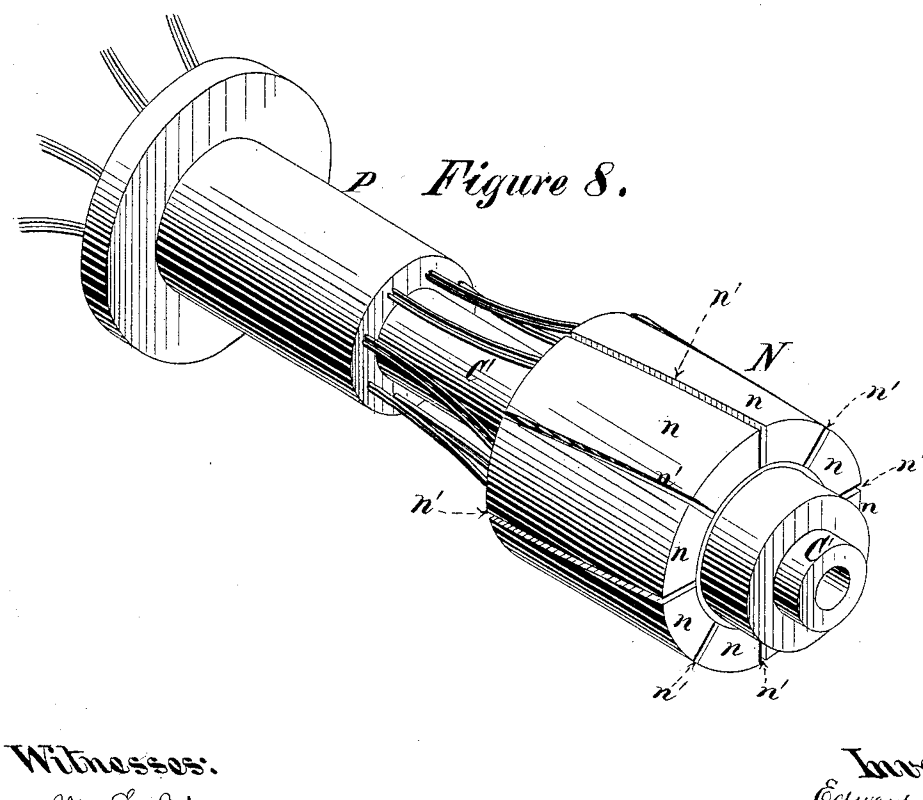


Figure 8.



Witnesses:

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UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY, ASSIGNOR TO WESTON DYNAMO-ELECTRIC MACHINE COMPANY, OF SAME PLACE.

IMPROVEMENT IN DYNAMO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **209,532**, dated October 29, 1878; application filed June 4, 1878.

CASE D.

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, New Jersey, have invented certain Improvements in Dynamo-Electric Machines, of which the following is a specification:

My improvements relate to that class of dynamo-electric machines in which a system or systems of coils which longitudinally traverse an armature rotating in the magnetic field between the poles of two stationary electro-magnets are included in circuit with the coils surrounding the stationary magnets; and my invention consists, first, in providing for the rotating coils a skeleton core, or, in other words, a core the outer portion of which is rendered discontinuous by a series of deep transverse grooves and by a longitudinal groove or slit extending from one end of the armature to the other. Instead of making the core of a single piece of iron it may be more conveniently constructed by mounting upon the armature-shaft a series of iron disks, separated from each other by intervening collars upon the same shaft. I use, preferably, a hollow shaft for the armature, and bore holes radially through the collars into the shaft for the purpose of providing a path for the circulation of air from the hollow shaft into the spaces between the disks, from which such air is discharged, when the armature is rotated, through the interstices in the coils which traverse its exterior. I also bore one or more holes through the disks for the purpose of connecting the air-spaces with each other and with air-chambers established at the ends of the armature, so that air may be supplied not only through the shaft but through the openings in the outer walls of the air-chambers. There are two advantages resulting from this mode of constructing the armature-core: First, there is a vigorous circulation of air through the core when the armature is rotated, which tends to keep the machine cool; and, secondly, owing to the discontinuity of the outer portion of the core, there is no metallic path completely around the core in any direction wherein rotary currents of electricity can be established by induction.

