(No Model.)

4 Sheets—Sheet 1.

J. WENSTRÖM.

DYNAMO ELECTRIC MACHINE.

No. 292,079. Patented Jan. 15, 1884.

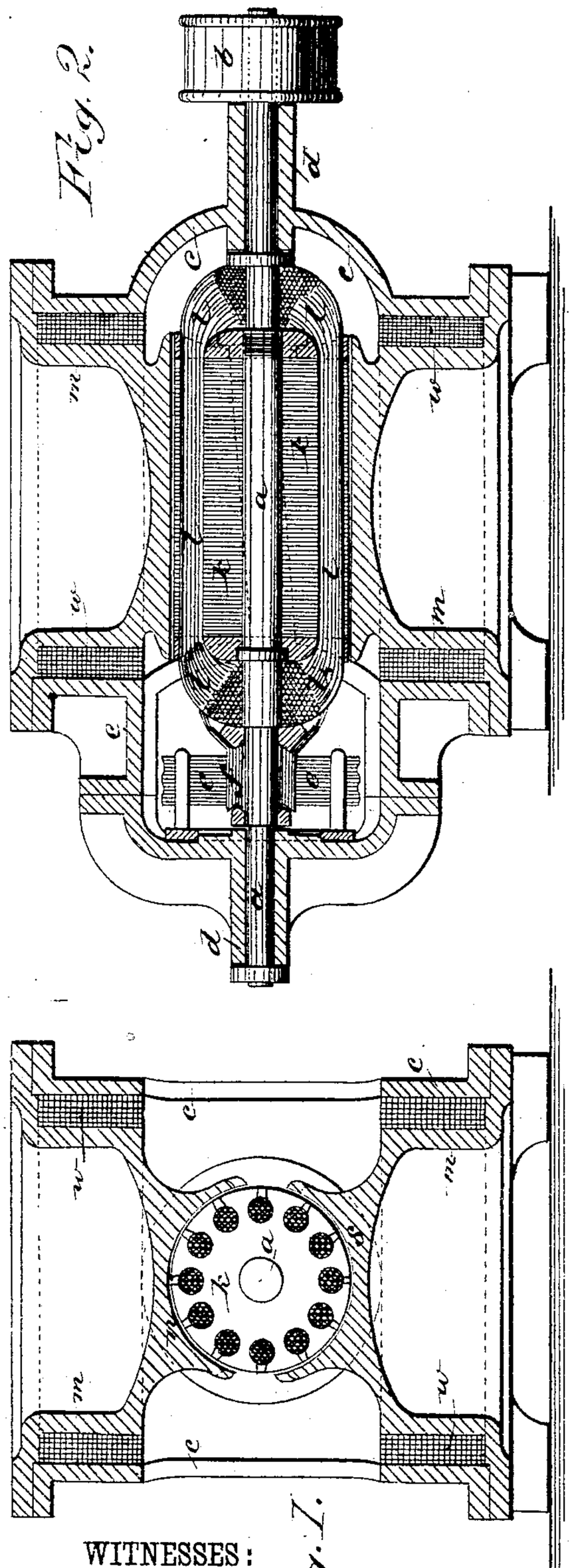

Fig. 2.

