No. 823,566 PATENTED JUNE 19, 1906.

W. L. WATERS.

DYNAMO ELECTRIC MACHINERY.

APPLICATION FILED SEPT. 24, 1904.

3 SHEETS—SHEET 1

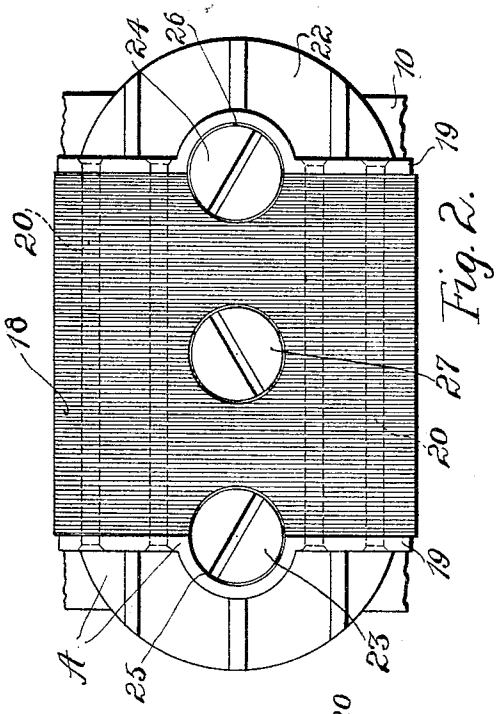


Fig. 2.

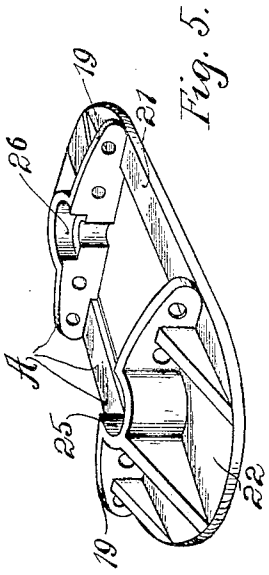


Fig. 5.

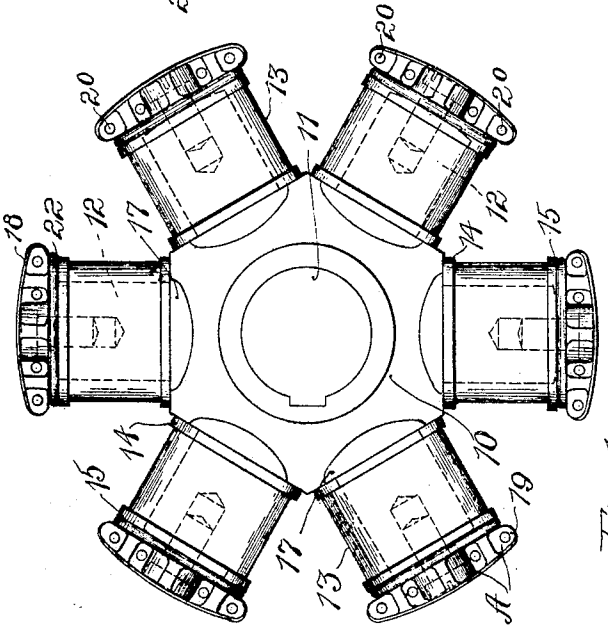


Fig. 1.

Witnesses:

Arthur H. Boettcher.

Charles J. Schmidt.

Inventor

William L. Waters

By Charles A. Brown

Attorney.

No. 823,566. PATENTED JUNE 19, 1906.

W. L. WATERS.

DYNAMO ELECTRIC MACHINERY.

APPLICATION FILED SEPT. 24, 1904.

