

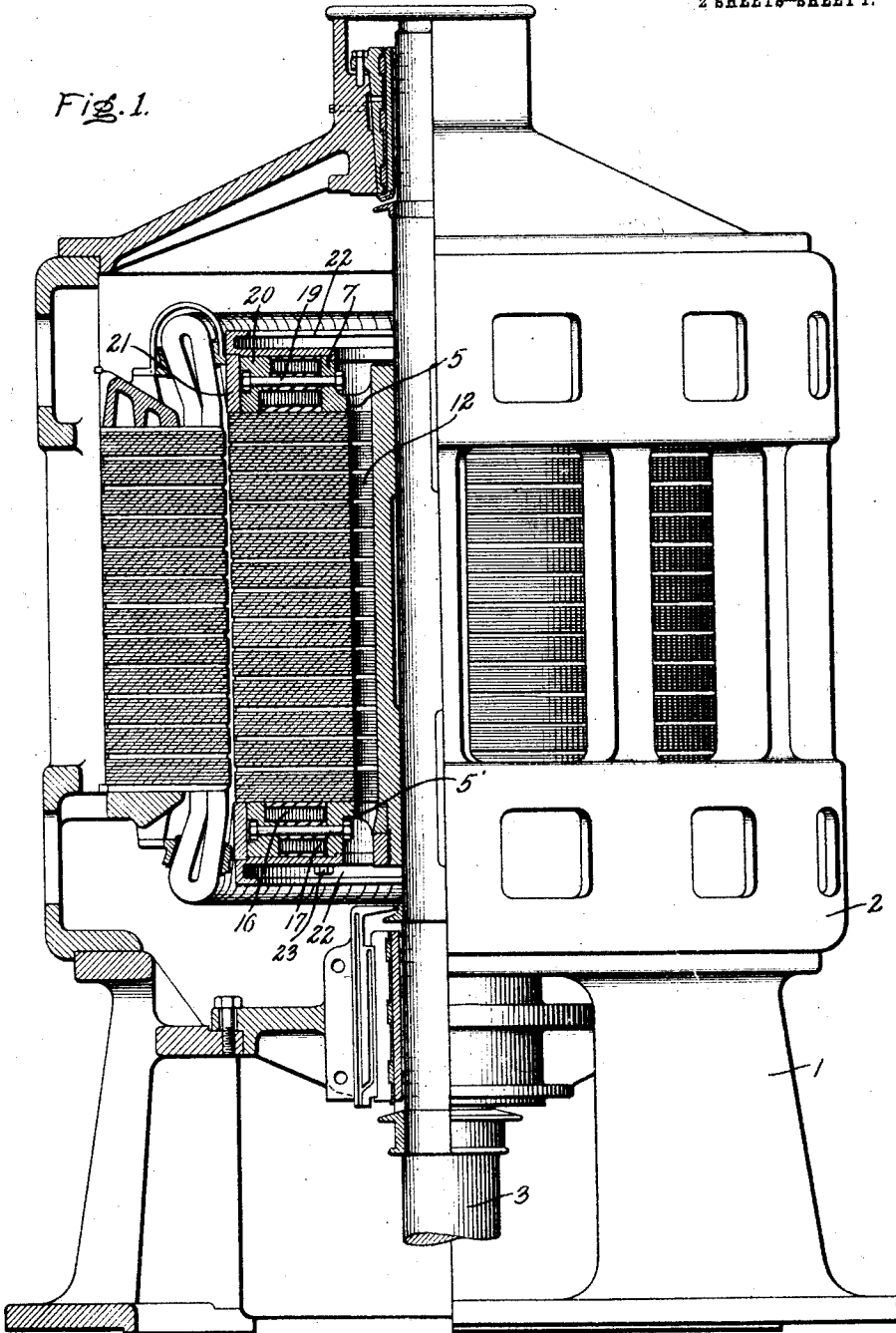
W. J. FOSTER.
DYNAMO ELECTRIC MACHINE.
APPLICATION FILED OCT. 13, 1905.

1,064,310.

