No. 681,317. Patented Aug. 27, 1901.

R. HIRSCH.

CORE AND POLE PIECE FOR FIELD MAGNETS OF DYNAMOS OR MOTORS.

(Application filed Oct. 19, 1899. Renewed June 29, 1901.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 2.

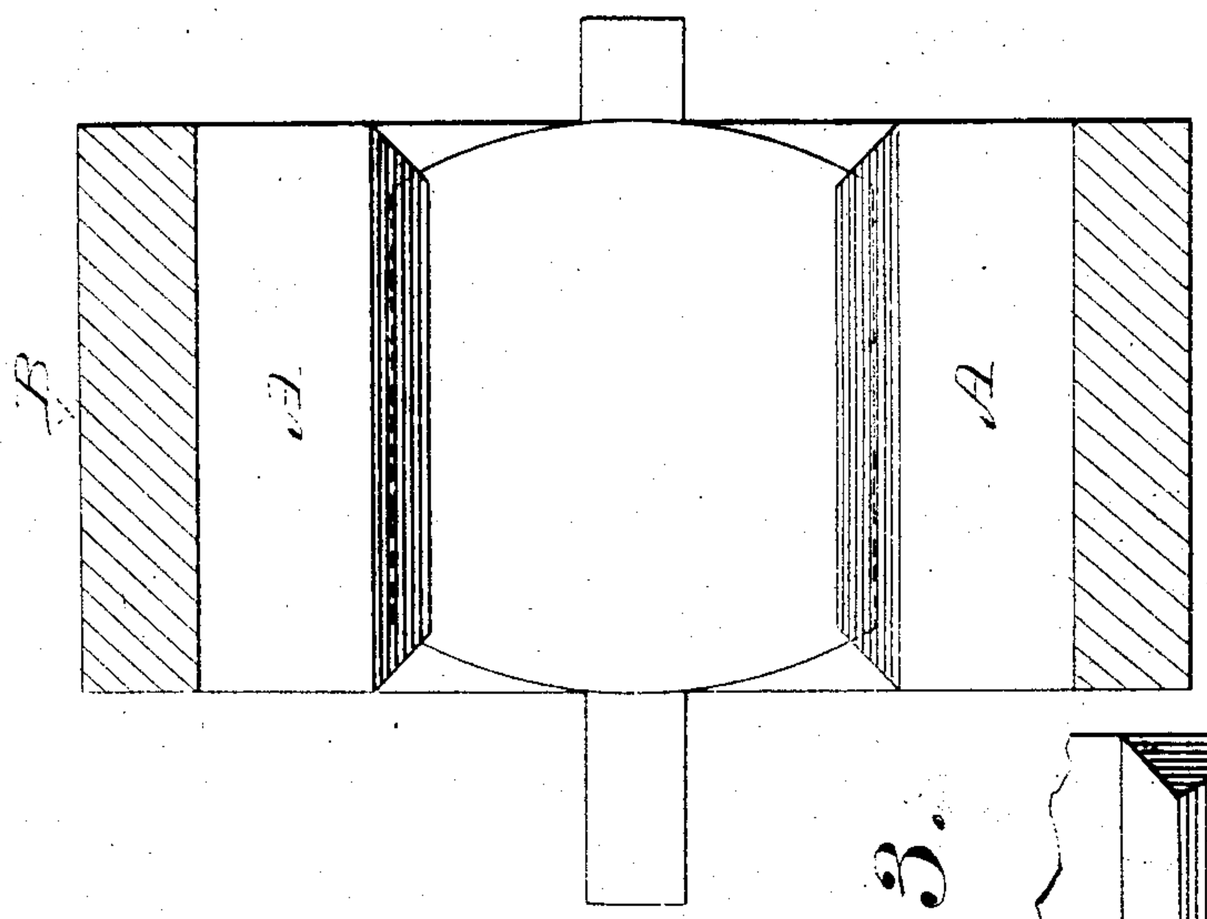

Fig. 3.

