(No Model.) 2 Sheets—Sheet 1.

R. EICKEMEYER.

DYNAMO ELECTRIC MACHINE.

No. 413,337. Patented Oct. 22, 1889.

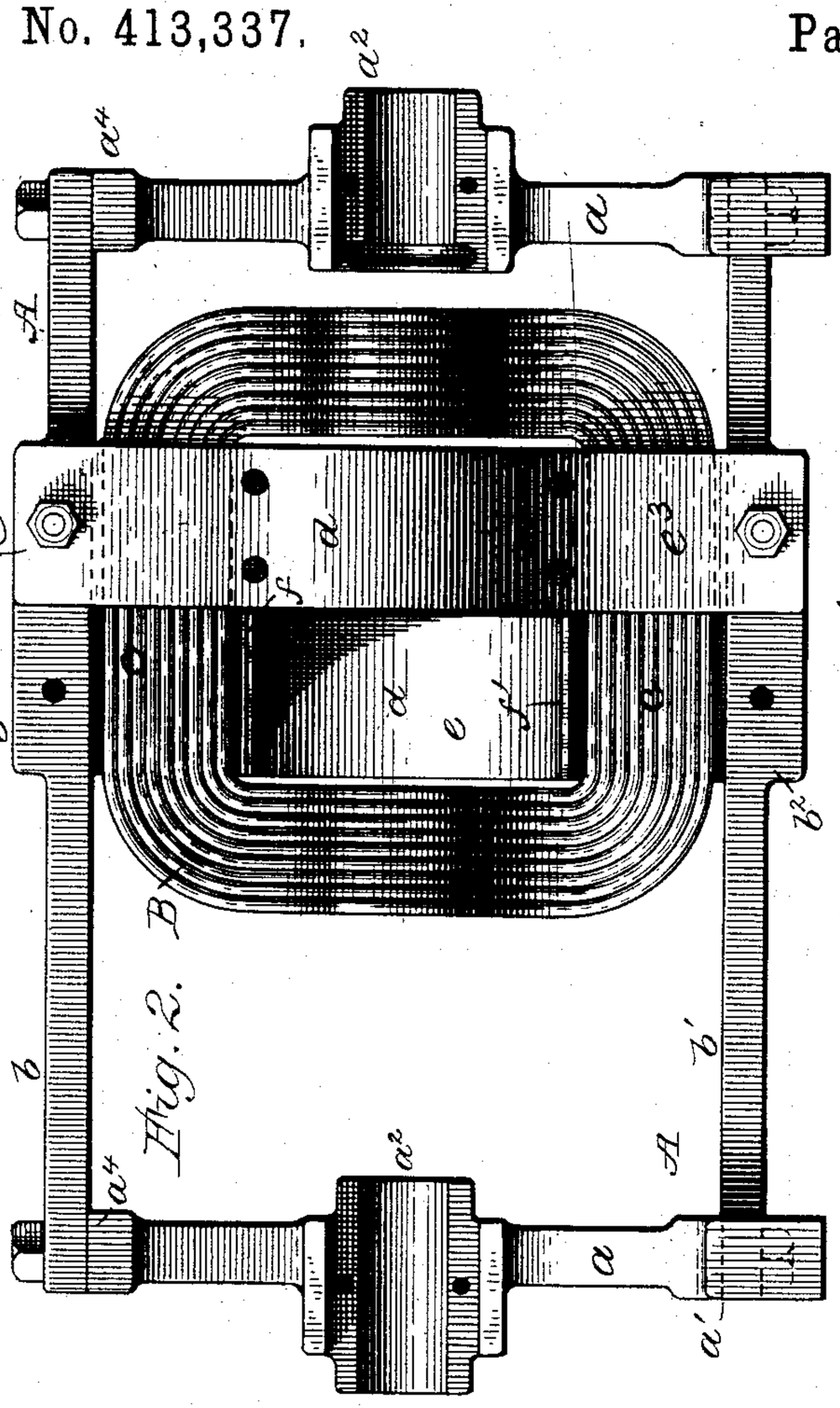

Fig. 2.