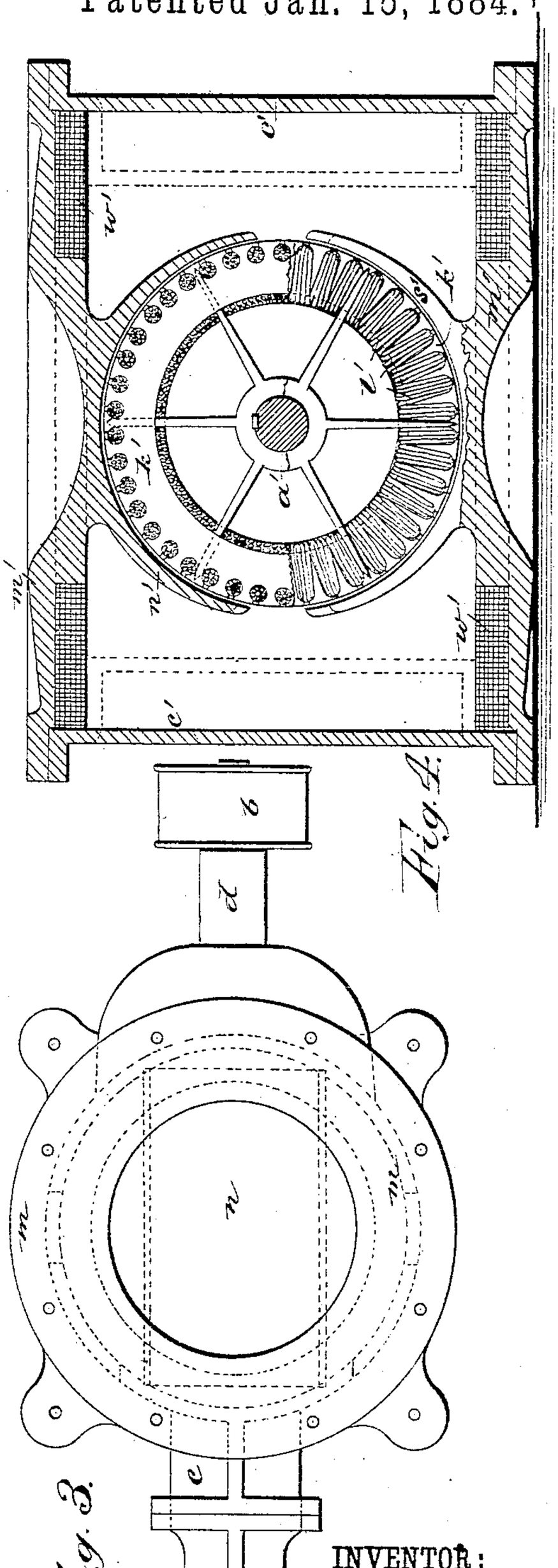

Fig. 4.

Fig. 1.

Fig. 3.

WITNESSES:

Ste Byer

C. Sedgwick

INVENTOR:

J. Wenström

Munn & Co

ATTORNEYS.

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J. WENSTRÖM.

DYNAMO ELECTRIC MACHINE.

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Fig. 5.