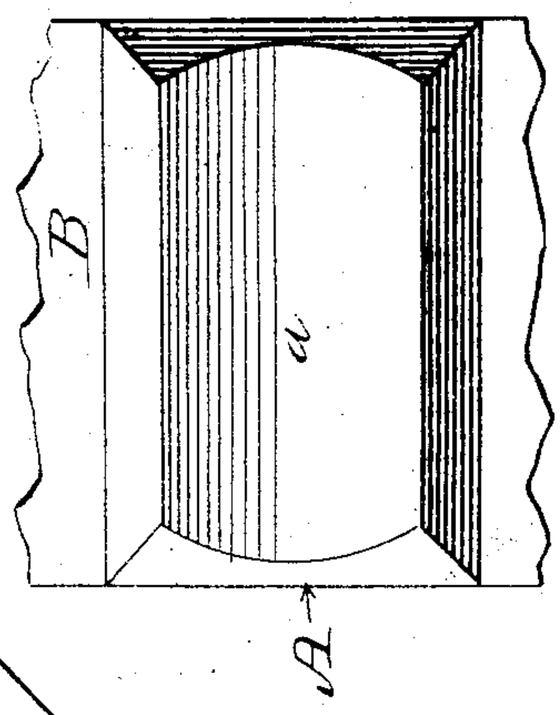

Fig. 1.