Patented June 10, 1913.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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INVENTOR:

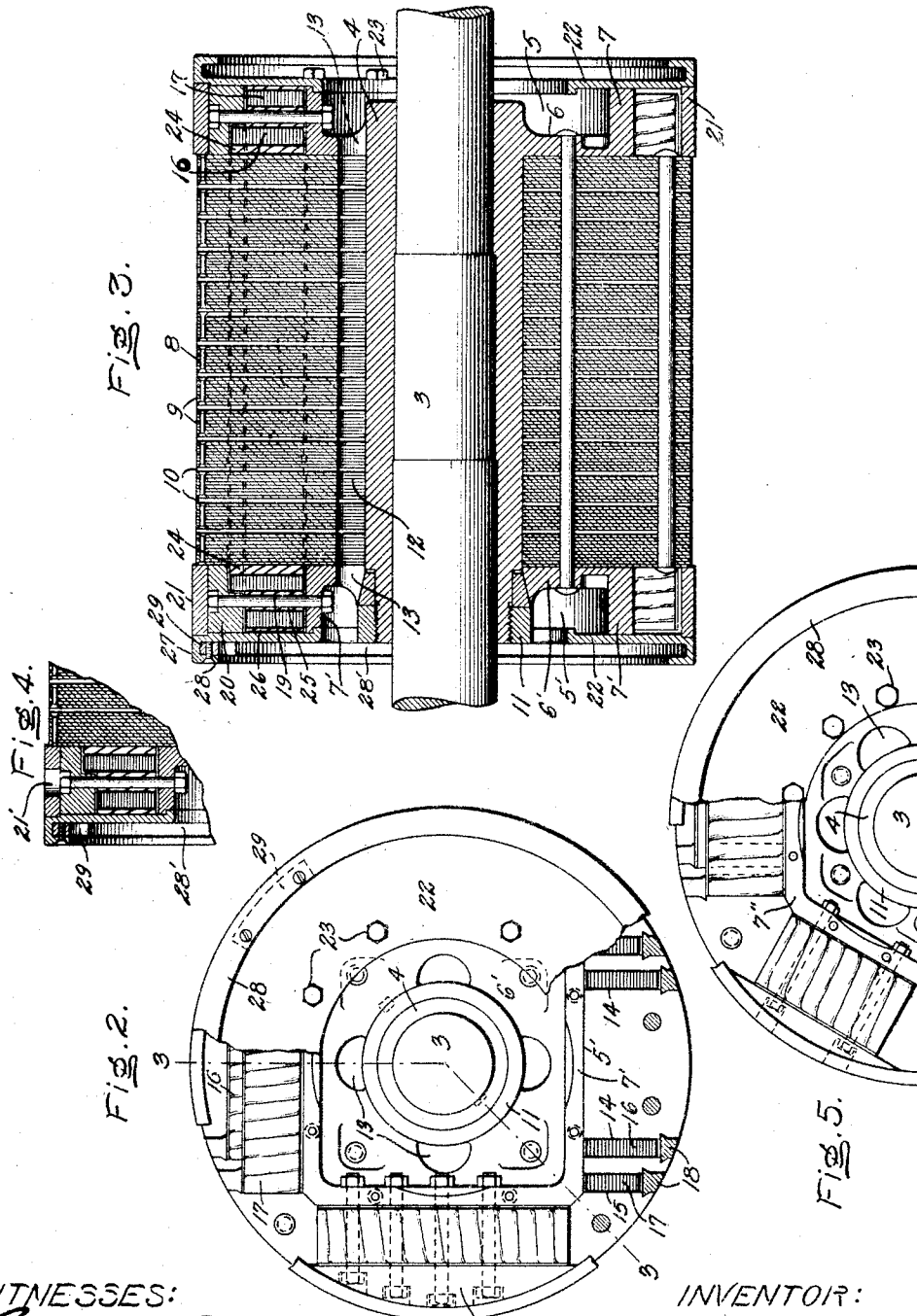
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DYNAMO ELECTRIC MACHINE.
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2 SHEETS-SHEET 2.