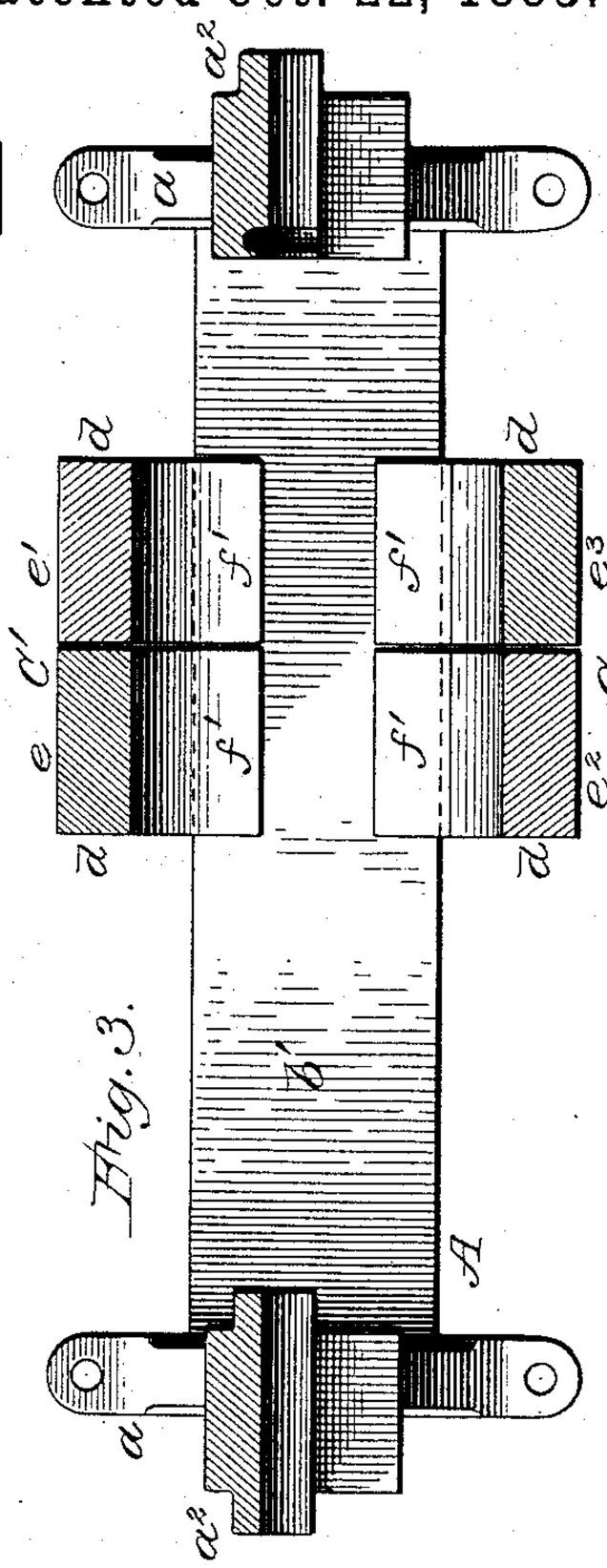

Fig. 3.