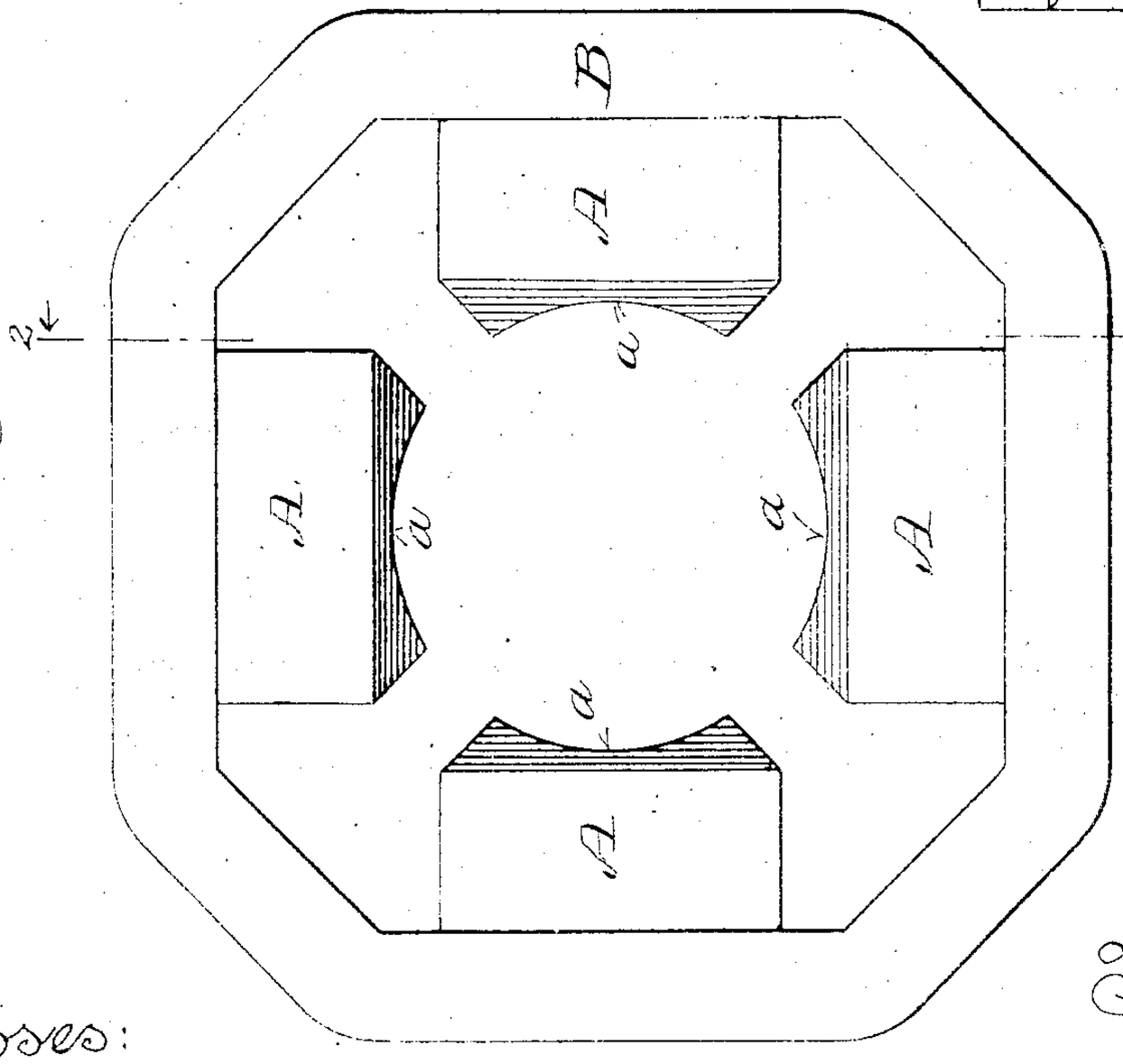

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Fig. 5.

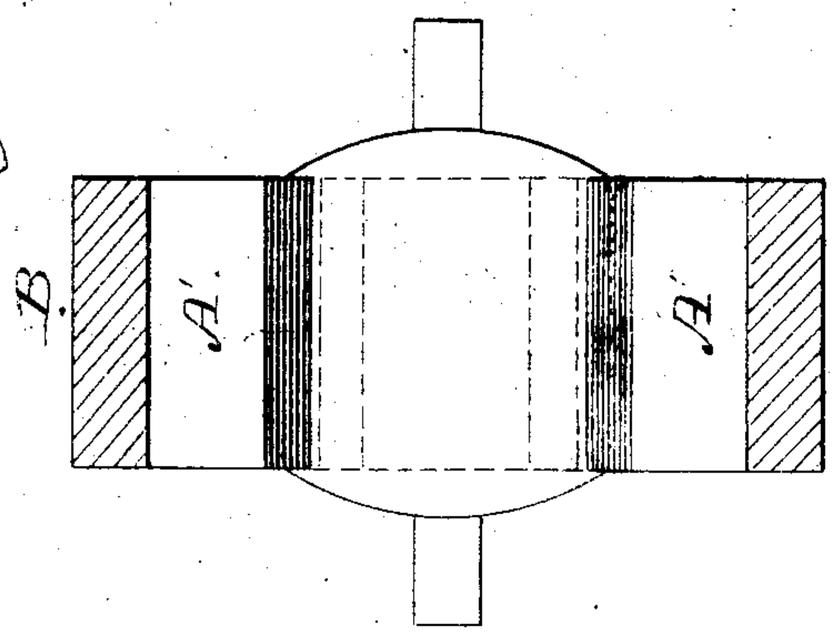


Fig. 6.

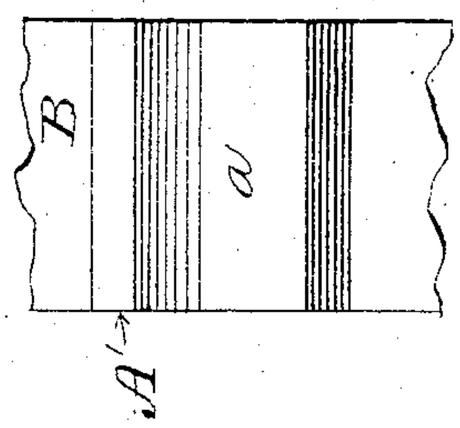


Fig. 4.