The second feature of my invention consists in successively winding upon the armature two systems of coils, one overlying the other, each system being wound in diametrically-separate divisions, and each division being connected to the next adjoining division by a loop, the bight of which is connected to one of the commutator-strips. The two free ends of each system of coils are respectively connected to the same two diametrically-opposite strips of the commutator. The two systems of coils are thus connected with each other as if they were composed of an endless wire. In the example of this mode of winding the coils shown in the drawings, I have wound each system of coils in four divisions, and I thus have eight loops for connection with the commutator, which accordingly has eight separately-insulated strips. In effect, two currents, generated in two parallel wires, are communicated to the two strips which are in contact with the brushes, and the whole double system of coils is constantly employed in the generation of the current.

It is an incidental feature of this part of my invention that the loops or wires connecting the coils with the commutator-strips are all carried through one of the journals of the armature-shaft, either through a bushing of insulating material inserted in a metallic shoulder, or collar upon the armature-shaft.

The third feature of my invention consists in combining with the machine a condenser, the opposite sides of which are connected respectively to the two binding-posts, whereby the variations in the strength of the current generated by the rotation of the armature are compensated for by the charge and discharge of the condenser.

The accompanying drawings are as follows:

Figure 1 is an isometrical perspective of the machine. Fig. 2 is an end view of the armature-core detached from the machine. Fig. 3 is a central longitudinal section of the armature-core. Fig. 4 is a transverse section of the armature through the line *x x* on Fig. 3. Figs. 5 and 6 are diagrams for illustrating the mode of winding the double system of armature-coils. Fig. 7 is a transverse section of that one of the armature-journals through which the connecting-wires pass from the coils to the commutator-strips. Fig. 8 is an isometrical perspective of the commutator, also showing the journal of insulating material, through which armature-connections are made.

The machine, in its general appearance, resembles that described in my application for a patent filed December 31, 1877, and designated as "Case A," the present application being "Case D" of the series which I thus commenced to designate by letter.

This machine consists of a substantial bed-plate, A, to which are secured the two vertical cores of the stationary electro-magnets B B^1. The upper ends of these cores are bolted to the cross-piece B^2, and the coils B^3 are so wound upon the vertical cores that the laterally-projecting poles b and b^1 are of opposite polarities. The inner faces of the poles b and b^1 are concave, and just clear the periphery of the revolving armature.

The poles, it will be seen, are each provided with a series of parallel slots, b^2, the object of these slots being to provide passages for the escape of air drawn into the rotating armature through the holes in its ends and ejected therefrom through the interstices in the coils traversing its exterior.

The armature-core C may be made of a single piece of metal, or it may be built up of separate pieces, as shown in longitudinal section in Fig. 3. In the latter case the core consists of two end pieces, c c, centrally mounted upon a preferably hollow shaft, C′. Between the two end pieces, and centrally mounted upon the same shaft, are a series of disks, D, which are separated from each other by the collars d. The end pieces, collars, and disks are clamped together by means of the nuts E E, which respectively engage screw-threads on the projecting portions of the shaft, and the heads, disks, and ends may be keyed together by means of the key-pin e.

It will be seen that holes F are bored radially through the collars d into the hollow shaft C′, so that air drawn into the hollow shaft when the armature is rotated may be discharged therefrom into the spaces f between the disks.

Several holes, G, extending longitudinally through the core, are bored through the end pieces and the disks. The outer ends of the core are recessed to form the air-chambers g g. The outer walls of these chambers are formed by the flanged tubes g^1 g^1. The flanged tubes g^1 are made larger than the shaft C′, and an annular opening, g^2, is thus provided, through which air may be drawn into the chamber g, and thence through the longitudinal holes G into the spaces between the disks.