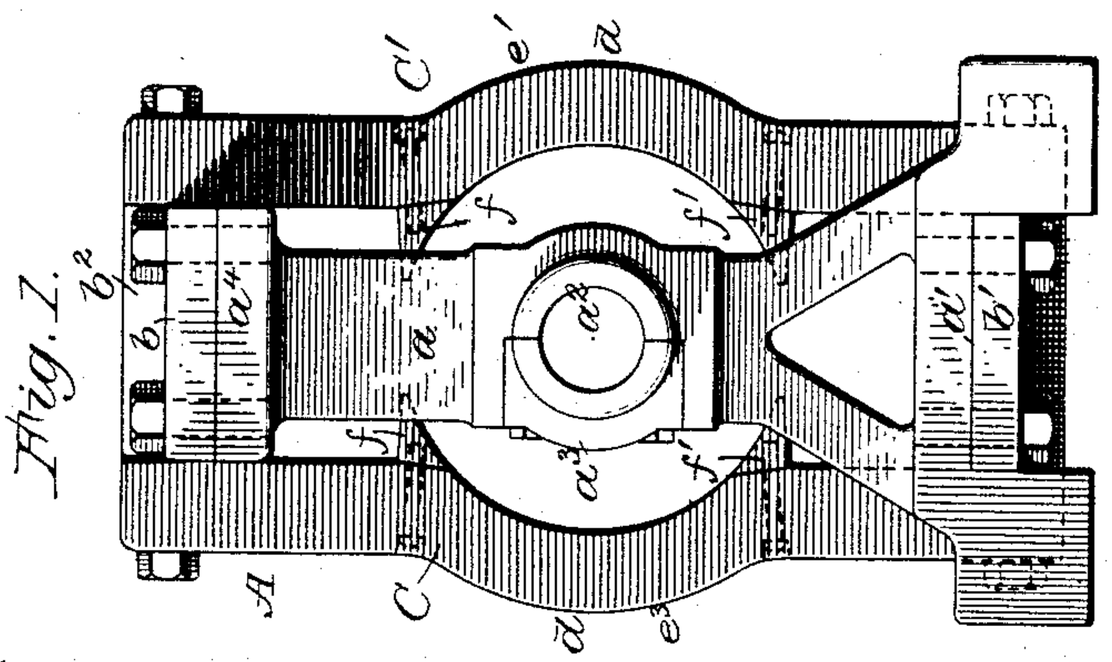

Fig. 1.

Attest:
Philip F. Larner.
Howell Battle.

Inventor:
Rudolf Eickemeyer.
By Wm. C. Ward & Co.
Attorney.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

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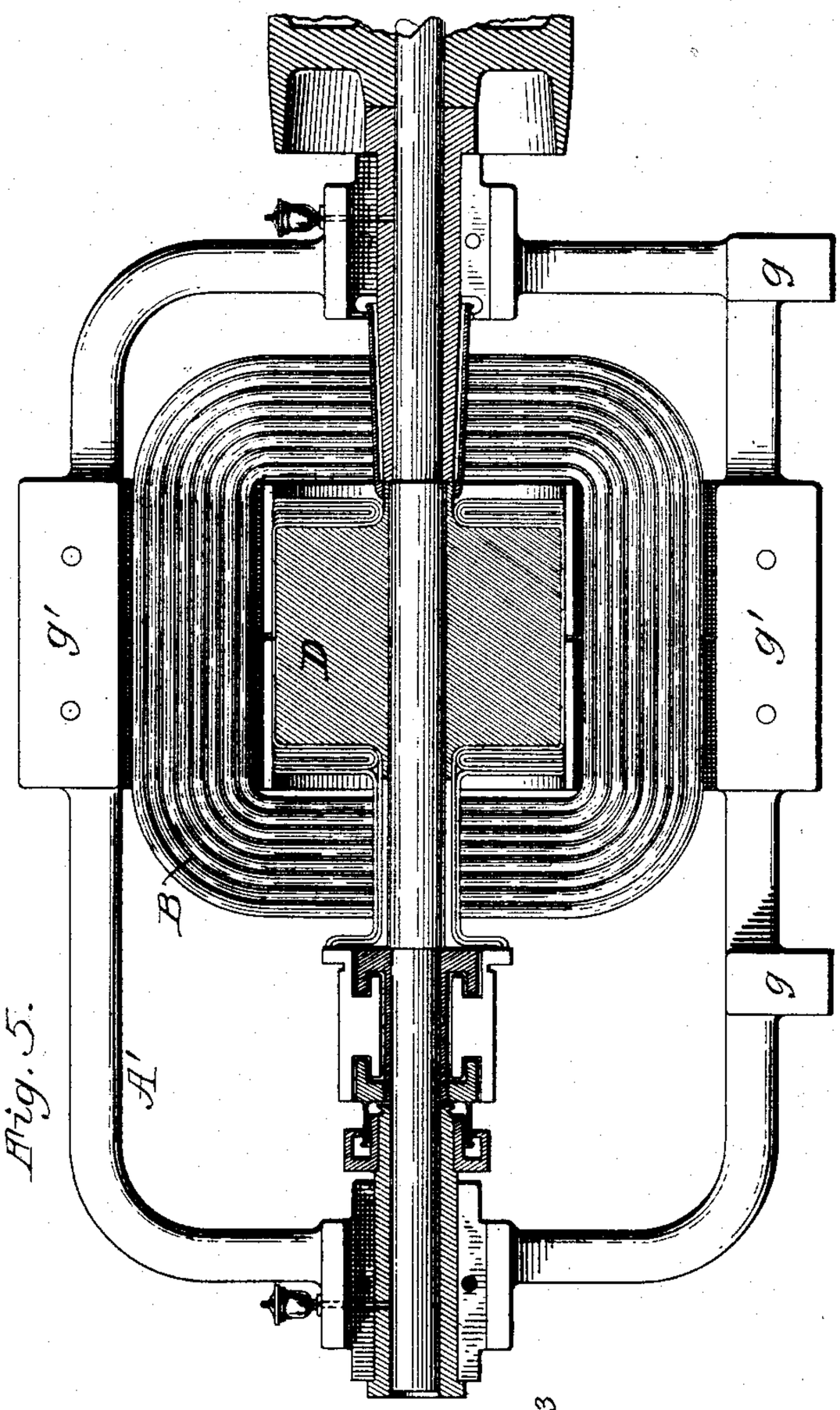