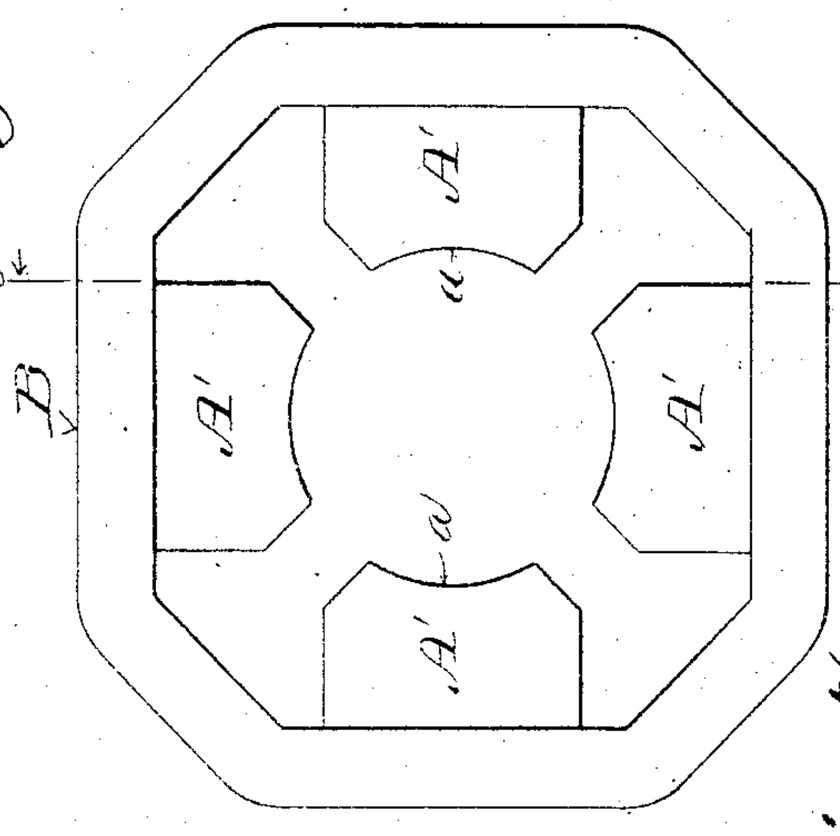


Fig. 8.

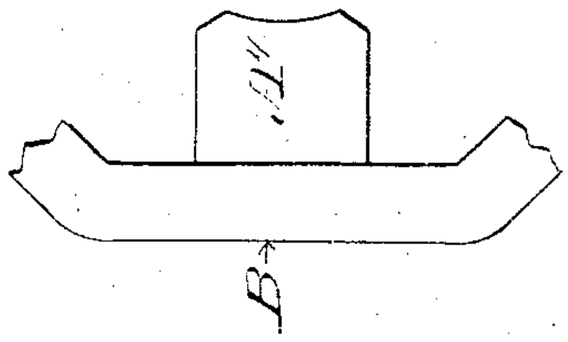
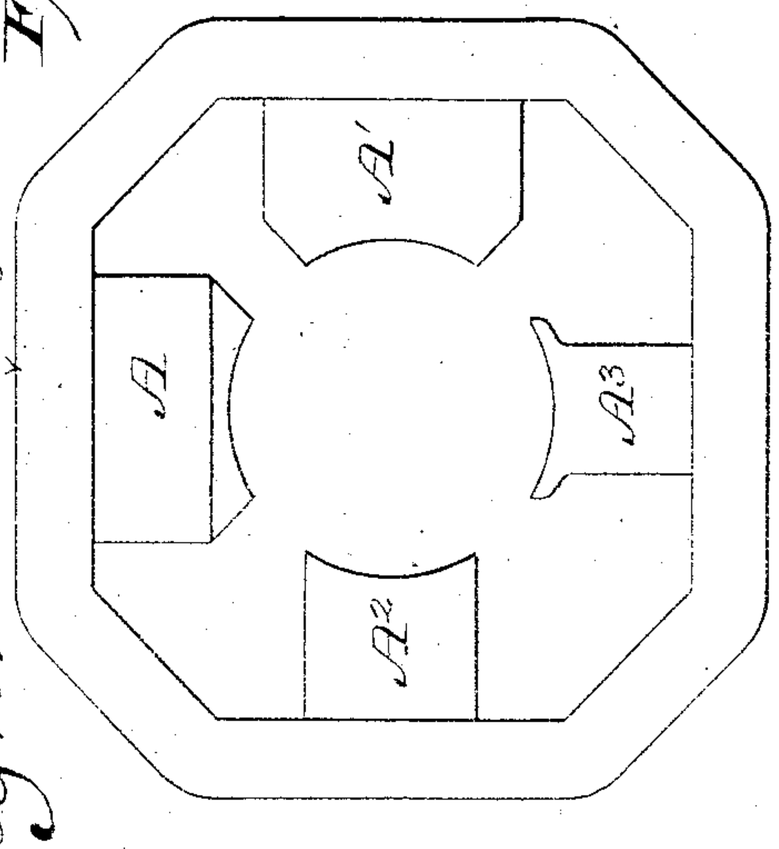


Fig. 7.