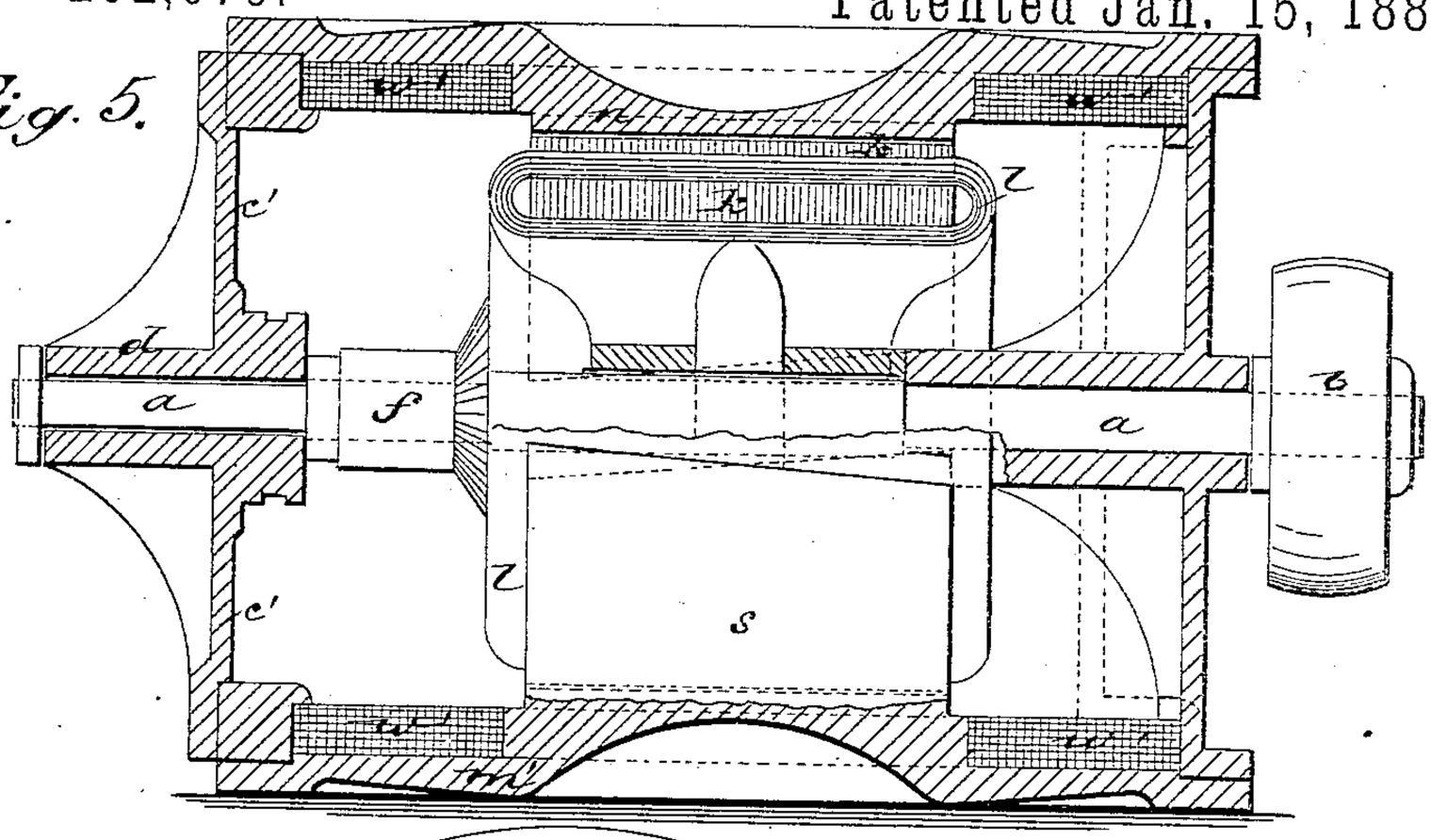


Fig. 6.

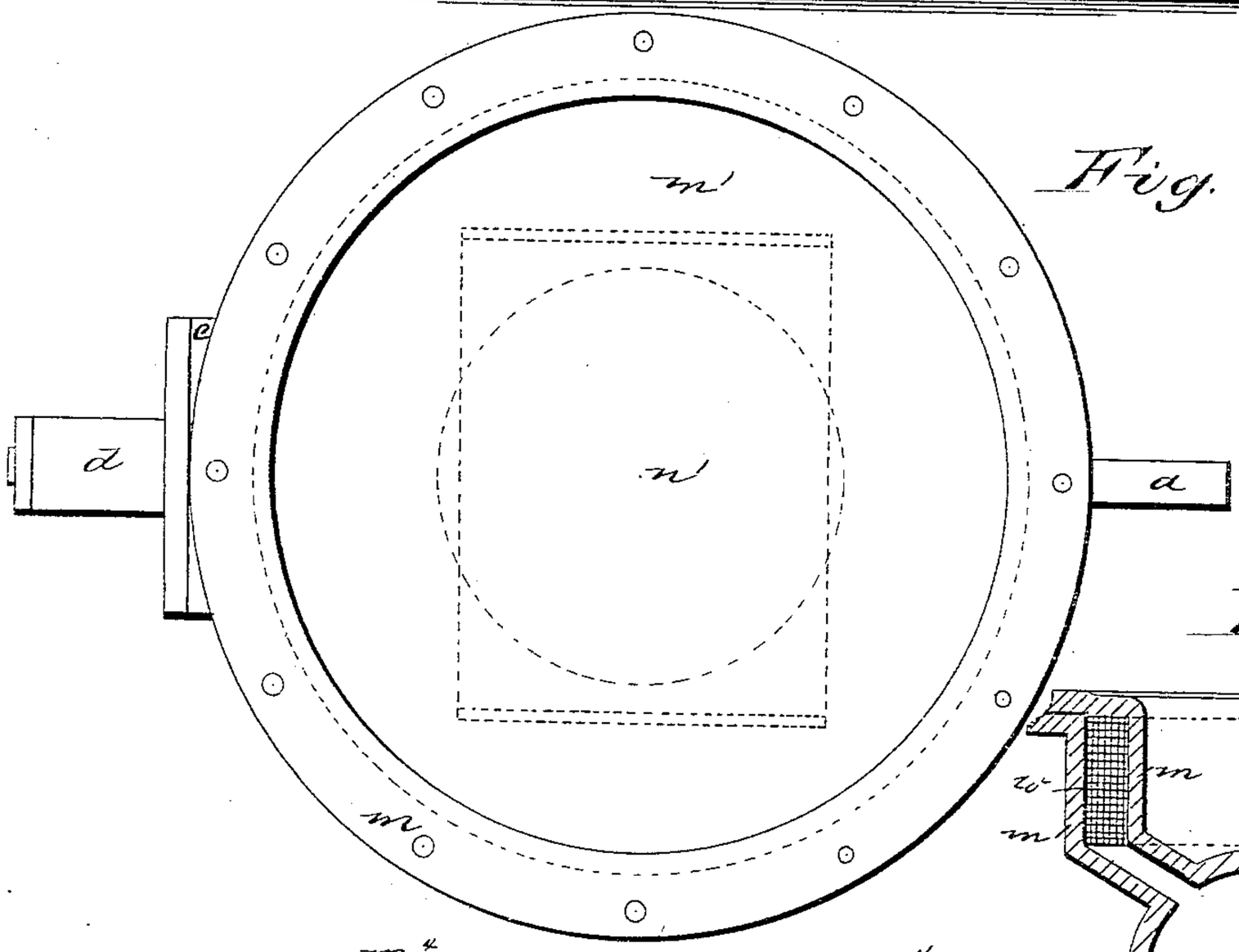


Fig. 7.