3 SHEETS—SHEET 2.

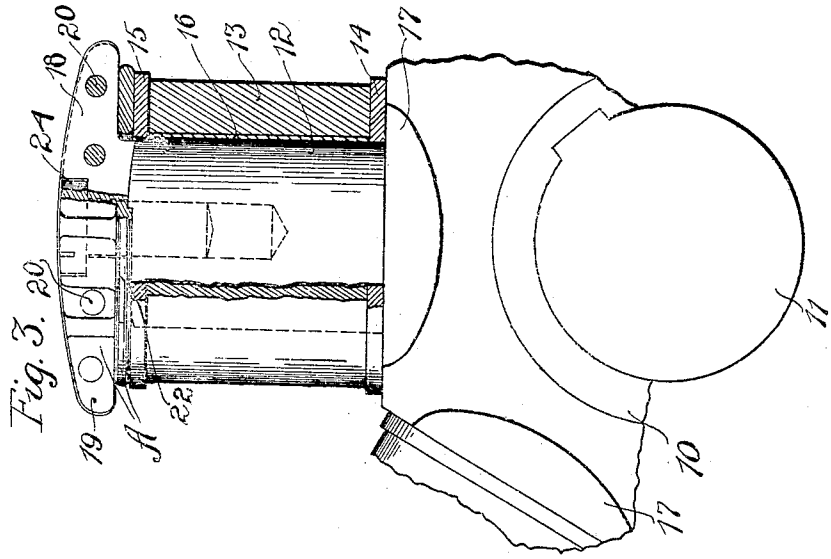


Fig. 3.

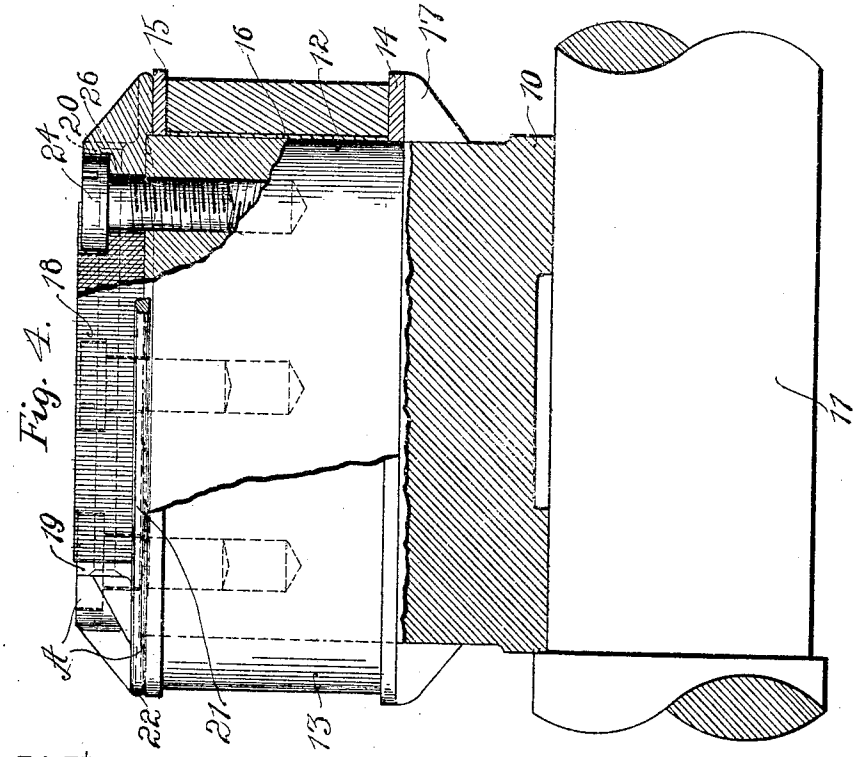


Fig. 4.

Witnesses:

Arthur H. Boettcher,

Charles J. Schmuck.

Inventor

William L. Waters

By Charles A. Brown

Attorney.

No. 823,566. PATENTED JUNE 19, 1906.

W. L. WATERS.

DYNAMO ELECTRIC MACHINERY.

APPLICATION FILED SEPT. 24, 1904.

3 SHEETS—SHEET 3

Fig. 4.