The object of the flanged tubes g^1 is to spread the coils where they pass over the ends of the core, and thus keep them clear of the shaft C′ and provide the annular opening g^2 for the passage of air into the air-chambers g. The end pieces c of the core and the disks are provided with the polar extensions H, which separate the divisions of the coil from each other, and thus leave spaces between the coils for the escape of air from the recesses in the core.

My core is longitudinally bisected by the slit i, for the purpose of preventing the establishment by induction of rotary currents in the disks or in the end pieces.

It will be seen that the armature-core is divided into eight sections, and is therefore adapted to carry four diametrically-separate divisions of coils.

In my invention the coils on the armature are practically composed of an endless wire; but they may be most conveniently considered and described as two similar systems of coils, the free ends of which are connected with each other. Fig. 5 is a diagram representing these coils as they would appear if their free ends were disconnected from each other and if the coils were detached from the core and laid alongside of each other upon a flat surface. One system of coils is represented by the full lines, and the other system by the dotted lines. The heavy black lines J J^1 J^2 J^3, within the groups of coils, are arbitrary representations of the core. Fig. 6 is an arbitrary representation of the end of the armature, showing the relative positions of the several divisions of the coils, and also showing the loops for connection with the commutator.

Similar letters of reference used in Figs. 5 and 6 indicate certain like parts which appear in both figures.

In tracing the mode of winding it will be convenient to start from the top of Fig. 5, at the free end l of one system of coils. From this point the wire traverses the core longitudinally, in, for example, a vertical plane, which may be represented by the vertical lines j on Fig. 6. Having made the desired number of turns on this division of the core a long loop, l^1, is left for connection with one of the commutator-strips, and the wire is then wound upon the next adjoining division of the core in a plane at an angle of forty-five degrees, as represented by the lines j^1. Having completed the number of turns on this angle I then form the loop l^2, and proceed to wind the wire longitudinally around the core in the horizontal plane represented by the lines j^2. I then form the loop l^3, and carry the wire around the next division of the core on the reverse angle of forty-five degrees, as represented by the lines j^3. After having completed the number of turns around this division of the core I bring out the free end l^4, which is then to be connected with the free end m of the other system of coils, or, in other words, connected to that strip of the commutator with which the free end m is connected.

To trace the course of the other system of coils, commence near the top of Fig. 5, at m, whence the wire proceeds, as indicated by the dotted line, overlapping the vertical division of the first system of coils, and after having made the proper number of turns forming the loop m^1, from which the wire is carried to the next division, and is there wound longitudinally, overlapping the division of the first coil, which is wound on an angle of forty-five degrees. The loop m^2 is then formed, and the wire is carried to the next division, where it is wound in a horizontal plane, overlapping the first coil, and is then brought out to form the loop m^3, from which it is carried around the last division of the first coil—that is, in a plane at a reverse angle of forty-five degrees, and the free end m^4 is carried out and connected with the free end l of the first system of coils, or, in other words, is connected with that strip of the commutator with which the free end l is connected.

Each loop is connected with a separate strip of the commutator, the loop of each division of the first system of coils being connected with the commutator-strip, which is diametrically opposite to the strip which is connected with the loop of the overlapping coil of the same division. For example, the loop l^1 is connected with the commutator-strip diametrically opposite the strip with which the loop m^1 is connected, and so on. Assuming one of the brushes to be in contact with that strip of the commutator with which the loop l^1 is connected, and the other brush to be in contact with the strip diametrically opposite with which the loop m^1 is connected, and assuming that the loop l^1 is positive and the loop m^1 is negative, the direction of the currents simultaneously generated in the coil is indicated by the arrow-heads, from which it will be seen that two currents, starting from the loop l^1, diverge and pass in opposite directions through the double system of coils and meet in the loop m^1, by which they are conveyed to the commutator-strip immediately opposite that with which the loop l^1 is connected.