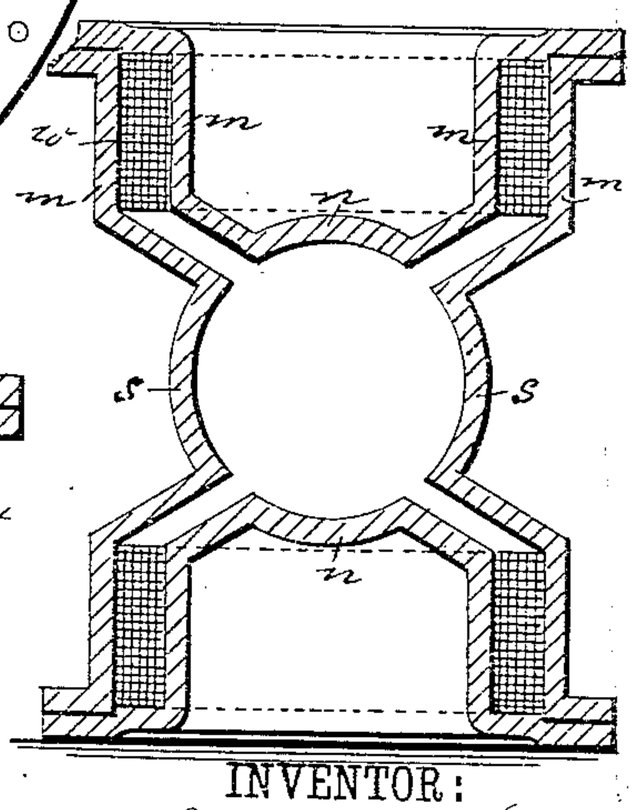
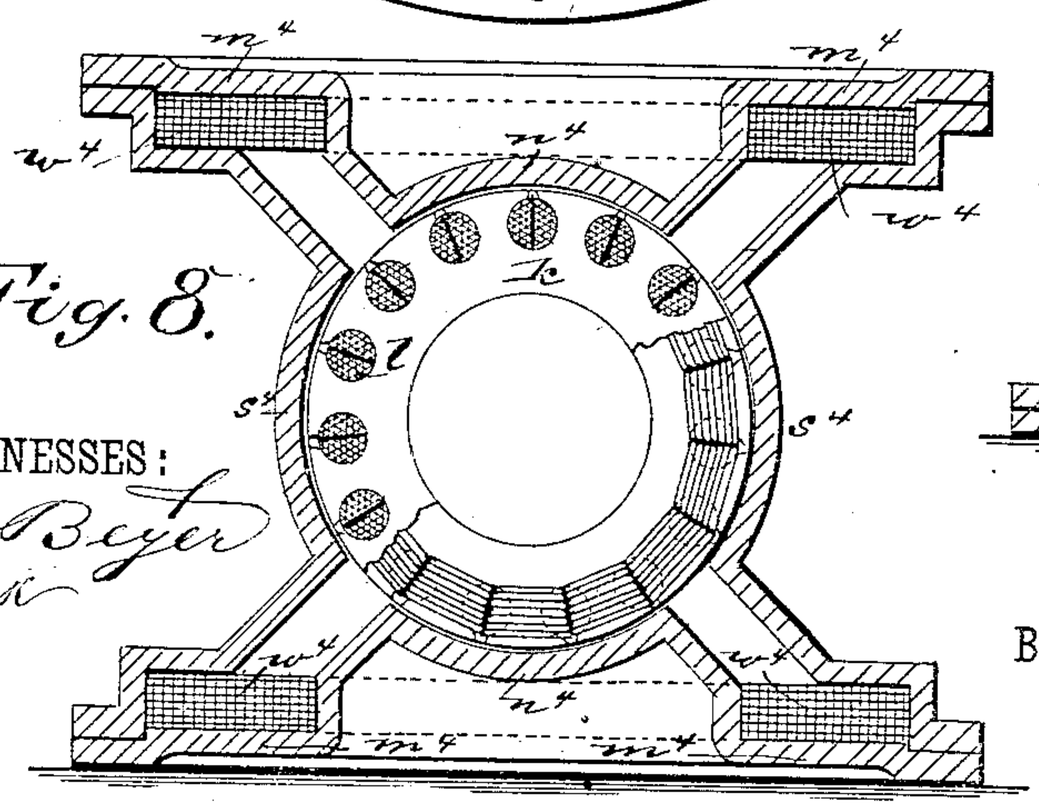


Fig. 8.



WITNESSES:

Otto Byer

C. Sedgwick

INVENTOR:

J. Wenstrom

BY Munn & Co

ATTORNEYS.

(No Model.)