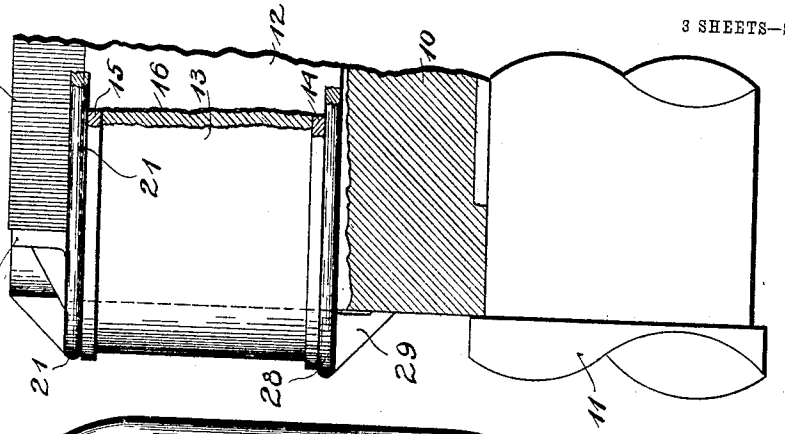


Fig. 5.

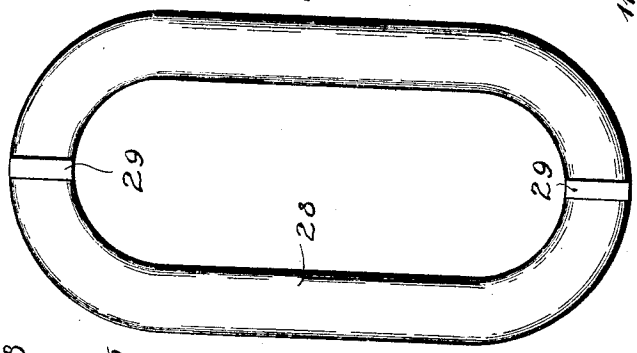
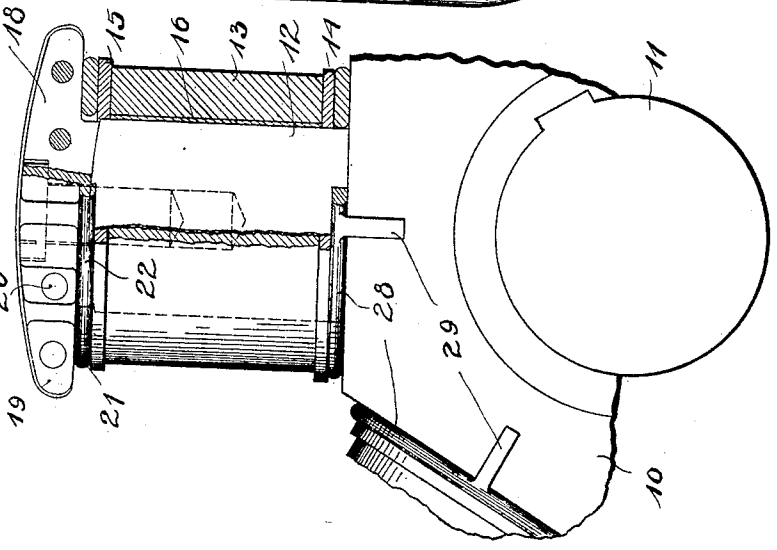


Fig. 6.



Witnesses:

Arthur H. Boettcher,

Charles J. Schmidt,

Inventor

William L. Waters

By Charles A. Brown

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM L. WATERS, OF MILWAUKEE, WISCONSIN.

DYNAMO-ELECTRIC MACHINERY.

No. 823,566. Specification of Letters Patent. Patented June 19, 1906.

Application filed September 24, 1904. Serial No. 225,733.

To all whom it may concern:

Be it known that I, WILLIAM L. WATERS, a subject of the King of England, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Dynamo-Electric Machinery, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to dynamo-electric machinery, and particularly to an improved mechanical construction for pole-pieces.

While the improved construction contemplated by my invention may be used in conjunction with stationary pole-pieces, it is of greatest utility when applied to revolving field-magnets having salient pole-pieces, such as are now frequently employed in alternating-current machines. A well-known type of alternator is provided with a revolving field-magnet having salient pole-pieces, each pole-piece being provided with a field-magnet coil. For commercial reasons it is desirable to cast the larger part of this field-magnet of mild or special magnet-steel. When such a casting is employed, however, it is found desirable to provide the pole-pieces with laminated pole-faces, the tips of the laminæ forming the pole-pieces extending beyond the sides of the cast pole-pieces. The rotation of the field-magnet causes centrifugal forces to act upon these laminated pole-pieces, tending to distort them. It has heretofore been found difficult to provide these laminated pole-faces with sufficient rigidity to withstand the centrifugal forces, especially when the machine is running; and it is the object of my invention to provide a laminated pole-face and associated retaining means for holding the pole-faces securely and firmly in position under all the required conditions of operation.