Fig. 5.

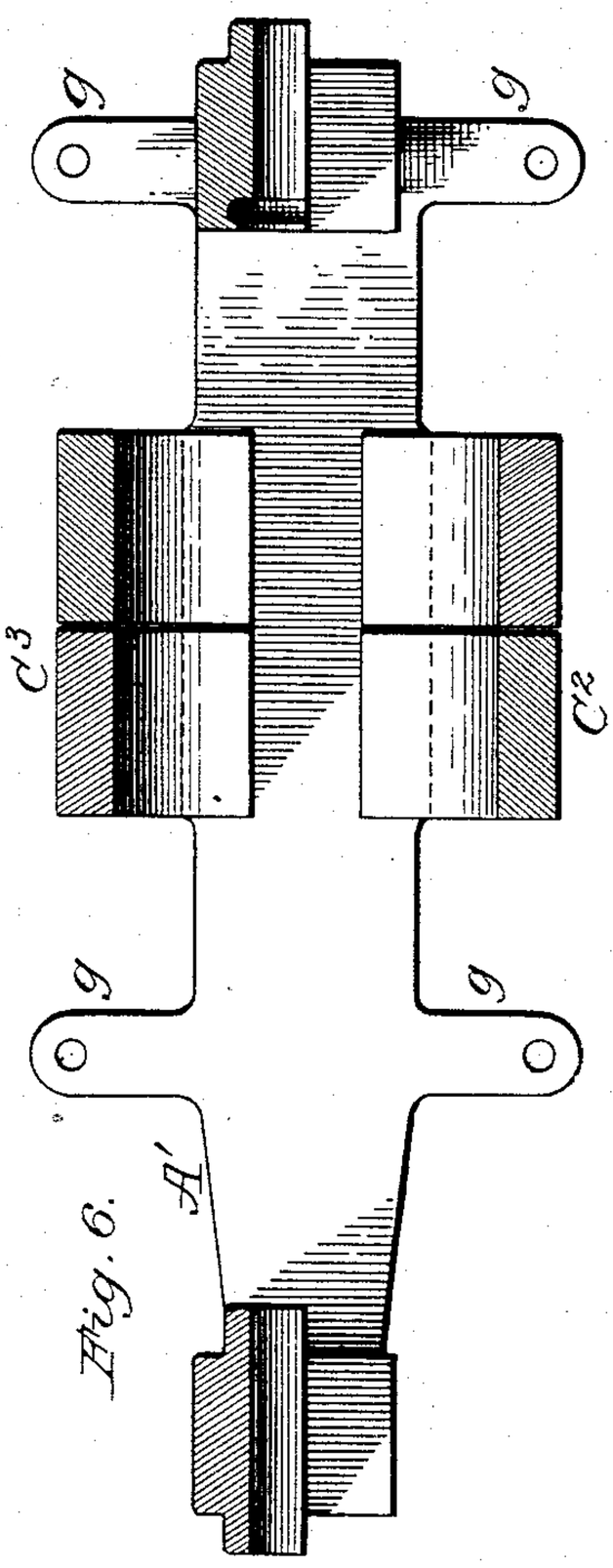

Fig. 6.