4 Sheets—Sheet 3.

J. WENSTRÖM.

DYNAMO ELECTRIC MACHINE.

No. 292,079. Patented Jan. 15, 1884.

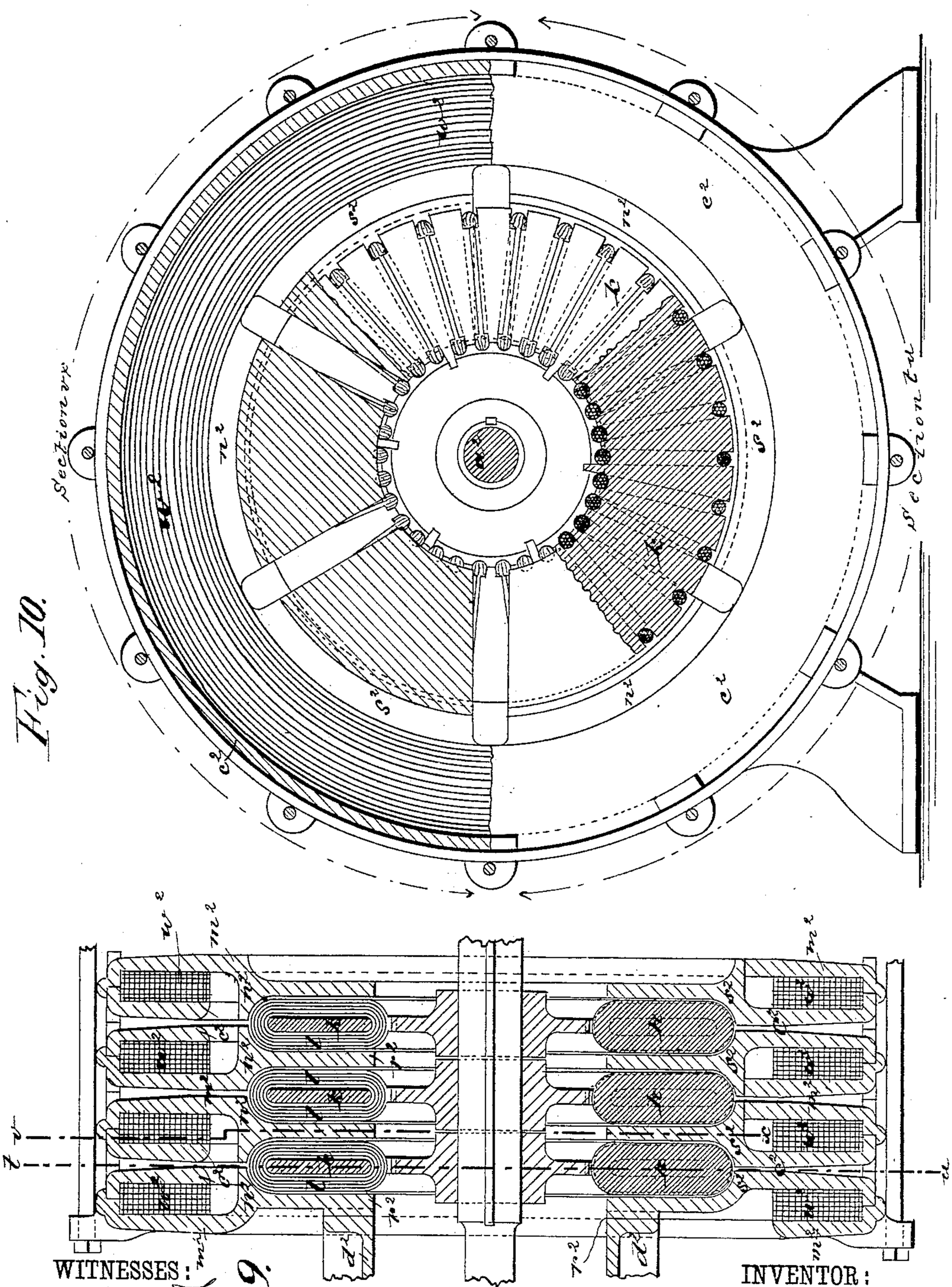


Fig. 10.

Fig. 9.

WITNESSES:

C. Ashton Beyer

E. Sedgwick

INVENTOR:

J. Wenström

BY Munn & Co

ATTORNEYS.

(No Model.)

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DYNAMO ELECTRIC MACHINE.

No. 292,079. Patented Jan. 15, 1884.

Fig. 11.

