No. 876,943. PATENTED JAN. 21, 1908.

C. E. CANFIELD.

DYNAMO ELECTRIC MACHINE.

APPLICATION FILED JUNE 8, 1904.

Fig. 1.

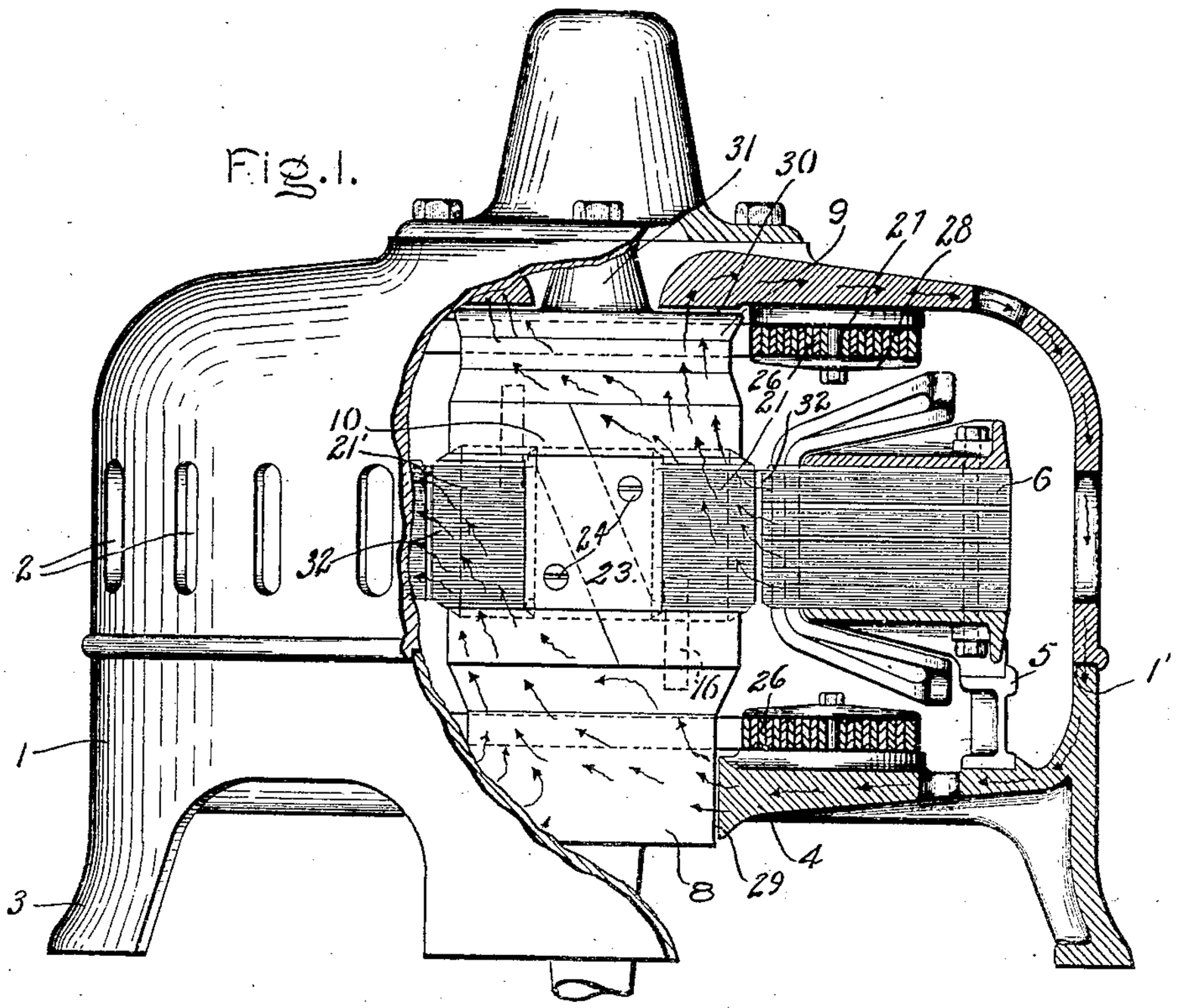

Fig. 3.