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UNITED STATES PATENT OFFICE.

LIAM J. FOSTER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

DYNAMO-ELECTRIC MACHINE.

1,064,310.

Specification of Letters Patent.

Patented June 10, 1913.

Application filed October 13, 1905. Serial No. 282,550.

To all whom it may concern:

Be it known that I, WILLIAM J. FOSTER, a citizen of the United States, residing at Schenectady, county of Schenectady, and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a specification.

The object of my invention is generally to simplify and improve the construction of dynamo electric machines, and particularly to provide a construction of the rotating member of such a machine suitable for operation at high rotative speeds.

In the embodiment of my invention which I have hereinafter illustrated and described, the rotating member of the machine is of the so-called smooth core type and is so constructed that it may be readily balanced and will not become unbalanced or otherwise injured by the stresses set up by its rotation at speeds such as are experienced with dynamo electric machines driven by steam turbines.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, however, reference may be had to the accompanying drawings and descriptive matter in which I have illustrated and described embodiments of my invention.

Of the drawings, Figure 1 is an elevation with parts broken away and in section of a four-pole dynamo electric machine; Fig. 2 is an end elevation with parts broken away and in section of the rotor of the machine shown in Fig. 1; Fig. 3 is a sectional elevation on the line 3—3, of Fig. 2; Fig. 4 is a sectional elevation illustrating a modified detail of construction; and Fig. 5 is an elevation of the end of the rotor of a six-pole machine.

In the drawings, 1 represents a base or support on which is mounted the stationary frame member 2 of a four-pole internal revolving field alternating current generator. The supporting member 1 in the particular machine illustrated is intended to be mounted upon the upper end of a vertical shaft steam turbine, the turbine shaft in such case being directly connected to and in alinement with the shaft 3 on the rotor of the dynamo electric machine.

The shaft 3 has keyed to it a shell or sleeve 4. The sleeve 4 is provided at one end with an integral flange or end member 5 comprising a radial web portion 6 and a flange portion 7 at right angles to the web portion 6. The flange portion 7 in the construction illustrated is rectangular as viewed from the end, the arrangement and construction being such that the flange 7 and web portion 6 resemble the sides and ends of a rectangular box. The core proper of the rotor is formed of laminæ 8 which are assembled in sections 9 on the sleeve 4 to which they are keyed, the laminæ in each section being riveted together. The sections are separated by suitable spacers in order to form radially extending ventilating passages 10. The sections 9 are clamped between the end member 5 and a similar end member 5' separable from the sleeve 4, comprising a web portion 6' and a flange portion 7' by means of a nut 11 threaded on the sleeve 4. As shown the laminæ are formed with registering openings in them which combine to form axially extending ventilating passages 12. Suitable openings 13 communicating with the passages 12 are formed in the end members 5 and 5'.

In the particular construction described, each lamina is formed with four similar symmetrically disposed sets of coil receiving openings. These openings in the laminæ register to form four sets of axially extending slots. Each set of openings comprises one inner pair of slots 14 and one outer pair of slots 15. The inner or bottom walls of the slots in each set all terminate in the same plane with the outer surface of the corresponding parts of the flange members 7 and 7'. The side walls of the slots in each set are parallel. By reason of the curvature of the outer surface of the core, however, the inner slots of each set are deeper than the outer slots. The windings for the rotor are divided into groups or sets, one group for each pole. Each group comprises, in the form shown, two coils 16 and 17 which are preferably form wound. Each coil 16 is received in one of the inner pairs of slots 14 and the corresponding coil 17 in the adjacent pair of slots 15. As shown, the slots may be formed to receive and hold against radial movement suitable coil retaining keys 18.