In accordance with my invention I provide a cradle consisting of two end plates, between which the laminæ of the pole-faces are clamped, the laminæ being held securely in position by means of rivets passing from one end plate to the other. The end plates of the cradle are fastened together in the preferred embodiment of my invention not only by means of the rivets passing through the laminæ, but also by means of cross-rods, which must be cast integrally with the end plates of the cradle. The cradle itself forms a support or wall for one end of the coil wound upon the pole-piece proper and serves also to retain the laminated pole-face firmly in position upon the pole-piece and to prevent its distortion, both while being secured in position and afterward when the machine is set in motion.

The preferred form of my invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 illustrates in end elevation a revolving field-magnet equipped with my invention. Fig. 2 is an end view of one of the pole-pieces provided with a laminated pole-face. Fig. 3 is an enlarged view in end elevation of one of the pole-pieces, parts being broken away to more clearly reveal the interior construction. Fig. 4 is a side elevation of the pole-piece shown in Fig. 3, parts being broken away to show the interior construction. Fig. 5 is a perspective view of the cradle which forms a part of my invention. Fig. 6 is an enlarged view in end elevation of a modified form of pole-piece, parts being broken away to show the interior construction. Fig. 7 is a side elevation of part of a modified form of pole-piece, parts being broken away to show the interior construction; and Fig. 8 shows a field-coil-supporting ring.

In all these figures similar reference characters are applied to like parts.

In the drawings the hub of the revolving field-magnet is shown at 10, mounted upon the shaft 11. Projecting radially outward from the hub 10 are a plurality of pole-pieces 12 12. The pole-pieces may be cast integrally with the hub portion 10, if desired. Upon each of the pole-pieces is wound a coil 13, each coil being previously formed upon a spool comprising the end plates 14 and 15, of vulcanite or other insulating material, and the shell 16, which when the coil is in position serves to insulate the conductors from the pole-piece. A series of lugs or brackets 17 17 is cast upon the hub portion, these brackets serving to support the inner ends of the coils and their spools. The sides of the pole-pieces are rounded, as indicated in Fig. 4, where one of the windings is broken away to show the pole-piece within. The laminæ forming the pole-face with which each pole-piece is equipped are shown at 18. These laminæ, as will be understood by those skilled in the art, are in the nature of soft sheet-iron punchings packed closely together and held in position between the end plates 19 19 of the cradle A. The outer ends of the pole-pieces 12 should

be turned, as best illustrated in Fig. 3, the laminæ being punched or bored at their inner edges to fit closely the outer ends of the pole-pieces. The rivets or bolts 20 20 extend through the laminæ from one end plate to the other, in which they are fastened. Extending between the end plates 19 and 19 are a pair of cross-rods 21 21, these rods serving to determine the distance between the inner sides of the end plates 19, giving to the cradle a certain degree of rigidity which assists in preventing distortion of the laminæ held thereby. The flange 22 extends outwardly from either end plate 19, this flange serving as a retaining-wall for the coil upon the associated pole-piece. The round-headed cap-screws 23 and 24 each pass through a hole drilled between the laminæ and an end plate and into the associated pole-piece, as best illustrated in Fig. 4.

As shown in Fig. 5, the cradle is provided with recessed lugs 25 and 26, each intended for the reception of a cap-screw. Additional cap-screws—as, for instance, that marked 27—may be inserted through the laminæ at intermediate points and screwed into a suitable hole in the pole-piece. The rotation of the field-magnet causes a tendency of the field-magnet windings to force themselves outwardly. This tendency is resisted by the flanges and cross-bars of the cradle through which the force is transmitted to the cap-screws 23 and 24. The distortion of the laminæ interposed between the end plates is resisted by the rivets passing through the laminæ, as well as by the cap-screws secured to the pole-pieces.