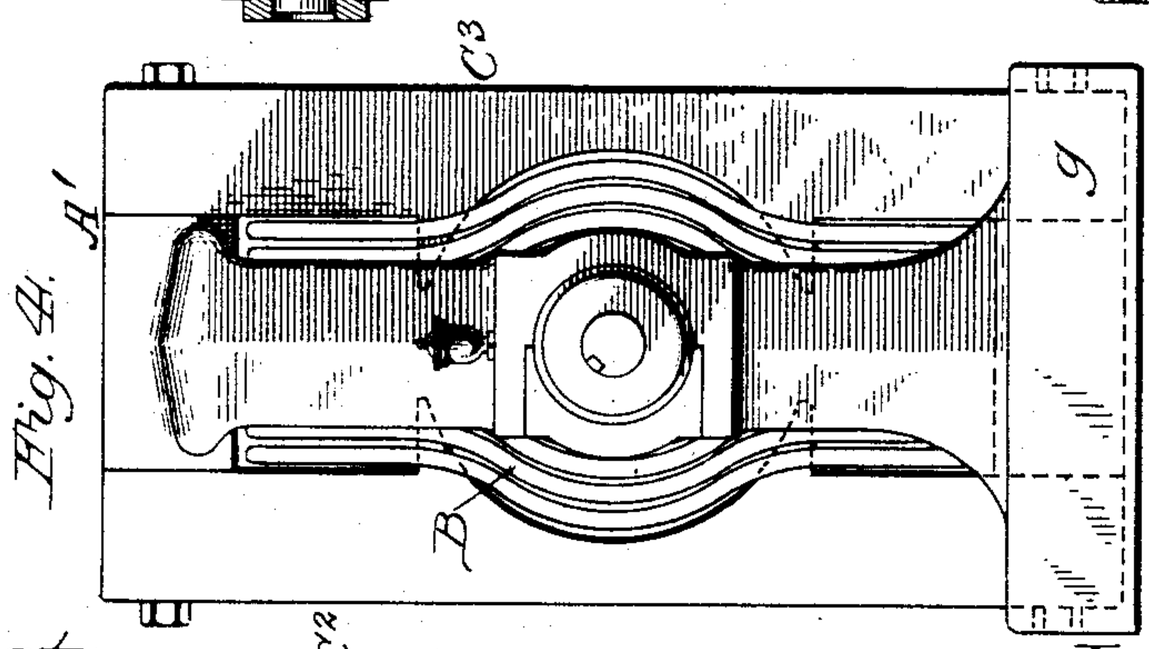

Fig. 4.

Attest:
Philip F. Larner.
Howell Battle.

Inventor:
Rudolf Eickemeyer.
By Munn & Wood
Attorneys.

UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 413,337, dated October 22, 1889.

Application filed February 8, 1889. Serial No. 299,171. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

My said improvements pertain to the framing and magnetic portions of dynamo-electric machines, and they are specially applicable to electric generators and motors wherein the magnetic circuit is completed, as disclosed in my Letters Patent No. 358,340, dated February 22, 1887.

With all of my machines having a completed magnetic circuit there is no appreciable external magnetism, and the interior field in which the armature is located is therefore much more effective than in other types of machines wherein the same quantity of copper and iron is employed, but which develop external magnetism to a wasteful and seriously objectionable extent. Since this construction of the early forms of my said machines I have been striving to devise and organize electric generators and motors embodying the completed magnetic-circuit feature, with special reference to the production of light-weight machines of high efficiency, it being obvious that for use in many connections weight should be reduced to a minimum. By my peculiar arrangement of the field-coil with reference to the armature and to the magnetic metal the weight of copper required for the coil is somewhat less than in other types of machines of like capacity, but the main reduction of weight must of course be attained in connection with the magnetic metal.

It is well known that wrought-iron is the best of all the magnetic metals, and that a lesser weight thereof can be relied upon for a given magnetic duty in a machine than if cast-iron be used; but it is equally well known that the working of wrought-iron into the various pieces and forms ordinarily required involves so much expense that its use is generally avoided and that cast metal is used instead. I have therefore, while seeking high efficiency and light weight, also devoted much time, attention, and experiment to devising certain parts of the machine in special form and so constructing and organizing them so to secure radical simplicity in construction and substantial economy not only in cost of materials, but also in the labor involved in the manufacture of the several parts and in their assemblage while setting up the machines.