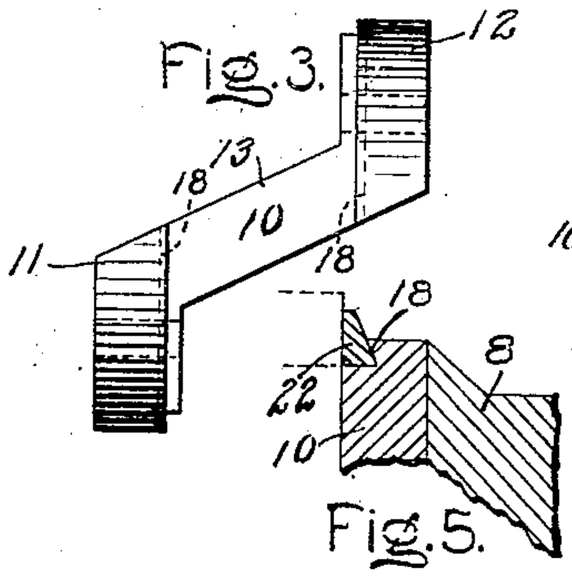

Fig. 2.

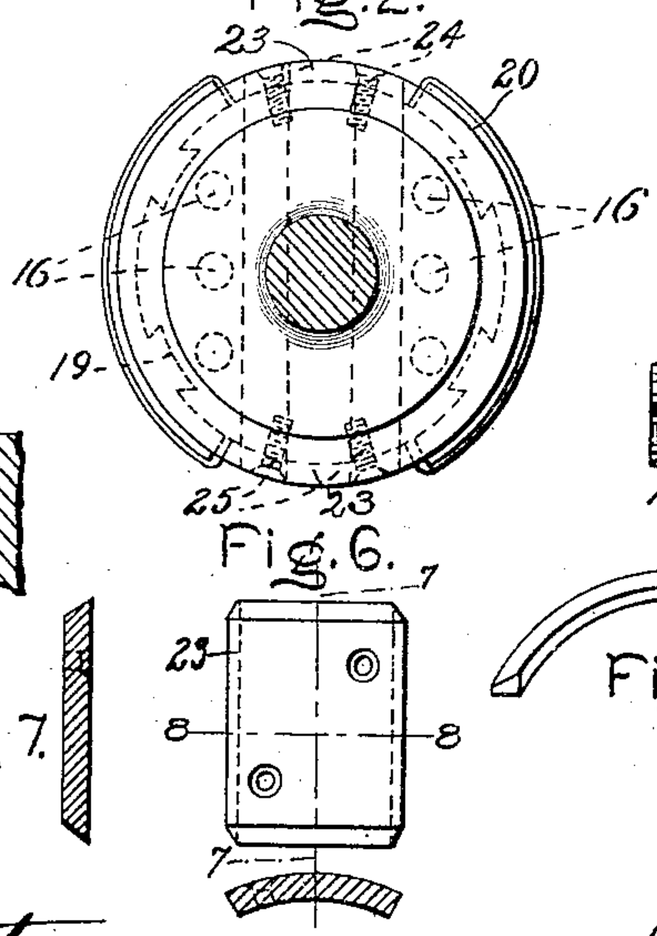

Fig. 4.