The end turns of the coils of each group

rest upon the corresponding part of the flange 7 or projecting coil supporting portion against which they are clamped or held in relatively fixed position by means of bolts 19 and segment shaped members 20 each of which bears against the outer surface of the end turns of the coils of each group and is shaped so as to space them apart. After the coils are assembled and the retaining keys 18 are put in place the segment shaped members are clamped up against the outer edges of the end turns or connections of the coils. If found desirable or necessary in particular cases, rings or bands 21, one at each end of the core, formed of suitable material having high tensile strength, such as nickel steel, may then be shrunk tightly about the members 20. If necessary, the members 20 may be first turned after being secured in place in order that their outer surfaces may be truly concentric. The heads of the bolts are received in recesses formed in the members 20 so that they do not interfere with the rings 21 or the turning operation referred to.

Apertured end cover members 22 are secured to the flange portions 7 and 7' with which they may have a tongue and groove connection as shown, by bolts 23. The inner edges of the end cover members 22 are flush with the inner surfaces of the flange portions 7 and 7'. The outer periphery of each member 22 is flush with the outer periphery of the adjacent ring or band 21 and is substantially flush with the outer periphery of the body of the core against the ends of which it will be observed the rings or bands 21 engage. Suitable space blocks 24, 25 and 26, which may be formed of wood, may be placed between the core, and the coil 16, between the two coils, and between the coils 17 and the end member 22, respectively. Each end cover member 22 is formed at its outer periphery with axially extending cylindrical flange portions 27 from the edge of which remote from the core, a web 28 extends inwardly. This results in the formation of the annular groove 28' at the outer periphery of the end member in which any necessary balancing weights 29 of any desired construction may be quickly and reliably secured. The balancing weights thus placed do not create undesirable windage by reason of the protection given by the flange or web 28.

The principal functions of the end cover members aside from forming a carrier for the balancing weights are to protect the coils from mechanical injury and to cut down undesirable windage of the machine. When the rings or bands 21 are employed the bolts 19 may be permanently retained in place or they may be withdrawn through openings 21' formed in the rings or bands, see Fig. 4. In this case the bolt holes form radially extending ventilating passages through which

air set in motion by the motion of the machine passes and cools the end connections of the coils. It will of course be understood that the air passing through the various ventilating passages of the rotor serves to cool not only the rotor core and the windings but the core and windings of the stator surrounding the rotor.

The construction illustrated and described is simple, compact and is well adapted to withstand the stresses created when the machine is operated at the rotative high speeds experienced in practice. By reason of the simplicity and symmetry of the construction little difficulty is experienced in balancing the rotor.

Arranging the bottom walls of the slots for the windings of each pole to lie in the same plane simplifies the means for supporting the end connection. With the slots arranged as shown the coils which are preferably form wound may be made rectangular in cross section and by reason of the parallelism of the side walls of the slots the insertion of the coils in their slots or their removal is facilitated.

It will be obvious to those skilled in the art that changes may be made in the form of my invention disclosed without departing from its spirit, and that some features of my invention may be employed without the use of others.

It will of course be clear that the invention is not limited to use in a four-pole motor, but could be advantageously employed in a machine having a different number of poles. In Fig. 5 I have shown a construction in which the invention is employed in a six-pole machine. In this embodiment of my invention the flange portions 7'' of the end members against which the inner edges of the end of the coils rest are hexagonal.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a dynamo-electric machine, a multipolar field magnet comprising a core and a plurality of coils per pole contained in coil receiving slots formed in the magnet core and arranged parallel with the axis of the pole, the bottom of the slots for each pole terminating in the same plane.

2. In a dynamo-electric machine, a multipolar field magnet comprising a core, a plurality of coils per pole contained in coil receiving slots formed in the magnet core, the bottoms of the slots for each pole terminating in the same plane, and an end member having coil supporting surfaces in the same plane with the bottoms of said slots.

3. A field magnet for a dynamo-electric machine comprising a core and a plurality of coils per pole contained in coil receiving slots formed in the magnet core, the sides of the slots for each pole being parallel and

their bottom walls terminating in the same plane.

4. A multipolar field magnet comprising a core, a plurality of coils per pole contained in coil receiving slots formed in said core, the sides of the slots for each pole being parallel and their bottom walls terminating in the same plane, and an end member having a supporting surface in the same plane with the bottom walls of the slots for each pole.