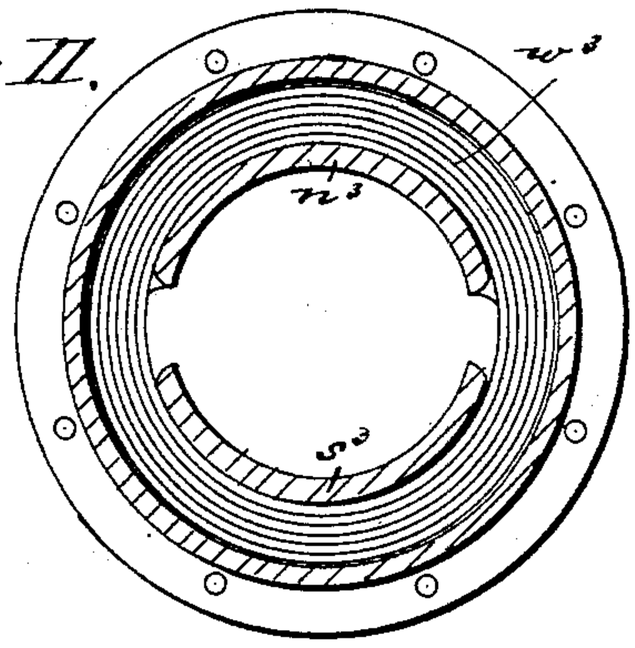


Fig. 12.

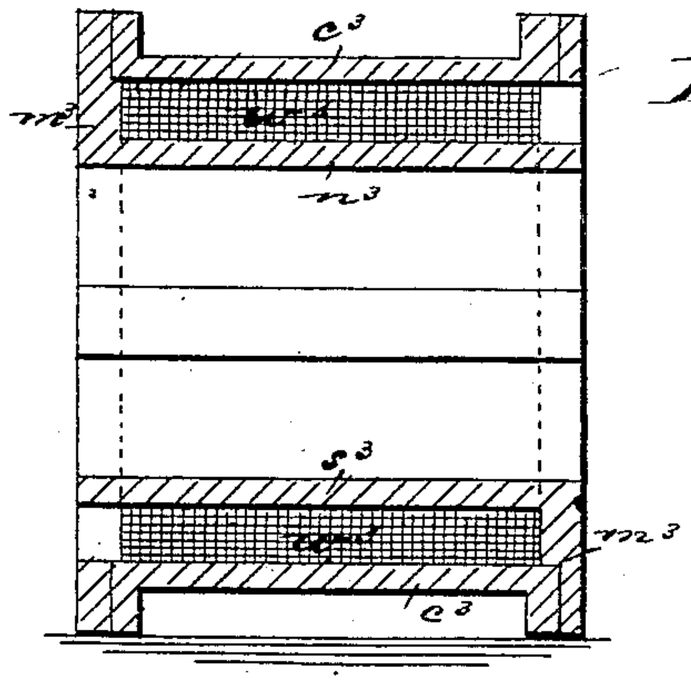


Fig. 14.

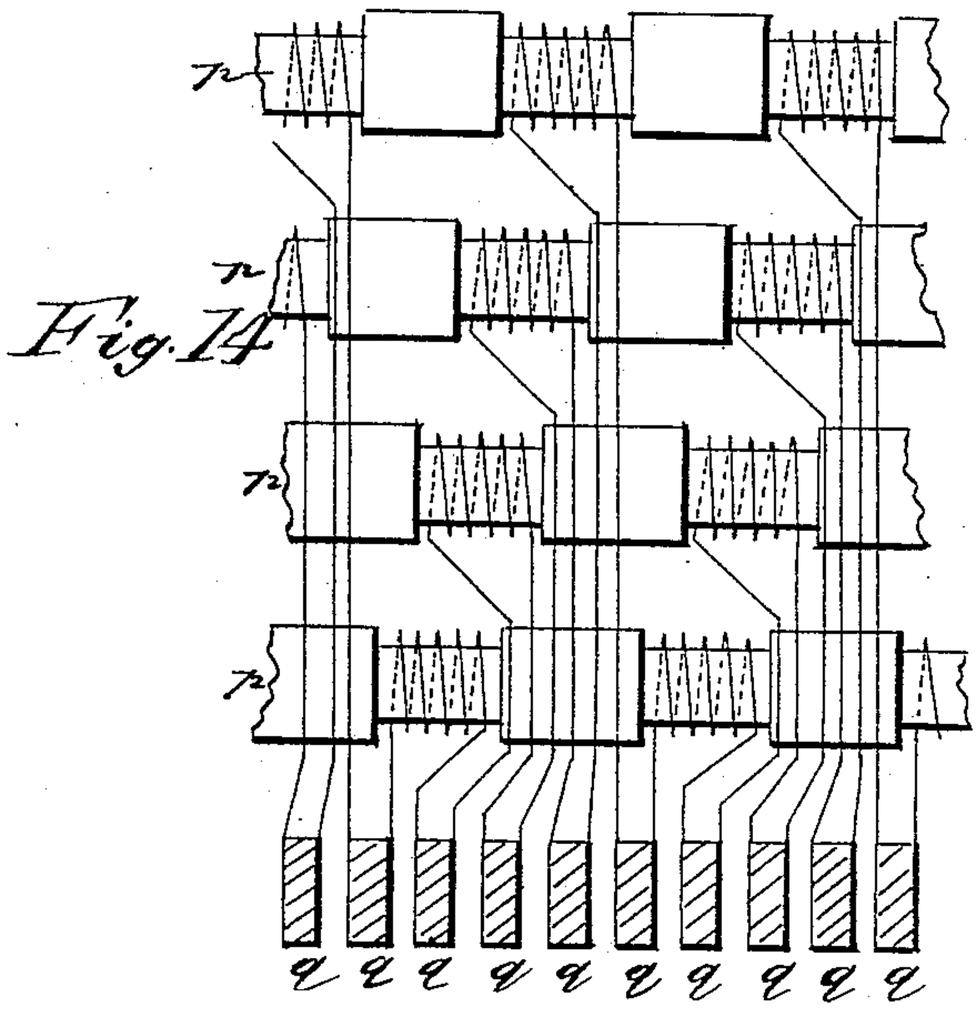
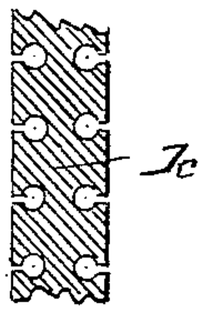