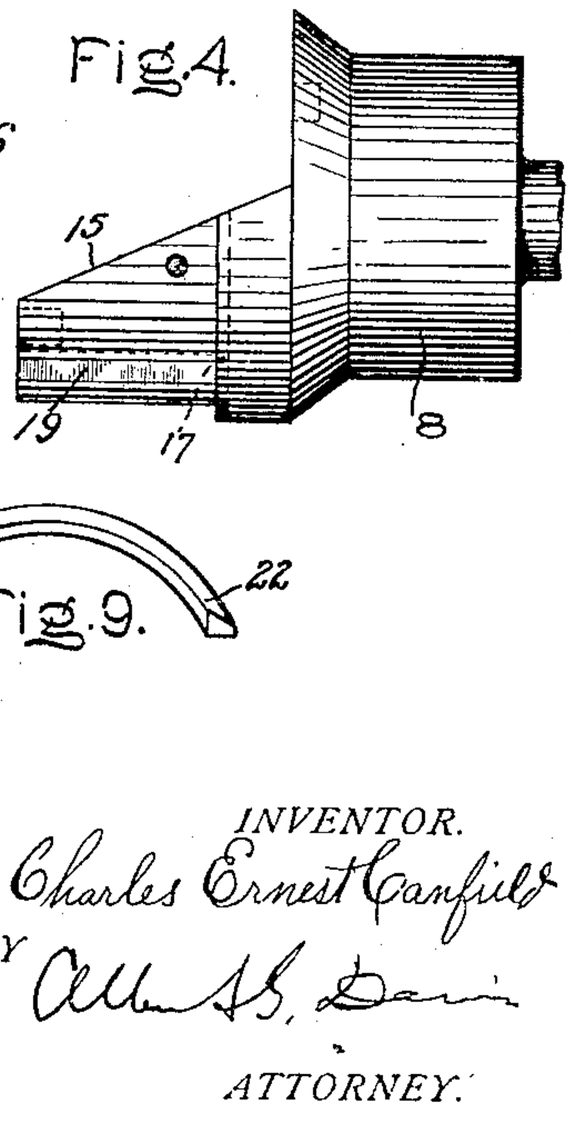

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8

Fig. 9.

WITNESSES:

George J. Thornton.

Helen Oxford

INVENTOR.

Charles Ernest Canfield

BY Allen S. Davis

ATTORNEY.

UNITED STATES PATENT OFFICE.

CHARLES E. CANFIELD, OF NORWOOD, OHIO, ASSIGNOR TO STANLEY ELECTRIC MANUFACTURING COMPANY, OF PITTSFIELD, MASSACHUSETTS, A CORPORATION OF NEW JERSEY.

DYNAMO-ELECTRIC MACHINE.

No. 876,943. Specification of Letters Patent. Patented Jan. 21, 1908.

Application filed June 8, 1904. Serial No. 211,576.

To all whom it may concern:

Be it known that I, CHARLES E. CANFIELD, a citizen of the United States, residing at Norwood, county of Hamilton, State of Ohio, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a specification.

The object of my present invention is the production of an improved form of dynamo electric machine particularly adapted for use at high speeds such as are common when the machine is directly connected to steam turbines or the like.

The various novel features of construction and arrangement 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 description and drawings in which I have described and illustrated one embodiment of my invention.

Of the drawings, Figure 1 is an elevation with parts broken away and in section showing an inductor alternator embodying my invention; Fig. 2 is a plan of the revolving member with the upper shaft portion or trunnion in section; Fig. 3 is an elevation of the non-magnetic separating piece; Fig. 4 is an elevation of the lower core frame member; Fig. 5 is a partial sectional elevation on a plane passing through the axis of rotation of the movable member parallel to the plane of projection in Fig. 1; Fig. 6 is an elevation of the cover plate; Fig. 7 is a section on the line 7 7 of Fig. 6 looking to the right; Fig. 8 is a section on the line 8 8 of Fig. 6 looking downward; and Fig. 9 is a perspective view showing one of the retaining wedges or space-blocks.

Referring to the drawings, 1 represents a cylindrical casing or shell of magnetic material which incloses the windings and revolving element of a dynamo electric machine and forms part of the magnetic circuit of the machine. This shell may be apertured at 2 for purposes of ventilation and is provided with supporting feet 3 and may be divided at 1′. At the lower end of the shell proper a horizontal annular portion 4 is found. Brackets 5 of non-magnetic material carried on the upper side of the horizontal portion 4 near its outer periphery support the laminated annular core 6 which may be constructed in the usual manner and provided with windings of the usual form found in machines provided with an internal revolving field magnet.

The revolving member of the machine illustrated comprises a pair of end pieces or members 8 and 9 formed of magnetic material and a separating member 10 of non-magnetic material, the magnetic material and the non-magnetic material having the same specific gravity. The member 10 comprises a pair of parallel portions 11 and 12 which are in forms of the segments of cylinders. These are connected by an inclined portion 13. The end member 8 is formed with a transverse flat surface against which the lower surface of the portion 12 of the member 10 abuts, and with an inclined flat surface 15 against which the lower side of the portion 13 of the member 10, as seen in Fig. 3, abuts. The upper end of the member 8 is flat and abuts against the under surface of the portion 11 of the member 10. The member 9 is similar in construction to the member 8 and fits against the upper side of the member 10 in the same manner that the end member 8 fits against the under side of the member. Dowel pins or bolts 16 extending parallel to the axis of the element pass through the portions 11 and 12 of the member 10 into recesses formed for the purpose in the end members 8 and 9.