5. In the rotating member of a dynamo electric machine, a core, windings therefor, portions of which project beyond the ends of the core, a plurality of members engaging the outer surfaces of the portions of the winding projecting by one end of the core, means for independently forcing each of said members radially inward against the winding, and a shrink ring for permanently holding said members in place.

6. In the rotating member of a dynamo electric machine, a core, windings therefor, portions of which project by the end of the core, end members for the core having a surface extending in the direction of the axis of the core against which the inner surface of said projecting winding portions rest, a plurality of members for engaging the outer surfaces of the portions of the windings projecting by one end of the core, means for independently securing each of said members to the adjacent end member, and a shrink ring for permanently holding said members in place.

7. In the rotating member of a dynamo electric machine, a core, windings therefor, portions of which project by the end of the core, end members for the core having a surface extending in the direction of the axis of the core against which the inner surface of said projecting winding portions rest, a plurality of members for engaging the outer surface of the portions of the windings projecting by one end of the core, means for independently securing each of said members to the adjacent end member, and an annular member surrounding said plurality of members to hold them in place.

8. In a dynamo electric machine, a slotted core, windings located in the slots of said core arranged in sets with one winding in each set surrounding another winding in said set, supporting devices for the ends of said windings engaging their inner and outer surfaces, and means for securing said supporting devices in position comprising a bolt or bolts extending between the windings of a set.

9. In a dynamo electric machine, a slotted core, windings located in the slots of said core and arranged in sets with one winding in each set surrounding another winding in said set, the ends of said windings being spaced apart, a support for the ends of the windings engaging their inner surfaces and

another support for the ends of the windings engaging their outer surfaces, and means passing through the spaces between said windings for securing the supports together.

10. In a dynamo electric machine, a multipolar field magnet having a plurality of windings for each pole, the inner edges of the windings for each pole being in the same plane and their outer edges being in different planes, and a retaining device engaging the ends of the windings, said retaining device being formed with separate surfaces one for each winding which bear against the outer surfaces of the windings.

11. In a dynamo electric machine, a rotating field magnet provided with two magnetizing coils per pole, the axes of said coils being substantially radial to the axis of revolution, and the outer edges of corresponding portions of the two coils for each pole being at different distances from the axis of rotation, and a member for engaging the outer surfaces of the ends of said coils provided with a portion engaging one coil and another portion engaging the second coil.

12. In a dynamo electric machine, a core, a set of windings therefor comprising two coils one of which surrounds the other, a fixed support against which the inner surface of the coils rest, a support engaging the outer surface of the ends of said coils, and means for securing said supports together comprising a bolt or bolts.

13. In a dynamo electric machine, a core, a set of windings therefor including a pair of coils arranged one within the other, a pair of supports for the ends of said coils, one engaging the inner surfaces of said coils and the other engaging the outer surfaces of said coils, one of said supports being stationary and the other of said supports being movable, and means for clamping the windings between said supports comprising a bolt or bolts which pass between the coils.

14. In a dynamo electric machine, a core, windings therefor, a member fixed with respect to said core against which the inner surface of ends of said windings rest, separate supporting devices each engaging the exterior surfaces of portions of the ends of said windings, means for securing said supports together comprising bolts, an annular member surrounding said outer supports and holding them in place, said annular member being formed with openings through which said bolts may be withdrawn.

15. In a dynamo electric machine, a core, a set of windings therefor comprising two coils one of which surrounds the other, a fixed support against which the inner surfaces of the coils rest, a support engaging the outer surfaces of the ends of said coils, and means for securing said supports to-

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gether, comprising a bolt or bolts which extend between the coils.

16. In an alternating current dynamo-electric machine, a member having coils, the
5 end turns of which extend beyond each side of the core of said member, the said coils being divided into a number of groups or sets, and means for spacing apart and
10 clamping in relatively fixed position the end turns of the coils of each group, the spac-

ing and clamping means of each group being independent of the spacing and clamping means of the other group.

In witness whereof, I have hereunto set my hand this 11th day of October, 1905. 15

WILLIAM J. FOSTER.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."