Although the best of my present machines are of minimum weight, they are not of minimum cost, because of the use of wrought metal throughout the magnetic system; but equally efficient machines are produced by me of somewhat greater weight, but substantially cheaper, because of the use of more or less cast metal.

After describing the machines illustrated in the drawings the features deemed novel will be specified in the several clauses of claim hereunto annexed.

Referring to the drawings, Figure 1 is an end view of a frame and cheek-pieces as constructed and organized by me for producing my present machines in one of their best forms and having wrought-metal electro-magnets. Fig. 2 is a side view of the same with the field-coil in position and with a part of one of the cheek-pieces removed. Fig. 3 is a central longitudinal section of the same. Fig. 4 is an end view of a machine differing from Fig. 1 only so far as is warranted by or incident to the use of cast metal in the electro-magnet. Fig. 5 is a longitudinal vertical section of the machine Fig. 4. Fig. 6 is a central horizontal section of a portion of the same machine.

The rectangular frame A of Figs. 1, 2, and 3 is constructed in four parts. The two end plates *a* are counterparts in outline, each being branched at the bottom to afford suitable feet, and each has just above the feet a lateral bearing-surface at *a'*, in this instance afforded by the under side of an integral cross-bar. Each end piece is centrally provided with a half-seat for the bearing of an armature-shaft, as at a^2, and with each of these a detachable half-seat a^3 is employed,

the parting between the halves being on a vertical line, and the portion a^3 of the bearing-seat can be applied and removed laterally and secured in place by bolts, as shown. The armature-shaft usually has its bearings in bushings, and the latter occupy said seat-bearings and are clamped therein; but it is to be understood that the character of these bearings may be varied indefinitely without affecting my invention. Above the bearings each end plate has a laterally-enlarged top, so as to afford an upper bearing-surface, as at a^4. It will be obvious that with the aid of separate detachable center pieces for patterns these end plates can be cast from one main pattern, and that their weight and bulk need be no greater than is absolutely requisite for enabling them to withstand the strains incident to the operation of the machine. It is to be understood that these end plates form no portion of the magnet, and that the upper and lower bearing-surfaces a' and a^4, however provided for, constitute essential features in connection with certain portions of my invention, and that the central location of the bearings for the armature-shaft is essential with reference to another portion of my invention, as will be hereinafter fully explained.

The top plate b and bottom plate b' in this machine are alike in form and dimensions, and can be interchangeably located, and they are firmly secured by means of bolts, respectively, to the upper bearing-surfaces a^4 and lower bearing-surfaces a' on the end plates. The plates b and b' are straight lengths of wrought bar-iron, and each at a little to the one side of its center is thickened, as at b^2. This extra metal at b^2 may be provided for by welding to the bar a piece of iron of the same thickness and width and of the desired length, or a thicker bar may be reduced in thickness, except at b^2; or if a little extra weight be not objectionable in any instance the entire bar or plate may be of uniform thickness, thereby obviating all necessity for welding or forging. These thickened portions b^2 of these plates constitute parts of the electro-magnet, and it is only necessary that there be a sufficient cross-section of metal to secure ample magnetic conductivity for a completed magnetic circuit, as will be hereinafter more fully explained. It will be seen that these top and bottom plates can be machined in pairs, or, in other words, that in truing up the edges and in planing or grinding those surfaces at or adjacent to which good joints should be provided both plates can be simultaneously operated upon and involve but little more time and labor for finishing up two or more of the same size than for finishing one. The only places at which machine-work is really needed are the two edges of the plates at b^2 and at each end for securing good bearings with the end plates, and the drilling of holes for bolts at b^2, and also at the ends, and inasmuch as the plates are counterparts in length and width the drilling can be accurately performed by unskilled labor when aided by "gigs" to serve as gages in a drilling-machine, and in like manner the drilling and tapping of the bolt-holes in the end plates can be executed at minimum cost.