Fig. 13.



WITNESSES:

C. Sedgwick

INVENTOR:

J. Wenström

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JONAS WENSTRÖM, OF ÖREBRO, SWEDEN.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 292,079, dated January 15, 1884.

Application filed December 7, 1882. (No model.) Patented in England October 10, 1882, No. 4,819; in France November 9, 1882, No. 151,999; in Sweden November 25, 1882, No. 409; in Belgium November 27, 1882, No. 59,676; in Austria-Hungary March 28, 1883, No. 11,903 and No. 21,432, and in Norway May 23, 1883.

To all whom it may concern:

Be it known that I, JONAS WENSTRÖM, of Örebro, Sweden, have invented a new and Improved Dynamo-Electric Machine, of which the following is a full, clear, and exact description.

The object of my invention is to utilize the excited magnetism more completely than is done in machines constructed heretofore, and by so doing I am able to reduce the quantity of wire upon the field-magnets and the resistance in the same, whereby I obtain the same result with less velocity and power, and consequently at a less cost of construction and operation, than in any other machine in use heretofore.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a cross-sectional elevation of my improved dynamo-electric machine. Fig. 2 is a longitudinal sectional elevation of the same. Fig. 3 is a plan view of the same. Fig. 4 is a cross-sectional elevation of a modification of the same. Fig. 5 is a longitudinal sectional elevation of the said modification. Fig. 6 is a plan view of the said modification. Figs. 7 and 8 are cross-sectional elevations of further modifications of the machine. Fig. 9 is a cross-sectional elevation of a further modification of the armature. Fig. 10 is a longitudinal sectional elevation of the same. Fig. 11 is a cross-sectional elevation of another modification. Fig. 12 is a longitudinal sectional elevation of the same. Fig. 13 is a cross-sectional detail elevation of part of the armature-disk of the machine shown in Figs. 9 and 10. Fig. 14 shows the stepwise arrangement of the coils in the armature.

c is the frame of the machine; *d d*, the bearings; *m m*, the field-magnets; *w w*, the insulated conductor, and *n s* the magnet-poles. Between the poles the armature revolves, which is mounted on the shaft *a*, and which is formed with an iron core, *k*, and the coils *l*, in connection with the commutator *f*, where the electric current is collected by the brushes *e*. The shaft *a* is rotated by a belt running over a pulley, *b*, mounted on the said shaft *a*. The electro-magnets used heretofore generally consisted of iron cores covered with wire. In such machines a large quantity of magnetism is excited around them, and as this magnetism is not used it causes a great loss. In my improved machine, on the contrary, the bulk of wire is enveloped in iron, and the excited magnetism will in all directions meet iron for conducting it to the place where it is wanted and will be advantageous. The excited iron at the same time serves as a frame-connection between all parts of the machinery, allowing the armature to move freely between the polar surfaces. Thus my invention allows a very close proximity of the pole-pieces to the armature.

The above is the essential feature in regard to the field-magnet of my improved machine, and I have invented several ways of accomplishing the desired result.