Figs. 6, 7, and 8 show a modified arrangement for supporting the field-coils. Instead of employing lugs or brackets 17, cast integrally with the field-frame, I employ a supporting-ring 28, (shown in Fig. 8,) which fits over the pole-piece and which is provided at its ends with brackets 29 29, which bear against the sides of the field-hub 10. The field-coils when slipped over the field-pole rest against the supporting-rings 29, and the brackets 29 prevent the overhanging portions of the supporting-ring from bending down. The feature in these methods of mounting the field-coils on the field-poles is that the windings stand out clear of the magnet-wheel and are fully exposed to the air-currents created by the machine and are thus subjected to the full cooling action of the air. At the same time there is a perfectly solid support for the lower ends of the magnet-coils, and when the coils are placed in position and the pole-faces belted down the coils are securely held both at the top and at the bottom.

While I have herein shown and described a preferred embodiment of my invention, it will be understood and appreciated that many modifications may be employed without departing from the spirit thereof. I do not wish, therefore, to be limited to the precise construction shown; but,

Having described my invention, I claim as new and desire to secure by Letters Patent—

1. In a dynamo-electric machine, the combination with a rotating field-magnet having salient pole-pieces, of a laminated pole-shoe for each pole-piece, a cradle comprising end plates, flanges and cross-bars, the laminæ of said pole-shoe being placed between said end plates, rivets passing through said end plates and said laminæ, and cap-screws set in recesses formed in said end plates and said pole-shoe and serving to secure said pole-shoe to the associated pole-piece.

2. In a dynamo-electric machine, the combination with a rotating field-magnet having rotating pole-pieces, of a laminated pole-shoe for each pole-piece, a cradle having end plates and cross-bars, the laminæ of said pole-shoe being placed between said end plates, rivets passing through said end plates and said laminæ, and cap-screws set in countersunk holes formed in said end plates and said pole-shoe, and serving to secure said pole-shoe to said pole-piece.

3. In a dynamo-electric machine, the combination with a rotating field-magnet having salient pole-pieces, of a coil upon each of said pole-pieces, a laminated pole-shoe for each pole-piece, a cradle comprising end plates, flanges and cross-bars, the laminæ of said pole-shoe being placed between said end plates, rivets passing through said end plates and said laminæ, said flanges engaging the coil of the associated pole-piece to retain the same in position, and means for clamping said cradle to the associated pole-piece.

4. In a dynamo-electric machine, the combination with a rotating field-magnet having salient pole-pieces, of a field-magnet coil upon each of said pole-pieces, brackets to support the inner ends of said coils, a laminated pole-shoe for each pole-piece, a cradle for each shoe, said cradle comprising end plates, flanges and cross-bars, the laminæ of said pole-shoe being placed between a pair of end plates, the flanges and cross-bars of said cradle serving as the support for the outer ends of the associated field-magnet coil, rivets passing through said end plates and said laminæ, and means for securing said cradle to the associated pole-piece.

5. In combination, a rotating magnet having salient pole-pieces, a plurality of soft-iron laminæ forming a pole-face for each pole-piece, a coil wound upon each pole-piece, a frame for supporting and retaining in position the laminæ of each pole-face, said frame serving also as a support for the outer end of the associated coil, and means for securing said frame to the associated pole-piece.

6. In combination, a field-magnet having salient pole-pieces extending from a hub, the

width of said pole-pieces being substantially equal to the width of said hub, field-coils surrounding said pole-pieces, a supporting-ring disposed between each coil and said hub, and brackets extending from said supporting-rings and engaging said hub for supporting the overhanging ends of said supporting-rings and said coils.

7. In combination, a rotating field-magnet having salient pole-pieces extending from a hub, the width of said pole-pieces being substantially equal to the width of said hub, a plurality of soft-iron laminæ forming a pole-face for each pole-piece, a coil formed upon each pole-piece, a frame for supporting and retaining in position the laminæ of each pole-face and for retaining said coil in position on said pole-piece, means for securing each frame to the associated pole-piece, a supporting-ring disposed between each coil and said hub, and brackets extending from said supporting-rings and engaging said hub for supporting the overhanging ends of said supporting-rings and said coils.

In witness whereof I hereunto subscribe my name this 16th day of September, A. D. 1904.

WILLIAM L. WATERS.

Witnesses:
JOHN E. HUBEL,
W. S. MAY.