The field-coil B is substantially rectangular in outline, and is usually constructed at least in two parts and at the ends of the coil. These parts are centrally curved outwardly to afford space for an armature-shaft, as in certain of my prior machines. The upper and lower sides c of this coil are rectangular in cross-section, have a width which corresponds to the width of the top and bottom plates b and b', and the coil is mounted in the frame so as to be parallel therewith and located with its straight sides c opposite the thickened portions b^2 of said plates.

The cheek-pieces C C′ in this machine are composed of bars of wrought-iron centrally bent or curved, as at d, and, although each cheek-piece may be made from one wide merchant bar of metal without departure from my invention, economy is attained by making each in two parts from a narrow merchant bar, as here shown, so that four counterpart pieces e e' e^2 e^3 will constitute the two cheek-pieces and enable any one piece to occupy either of the four positions in the machine. Each of these pieces has two extensions f and f', which are bolted to and inwardly project from the inner sides of the cheeks above and below the bend or concavity d. These extensions not only cheaply enlarge the concavity, but enable portions of each cheek-piece to be surrounded by the field-coil. Each of the cheek-pieces is centrally drilled near its ends for the reception of the bolts by which it is secured to the top and bottom plates, and if these holes be uniformly located, as is intended, no special or individual fitting or marking is needed, because in setting up the machines, or in replacing parts after dismantling for repairs, &c., any one part may occupy either of the four positions. It will be seen that the interior space inclosed by the coil and by the concaved cheek-pieces is cylindrical, and that it is adapted to receive an armature of corresponding dimensions, and also that the cheek-pieces have a width equal to the interior length of the coil, so that only the sides c of the coil are directly inclosed by the top plate, bottom plate, and cheek-pieces, thus leaving the ends of the coil wholly exposed to such cooling influences as are incident to free atmospheric radiation. No armature has been shown in connection with these views Figs. 1, 2, and 3, it being deemed unnecessary in view of what is shown in other figures to be hereinafter described; but it is to be understood that the field-coil, already described, directly polarizes the core of an armature, and that the ends of the coil constitute end walls of the cylindrical space occupied by the armature.

While the machine thus far described has a frame and a highly-efficient electro-magnet extremely simple in construction and very light in weight, and which can be produced with substantial economy, still greater economy, both in materials and labor, may be attained by the use of more or less cast metal in the electro-magnet; but this will naturally involve considerably greater weights.

In Figs. 4, 5, and 6 I have illustrated a heavier and cheaper machine embodying portions of my present invention. In this machine the frame A′ is rectangular in form, and the bottom part has lateral extensions *g* to serve as feet, and it is wholly composed of cast metal and can be cast in one piece. The upper and lower sides of this frame have thickened portions, as at *g′*, and the end portions have half bearing-seats for the armature-shaft, as in the machine first described. The edges of the frame at the portions *g′* require to be trued up or planed, and this, with the drilling and tapping for bolts and reaming at the bearing-seats, constitutes all the machine-work required. With the exception of the thickened portions at *g′*, the bulk and weight of the frame can be reduced to the lowest point consistent with the strains involved during the operation of the machine, and at *g′* the cross-section of the frame may be less and never need be greater than the cross-section of the cheeks at their drilled ends.

The cheek-pieces C^2 C^3 have the same form as those already described; but, being made of cast metal, the cheek-extensions are integral, and the weight and bulk of these cheek-pieces are enough greater than those previously described to compensate for the lesser magnetic conductivity of cast metal as compared with wrought metal.

The field-coil B is the same as in the first machine, and it directly polarizes the armature D, which has a core composed of magnetic metal, and said armature occupies the cylindrical space inclosed by the field-coil and the concaved faces of the cheek-pieces.

Although the armature here shown has a winding heretofore patented by me, and special means are shown, as in certain of my prior machines, for protecting the field-coil, the armature, and the commutator from oil liable to exude from the bearings, it is to be understood that these features form no portion of my present invention, it being quite immaterial as to the kind of armature employed in connection with certain portions of my invention, although for obtaining the best results it should have a core containing magnetic metal.