As shown in Figs. 1 to 3, inclusive, the magnet-coils *w* are inclosed by iron cylinders *c* and *m*, which, in their extension, form the frame of the machine as well as the magnet-poles *n* and *s*. In Figs. 1 and 2 I have shown the arrangement for two poles, and in Fig. 8 I have shown the arrangement for four poles. In the device shown in Figs. 4 to 6, inclusive, the disk-formed copper coils *w'* are placed on iron plates *m'*, and, if desired, the frame-cylinders *c'* may also surround the coils, as indicated by the dotted lines in Fig. 5. Figs. 4 and 5 show a machine with two poles, and Fig. 8 shows a machine with four poles. The disk form shown in Figs. 9 and 10 has several disk-form coils inclosed in iron and placed beside each other. The circumference being subdivided in six parts, *n* indicating the north pole and *s* south pole, there are three pairs of poles. In Fig. 10 several disks *m c* are placed beside each other and surround the wire coils *w w*, and as three pole-pieces project from each disk, one pair of disks projects three pairs of poles.

In the drawings three pairs of poles are shown; but more or less can be provided, if

desired. The dissimilarity in the magnetism of the poles is effected in the following manner: The poles n^2 of one polarity project from the disks m^2 m^2, and the poles s^2 s^2 of the other polarity from the frame c^2 c^2. Further, to cool the machine, space for a circulation of air is left between each pair of iron disks. Bearings d^2 of diamagnetic metal are bolted on the outside of polar projections r^2. The bobbin form, Figs. 11 and 12, is provided with only one coil, w^3, which is placed between the cylinder c^3 and the pole-pieces n^3 s^3. In the drawing only one pair of poles is shown; but it is evident that more than one can be provided. In all the above-mentioned different forms of field-magnets the combinations of the copper coils are so arranged that the electric current excites magnetism of one polarity in the poles n n' n^2, &c., and the opposite polarity in the poles s s' s^2, &c. My invention of inclosing the copper wires in iron forming the frame may also be applied as an improvement in electric machines of other types.

Armature.—The iron cores of the revolving magnets in machines constructed heretofore are separated from the surface of the poles by copper coils, or the core comes close to the pole at a small portion of its surface only. In my machine the core presents almost its entire surface to the influence of the poles as the conductors for the electric circuit are contained in channels of cylindrical or hexagonal form, the entrance of which is formed by a narrow tapering slit filled with diamagnetic material. The iron core is made in the usual manner, either solid or composed of isolated sheets. According to the different forms of field-magnets used, I have provided different forms of armatures, which will now be described. In Figs. 1 and 2 I have shown the cylindrical arrangement. The iron core is mounted directly on the axle, and each coil occupies the half of two channels, both in the same position in relation to the poles of opposite magnetism. In Figs. 4 and 5 I have shown the ring arrangement. An annular core is fixed on the shaft by means of diamagnetic metal, the channels for the isolated conductors are cut on the outside, and the returning wire is laid on the smoothed inside of the ring. In the annular-disk form shown in Figs. 9 and 10 the cores are fixed on the shaft by centers of non-magnetic metal. If the cores are made of sheet-iron, they are coiled concentrically from strips. In this case the induction-coils are inserted in radial grooves opposite each other on the surface of the disk-form core, as shown in Fig. 13. If more than one disk is used, the coil must be arranged in the manner of steps, as shown in Fig. 14. The magnet-poles have projections r^2 r^2, which embrace the annular disk of the armature as closely as a free movement will allow. In the circular arrangement shown in Fig. 8, every coil occupies half of each of two adjacent channels. My improved armature can also be used in machines with permanent steel magnets. The above-described field-magnets and armatures can be used in the manner shown in the drawings, or in any other manner, or with field-magnets or armatures of any other suitable construction. Field-magnets and armatures of my invention can also be used with machines for alternate currents for one or more circuits.

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

1. In dynamo-electric machines, the field-magnets arranged on both sides of the armature, enveloping the two energizing-helices w w by iron housings, whereby all the excited magnetism may be collected and transmitted, the magnetic field confined within the machine, and a firm connection obtained between the pole-pieces and bearings.

2. The field-magnets of a dynamo-electric machine, composed of one or more annular energizing-helices w w, arranged concentrically about shaft a, and inclosed in iron shells m c, from which project alternate pole-pieces, and which serve at the same time as a rigid frame for the machine, as described.

3. In dynamo-electric machines, an armature provided with grooves in the core of the armature, for receiving the electrical conductors, which grooves are arranged in such a manner that narrow slits are formed in the surface of the core, which slits are filled with diamagnetic material, substantially as herein shown and described, and for the purpose set forth.

The foregoing specification of my improvement in dynamo-electric machines signed by me this 25th day of August, 1882.

JONAS WENSTRÖM.

Witnesses:
NEU A. ELFWING,
E. H. BRUTON.