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UNITED STATES PATENT OFFICE.

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CORE AND POLE-PIECE FOR FIELD-MAGNETS OF DYNAMOS OR MOTORS.

SPECIFICATION forming part of Letters Patent No. 681,317, dated August 27, 1901.

Application filed October 19, 1899. Renewed June 29, 1901. Serial No. 66,526. (No model.)

To all whom it may concern:

Be it known that I, ROBERT HIRSCH, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Cores and Pole-Pieces for Field-Magnets of Dynamos or Motors, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The main objects of my invention are to increase the efficiency and to reduce the cost of dynamo-electric machines and motors.

It consists in certain novel features in the construction of the pole-pieces and cores of the field-magnets, as hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like letters designate the same parts in the several figures.

Figure 1 is a side elevation of the cores and pole-pieces and of the supporting-frame of a four-pole electrical machine embodying my invention. Fig. 2 is a vertical cross-section of the same in a plane parallel with the axis of the armature and indicated by the line 2 2, Fig. 1. Fig. 3 is a face view of one of the pole-pieces. Fig. 4 is a view corresponding with Fig. 1, but on a smaller scale, showing a modified form of the cores and pole-pieces of the field-magnets. Fig. 5 is a vertical section thereof on the line 5 5, Fig. 4. Fig. 6 is a face view of one of the pole-pieces shown in Figs. 4 and 5. Fig. 7 is a diagram similar to Figs. 1 and 4, showing for the purpose of comparison and explanation four pole-pieces the faces of which have the same areas, while the cross-sectional areas of the cores are different; and Fig. 8 is an end view of still another form of pole-piece and core, the cross-sectional area of the core being the same as the area of the faces of the pole-pieces shown in Fig. 7, while the area of the face is smaller.

In the construction of dynamos and motors it is considered the best practice and is customary to construct the pole-pieces to extend around or cover circumferentially about two-thirds of the armature. It has also been the practice heretofore to make the pole-pieces of a cross-sectional area not greater and oftentimes considerably less than two-thirds of the circumferential area of the armature, and sometimes the corners of the pole-pieces have been cut away in order to avoid leakage, thereby reducing the area of their faces below two-thirds of the circumferential area of the armature and to that extent reducing the magnetic effect of the field upon the armature.

It is well-known that the electromotive force of the current generated in the armature of a dynamo or motor depends primarily upon the number of ampere turns or windings in the field, the speed of the armature, and the length of armature-windings. I have found that by increasing the cross-sectional area of the pole-pieces relatively to their faces the magnetic effect of the field upon the armature will be materially increased with a given number of ampere turns or windings and that with pole-pieces and cores so constructed a current of the required electromotive force can be induced by the field in the armature of an electrical machine, particularly in machines of the smaller sizes, in which the increased efficiency is proportionately greater with a smaller number of ampere-turns, and consequently less weight of wire in the coils of the field, and with cores of smaller dimension radially than are required to induce such a current in machines as heretofore constructed.

Referring to Figs. 1, 2, and 3 of the drawings, A A designate the cores and pole-pieces, and B the frame, of a four-pole electrical machine constructed in accordance with my invention. The faces *a a* of the pole-pieces are curved in conformity with the periphery of the armature, according to the usual and better practice, and are made of an area equal to or greater than two-thirds of the circumferential area of the armature. From the faces *a a* the cores are beveled or rounded outwardly on the sides and ends, so as to increase their cross-sectional area, and wire is wound around them in any of the usual ways to form field-magnets with shunt, series, or compound windings. It will be apparent that by this increase in the cross-sectional area of the

cores and the consequent decrease in the number of ampere-turns required to produce a given electromotive force in the armature the dimension of the cores radially with respect to the armature may be considerably decreased. By thus reducing the radial dimension of the cores the dimensions of the frame B transverse to the axis of the armature are correspondingly reduced and the machine is made more compact as well as more efficient. Since an increase in the cross-sectional area of the cores, as above explained, admits of a considerable reduction in the weight of copper wire required in the field-coils to produce the required magnetic effect, the cost of construction is correspondingly reduced, since the cost of copper wire saved in the windings is much greater than the cost of the slight increase in the amount of iron in the cores. The increased magnetic efficiency of the field being due rather to the disposition or arrangement of the iron than to an increase in its volume, very little, if any, increase in the amount of iron over that employed in cores and pole-pieces of the ordinary construction will be required.