It will be seen that in both of the machines shown there is a rectangular frame, and that in both the top and bottom portions thereof serve as parts of electro-magnets; also, that the end portions of both serve as standards for the armature-bearings; also, that in both machines there is the same kind of rectangular field-coil parallel with the top and bottom of the frame and secured in position by the cheek-pieces, which in both machines are bolted to the opposite edges of the frame at top and bottom and have a width substantially equal to the interior length of the field-coil, and that the ends of the latter are fully exposed and a cylindrical space for the armature is afforded between the concaved cheek-pieces and within the coil, and also that portions of said cheek-pieces are inclosed by said coil. It will also be seen that in both machines the armature-space is in line with the bearing-seats in the end plates and exactly between the top and bottom of the frame, so that in assembling the parts or setting up a dismantled machine the field-coil and the cheek-pieces may be mounted with either side upward without deranging their relations to each other or to the armature or to the frame, and this novel feature is of obvious value, although it may be omitted without departure from other portions of my invention.

It will be obvious that with the cast-iron frame of Fig. 4 the wrought-metal cheek-pieces of Fig. 1 may be employed for producing a machine intermediate in weight and and in cost.

It will be readily understood that in both machines there can be no appreciable external magnetism, because the magnetic circuit is completed from the center of each cheek-piece to the other through the metal in the top and bottom portions of the frame, and that the magnetic lines are restricted to the interior space, and with an armature-core polarized on opposite sides adjacent to the center of the concave faces of the cheeks a highly-effective magnetic field is afforded between the armature-core and the faces of the cheeks.

By removing the detachable portions of the seat-bearings for the armature-shaft and the cheek-piece on the same side of the machine the corresponding half of the field-coil can be readily removed, leaving the armature free to be laterally displaced for examination or repair, and these parts can be replaced with little expenditure of time and labor.

Either of the two machines shown and described is much lighter in weight and of much less cost than any other machine of corresponding efficiency heretofore devised by me and involving a completed magnetic circuit, and I believe when compared with machines of any other type having corresponding efficiency that the differences in weight and cost are still greater in favor of my present machines.

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

1. In a dynamo-electric machine, the combination of a rectangular frame having a top and bottom which serve as portions of an electro-magnet and ends which couple the top and bottom and serve as standards for an armature-shaft, a field-coil substantially rectangular in outline mounted within and par-

allel with the top and bottom of said frame, and concaved cheek-pieces which are bolted to the opposite edges of said frame at top and bottom, have a width substantially equal to the interior length of the coil, confine said coil in place, and afford between their concave faces and within the coil a cylindrical space for the reception of an armature of appropriate length and diameter, substantially as and for the purposes specified.

2. In a dynamo-electric machine, the combination of a rectangular frame having a top and a bottom which serve as portions of an electro-magnet, counterpart cheek-pieces bolted to the opposite edges of said top and bottom of the frame, and concaved exactly midway of their length, a field-coil rectangular in outline within said frame, and secured in position between and by said cheek-pieces and affording within said coil and between the concave faces of the cheek-pieces a cylindrical armature-space, and end plates which couple the top and bottom of the frames and are provided with seats for shaft-bearings, which are centrally located and in line with the axial line of said armature-space, substantially as and for the purposes described.

3. In a dynamo-electric machine, the combination of a rectangular frame having a top and a bottom which serve as portions of an electro-magnet, cheek-pieces composed of curved wrought-iron having cheek-extensions bolted thereto, and a field-coil substantially rectangular in outline within said frame, secured in position by and between said cheek-pieces, which are bolted to the edges of the top and bottom of the frame, said coil inclosing said cheek-extensions and affording within it and between the concaved cheek-pieces a cylindrical space for the reception of an armature, substantially as and for the purposes specified.

4. In a dynamo-electric machine, the combination of a rectangular frame having end plates to which are bolted a top and a bottom composed of wrought-iron bars which serve as parts of an electro-magnet, wrought-iron curved cheek-pieces provided with cheek-extensions bolted thereto, and a field-coil substantially rectangular in outline within and parallel with said frame, which surrounds said cheek-extension and is secured in position by and between said cheek-pieces, which are bolted to said top and bottom plates and afford between their concave faces and within the coil a cylindrical space for the reception of an armature, substantially as and for the purposes specified.

RUDOLF EICKEMEYER.

Witnesses:
JAMES S. FITCH,
RUDOLF EICKEMEYER, Jr.