It will thus be seen that the whole of the double system of coils is utilized for the production of each electrical impulse collected by the brushes.

My commutator N (see Fig. 8) consists of a cylinder provided with eight separately-insulated strips, n, and the divisions n' between the strips, instead of being parallel with the axis of the commutator, as usual, are slightly inclined thereto, or are spiral. There is therefore no break in the circuit as the commutator revolves, because the brushes, before they lose contact with one strip, acquire contact with the next following strip; and this arrangement of the commutator with reference to the brushes, and in connection with armature-coils wound in the peculiar mode described, results in the production, by my machine, of a continuous current.

The continuity of the current results from the fact that when, for example, the positive brush is in contact with the two loops l^1 and l^2, and the negative brush is in contact with the two loops m^1 and m^2, the diagonal divisions j^1 of the coils are alone short-circuited, the other divisions remaining more or less active in the generation of the current.

The bearings for the shaft C′ are formed in the cross-pieces O O′, and the journal P at the commutator end of the shaft is made sufficiently large for the insertion of eight tubes of insulating material, p, to contain the loops which connect the several strips of the commutator with the armature-coils.

At some convenient point on the machine, usually between the binding-posts, I arrange the condenser R, the opposite sides of which are connected respectively to the two binding-posts by the wires r r'.

I do not deem any special description of the condenser necessary, as such forms of apparatus are well known and in common use for various purposes.

In machines of the class to which mine belongs there is some diminution in the strength of the current, due to the cutting out or short-circuiting of one division of the coils at the instant when the brushes are in contact with two adjoining strips of the commutator. The condenser, charged by the current at its highest strength, is partially discharged when there is a diminution in the strength of the current, and its discharge thus tends to equalize the strength of the current in the operative part of the circuit.

I claim as my invention in a dynamo-electric machine—

1. An armature-core having formed in it a series of recesses extending inward from its periphery, in combination with holes extending longitudinally through the core from one end to the other, substantially as and for the purposes set forth.

2. An armature-core composed of a series of short cylinders or disks mounted at intervals upon a common shaft and bisected from their peripheries to a line near their centers, substantially as and for the purpose set forth.

3. An armature-core composed of a series of disks separated from each other by collars, substantially as described, and mounted upon a hollow shaft, and provided with holes bored radially through the shaft and the collars for allowing air to be drawn through the shaft and discharged into the spaces between the disks when the armature is rotated, substantially as and for the purpose set forth.

4. An armature, substantially such as described, provided at its ends with the air-chambers G, the outer walls of which are formed by the flanged tubes g^1 provided with openings, substantially as shown, for the admission of air into such air-chambers and its discharge through the end pieces e into the spaces between the disks, substantially as and for the purpose set forth.

5. An armature wound with a double system of coils in diametrically-separate divisions, such divisions being looped together and the loops connected with the commutator-strips, substantially as shown and described.

6. A double system of armature-coils wound and connected substantially as shown and described, in combination with a commutator composed of separately-insulated strips divided from each other on lines at an angle to the axis of the commutator-shaft, and two brushes, each adapted to hold contact with one strip until after it has acquired contact with the next adjoining strip, substantially as and for the purposes set forth.

7. A rotating armature having a recessed core with openings in its ends and in its periphery, in combination with the slots b^2 in the poles of the stationary magnets, substantially as and for the purpose described.

8. Independently-insulated wires or loops connecting the armature-coils with the commutator-strips, carried through the journal of the commutator-shaft, and insulated therefrom, substantially as described.

9. An armature-core provided with the polar extensions H, substantially as described.

10. A dynamo-electric machine, substantially such as described, in combination with a condenser, the opposite sides of which are connected respectively with the two binding-posts, with which the operative part of the circuit is connected, substantially as and for the purpose set forth.

EDWARD WESTON.

Witnesses:

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E. H. WILLIAMS.