Referring to Figs. 4, 5, and 6, showing a modified construction, the cores A′ A′ are extended on the sides only and are of the same length parallel with the armature as the faces *a a*. While this construction does not increase the magnetic effect of the field to the same extent as that shown in Figs. 1, 2, and 3, it nevertheless possesses great advantages and secures much better results than the ordinary forms of construction.

To illustrate the operative efficiency under given conditions of a machine constructed in accordance with my invention and machines constructed in accordance with the practice which has heretofore been followed, I have shown in Figs. 7 and 8 pole-pieces of five different forms A, A′, A^2, A^3, and A^4, the first two being like those shown in Figs. 1 and 4, respectively. The four pole-pieces shown in Fig. 7 have faces of the same area, which, for illustration, may be assumed to be 46.155 square centimeters. The cross-sectional area of the core of the pole A is assumed to be 92.34 square centimeters; the area of the core of pole A′, 71.857 square centimeters; the area of the core of pole A^2, 46.155 square centimeters, and the area of the core of pole A^3 34.39 square centimeters. Assuming that machines are constructed with poles of the several forms shown in Fig. 7, the armatures of all being alike and turned at the rate of one thousand revolutions per minute and the field of each machine having eighteen hundred and ninety ampere-turns, the electromotive force developed in the armature of the machine having pole-pieces like A, I have found to be 29.13 volts; that developed in the machine having pole-pieces like A′, 21.04 volts; that developed in the machine having pole-pieces like A^2, 12.6 volts, and that developed in the machine having pole-pieces like A^3, 8.49 volts. A machine constructed with pole-pieces like A^4, (shown in Fig. 8,) having faces of reduced area and cores of the same cross-sectional area as the core A^2, will under the conditions assumed with respect to the forms shown in Fig. 7 develop an electromotive force in the armature of 12.33 volts.

It will be seen from the foregoing comparison that the efficiency of a machine provided with pole-pieces like those shown in Fig. 1 will be more than double that of a machine provided with pole-pieces like that shown at A^2 in Fig. 7, the most efficient form of pole-piece made, so far as I am aware, according to the present practice, and that the efficiency of a machine provided with pole-pieces like those shown in Fig. 4 will be nearly double that of a machine provided with pole-pieces like A^2.

For the purpose of illustration and explanation I have shown my invention as embodied in a four-pole machine; but it is equally applicable to machines having two or a greater number of poles and to various types of machines, and I do not wish to be understood as limiting my invention to any particular construction, except as to the construction of the pole-pieces defined in the following claims.

I claim—

1. Cores and pole-pieces for the field-magnets of dynamo-electric machines and motors, having faces of an area not less than two-thirds of the circumferential area of the armature, and a cross-sectional area greater than that of their faces, substantially as and for the purposes set forth.

2. Cores and pole-pieces for the field-magnets of dynamo-electric machines and motors, having faces of an area not less than two-thirds of the circumferential area of the armature, and extended on the sides beyond their faces so as to increase their cross-sectional area, substantially as and for the purposes set forth.

3. Cores and pole-pieces for the field-magnets of dynamo-electric machines and motors, having faces of an area not less than two-thirds of the circumferential area of the armature and extended on the sides and ends beyond their faces so as to increase their area in cross-section, substantially as and for the purposes set forth.

4. Cores and pole-pieces for the field-magnets of dynamo-electric machines and motors, having curved faces of an area not less than two-thirds of the circumferential area of the armature, and extended on the sides so as to increase their area in cross-section, their sides being beveled next to their curved faces, substantially as and for the purposes set forth.

5. Cores and pole-pieces for the field-magnets of dynamo-electric machines and motors,

having curved faces of an area not less than two-thirds of the circumferential area of the armature, and extended on the sides and ends beyond said faces so as to increase their area in cross-section, the sides and ends being beveled next to the curved faces, substantially as and for the purposes set forth.

In witness whereof I hereto affix my signature in presence of two witnesses.

ROBERT HIRSCH.

Witnesses:
CHAS. L. GOSS,
KENT H. FLANDERS.