In constructing the revolving element the surface of contact between the members 8 and 9 and the member 10 are first trued up and the parts are then assembled with the dowel pins or bolts in place. The assembled construction is then turned into a solid of revolution and circumferentially under-cut grooves 17 and 18 are formed in the end piece 8 and member 10 and in end piece 9 and member 10 respectively. The parts are then disassembled and a pair of undercut grooves 19 extending parallel to the axis of the elements are formed in the cylindrical side of each of the overlapping portions of

the members 8 and 9. Between the grooves 17 and 18 arc-shaped laminæ 20 formed with tenons which dovetail into the grooves 19 are assembled to form polar projections 21 and 21′ respectively. Retaining wedges or space-blocks 22 shaped in cross-section as shown in Fig. 9 are employed to fill the grooves 17 and 18 adjacent the polar portions 21 and 21′. The space-blocks 22 which are adjacent the separating member 10 are formed of non-magnetic material similar to that out of which the member 10 is made, while the space-blocks which are adjacent the end sections 8 and 9 respectively are formed of magnetic material. Cover plates or filling pieces 23 extend between the adjacent edges of the polar projections. The ends of the cover plates 23 are beveled to enter the grooves 17 and 18. Screws 24 and 25 pass through each cover plate into the end members 8 and 9 respectively and serve to lock the end members against longitudinal movement. Displacement of the parts by the centrifugal forces resulting from the rotation of the element are resisted by the dowel pins or bolts 16 and by the engagement of the beveled ends of the cover plates with the under-cut surfaces forming the walls of the grooves 17 and 18. Annular magnetizing coils 26 for the revolving element are carried within the casing by the top and bottom walls thereof in any suitable manner as by bolts 27 and end plates 28.

The lower end of the end member 8 is cylindrical and is separated by a thin vertical air space or gap 29 from the inner periphery of the annular portion 4 of the frame. The upper end of the core member 9 is separated from the under side of the top portion of the shell 1 by a thin horizontal air gap or space 30 as the aperture centrally formed in the upper portion of the shell is only large enough to receive, with the proper amount of clearance, the shaft section or trunnion 31 carried by the upper end member 9. Assuming that both of these coils tend to produce a flux passing in an upward direction, the magnetic circuit of the machine is as follows: from the portion 4 of the shell through the vertical air gap 29 to the end member 8; thence through the pole portion 21′ and vertical air gap 32 to the armature 6; from the armature 6 back through the air gap 32 through the pole portion 21 to the end member 9; and thence through the horizontal air gap 30 to the upper portion of the shell, from which it passes through the cylindrical portion of the shell to the portion 4. The passage of the magnetic flux from the end member 8 directly to the end member 9 is prevented by the non-magnetic character of the cover plate 23 and filling member 22, the length of the path through the non-magnetic portion of the revolving element being very much greater than twice the length of the air gap between each pole piece and the armature. As the air gap between the end member 9 and the top of the shell or casing is horizontal the weight of the revolving element may be substantially supported by the magnetic forces tending to shorten this air gap, these forces not being balanced by similar forces tending to shorten the other air gaps since the latter are at right angles to the first.

An important feature of my invention consists in the use of a material out of which the non-magnetic filler 10 and the non-magnetic wedges 22 are made, having the same specific gravity as the end members 8 and 9, such as aluminium bronze of the proper composition. By reason of this choice the parts are all in perfect balance, which is a necessary arrangement when the machine is intended to operate at high speed.

As will be readily understood by those skilled in the art, the revolution of the revolving element will generate electromotive force in any suitable winding which may be placed in the armature 6.

By the construction described a very strong and compact revolving element is produced which is very well adapted to resist the centrifugal stresses produced at high speeds. Moreover the construction is such as to insure a very low peripheral velocity for a machine having a given output.

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

1. In a dynamo electric machine, a revoluble element comprising a pair of end pieces of magnetic material, a member of non-magnetic material arranged diagonally between said end members, and bolts or keys extending through said non-magnetic material into said end members.

2. In a dynamo-electric machine, a revoluble element comprising a pair of end members formed of magnetic material, and a diagonally-extending member of non-magnetic material between said end members, said non-magnetic material having the same specific gravity as the magnetic material.

3. In a dynamo-electric machine, a balanced revoluble element partly formed of magnetic material and non-magnetic material, said non-magnetic material being unsymmetrically placed with respect to the axis of revolution of the element and having the same specific gravity as the magnetic material.

4. In a dynamo-electric machine, a balanced revoluble element comprising a portion or portions of magnetic material, and a portion of aluminium bronze of the same specific gravity as the magnetic material unsymmetrically placed with respect to the axis of revolution of the element.

5. In a dynamo electric machine, a rev-

oluble element, symmetrically dimensioned with respect to the axis of revolution and composed partly of magnetic material and partly of non-magnetic material, the non-magnetic being unsymmetrically placed with respect to the axis of revolution and having the same specific gravity as the magnetic material.

6. In a dynamo-electric machine, an element revolving about a vertical axis, three parallel branches of the magnetic circuit of the machine extending transversely to said axis, a horizontal air gap between one of said branches and the element, through which the working flux of the machine passes, and vertical gaps between the other branches and the element.

7. In a dynamo-electric machine, a revolving element comprising a pair of overlapping end pieces of magnetic material, a separating member of non-magnetic material, a circumferentially-extending under-cut groove being formed in one of said end members and said separating member, and a similar groove being formed in the other of said end members and said separating member; and cover plates each having one end extending into one of said grooves and the other end extending into the other of said grooves.

8. In a dynamo-electric machine, a revolving element comprising a pair of overlapping end pieces each formed with a recess and a connecting member having portions extending into said recesses, and means for securing said connecting member to each of said end members.

9. In a dynamo-electric machine, a revolving element comprising a pair of overlapping end pieces each having a recess formed in it and a connecting member, portions of which project into said recesses, said recesses and projecting parts being formed to prevent movement of the connecting member away from the axis of said element, and means for securing each of said end members and said connecting member.

10. A revolving element comprising a pair of overlapping members suitably connected and formed with recesses extending into said members in a direction of the axis of said element, a plate or plates extending at opposite ends into the recesses in the respective members, and means for fastening said plate or plates to said members.

11. A revolving element, comprising a pair of overlapping members suitably connected and formed with recesses extending into said members in the direction of the axis of said element, filling pieces extending into said recesses, and bolts or pins extending through said filling pieces into said members and at an angle to said axis.

12. In a dynamo-electric machine, a revolving element comprising a pair of end pieces having overlapping portions of magnetic material, a separating member of non-magnetic material, a circumferentially-extending under-cut groove being formed in one of said end members and said separating member, and a similar groove being formed in the other of said end members and said separating member, laminated polar portions being secured on said overlapping portions, space blocks filling the grooves at opposite ends of said polar portions, and cover plates each having one end extending into one of said grooves and the other end extending into the other of said grooves.

13. In a dynamo-electric machine, a revolving element comprising a pair of end pieces having overlapping portions of magnetic material, a separating member of non-magnetic material, a circumferentially-extending under-cut groove being formed in one of said end members and said separating member, a similar groove being formed in the other of said end members and said separating member, laminated polar portions being secured on said overlapping portions, space blocks filling the grooves at opposite ends of said polar portions, cover plates each having one end extending into one of said grooves and the other end extending into the other of said grooves, and bolts passing through each of said cover plates into each of said end members.

14. In a dynamo electric machine, a revolving element comprising a circumferentially recessed member, segmental pole-pieces distributed within said recess, and filling pieces arranged within said recess and between adjacent edges of said pole pieces.

15. In a dynamo electric machine, a revolving element comprising a circumferentially recessed member, segmental laminated pole-pieces distributed within said recess, and filling pieces composed of non-magnetic material arranged within said recess and between adjacent edges of said pole pieces.

16. In a dynamo electric machine, a revolving element comprising a member having an undercut recess extending circumferentially thereof, and segmental pole-pieces and complementary segmental space-blocks arranged within said recess and extending into the undercut portion thereof.

17. In a dynamo electric machine, a revolving element comprising a member having an undercut recess extending circumferentially thereof, said member being divided along a plane passing through said recess, and segmental pole-pieces and complementary segmental space-blocks arranged within said recess and extending into the undercut portion thereof.

18. In a dynamo-electric machine, a revolving element comprising a member hav-

ing an undercut recess extending circumferentially thereof, said member being divided along a plane passing through said recess, segmental pole-pieces and complementary segmental space-blocks arranged within said recess and extending into the undercut portion thereof, filling pieces between adjacent edges of said pole-pieces, and means for securing said filling pieces to each of the sections of said divided member.

In witness whereof, I have hereunto set my hand this third day of June, 1904.

CHARLES E. CANFIELD.

Witnesses:

CHARLES E. LORD,

LOUIS C. NICHOLS.