6 Sheets—Sheet 1.

E. WESTON.

Dynamo-Electric Machine.

No. 211,311. Patented Jan. 14, 1879.

Figure 1.

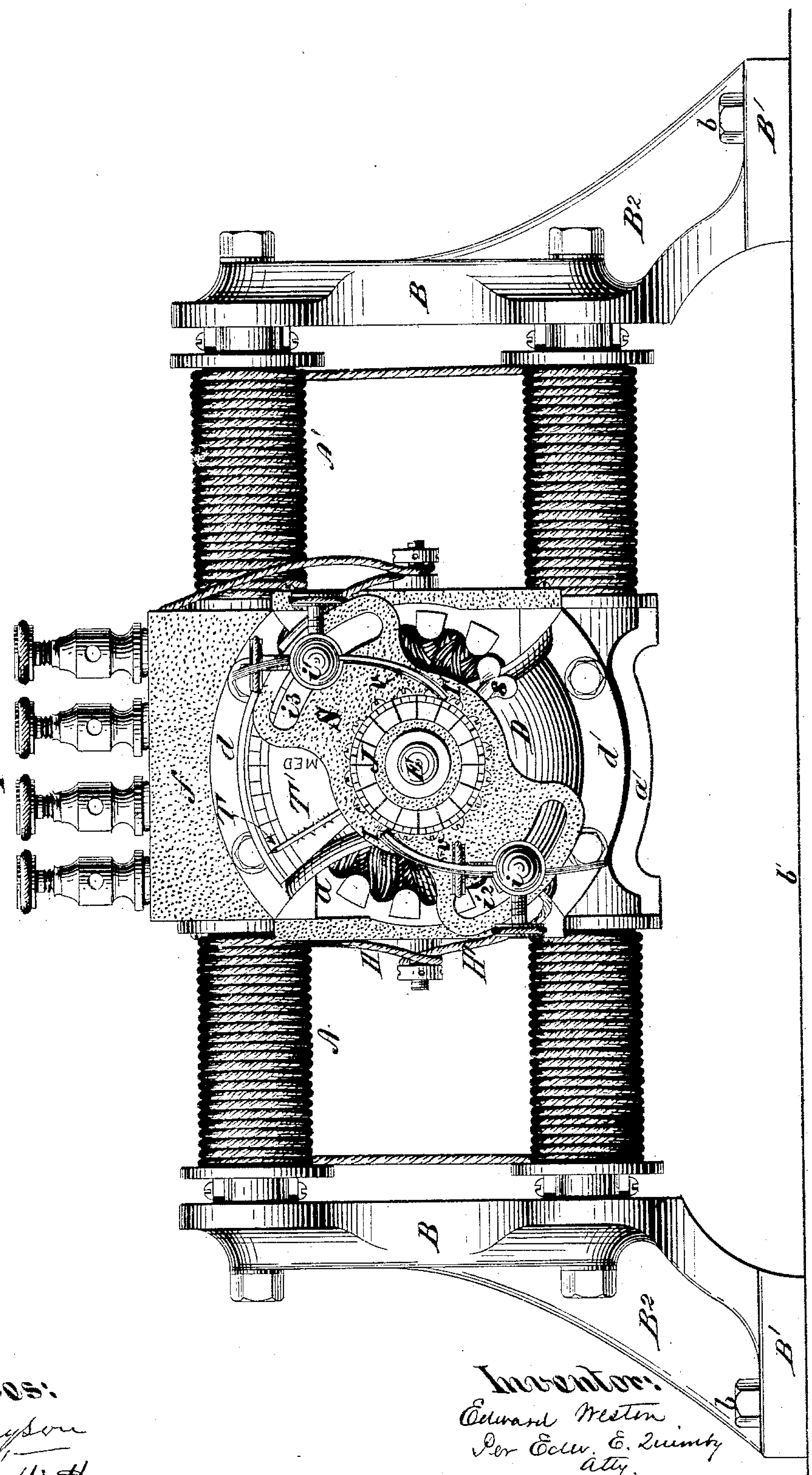

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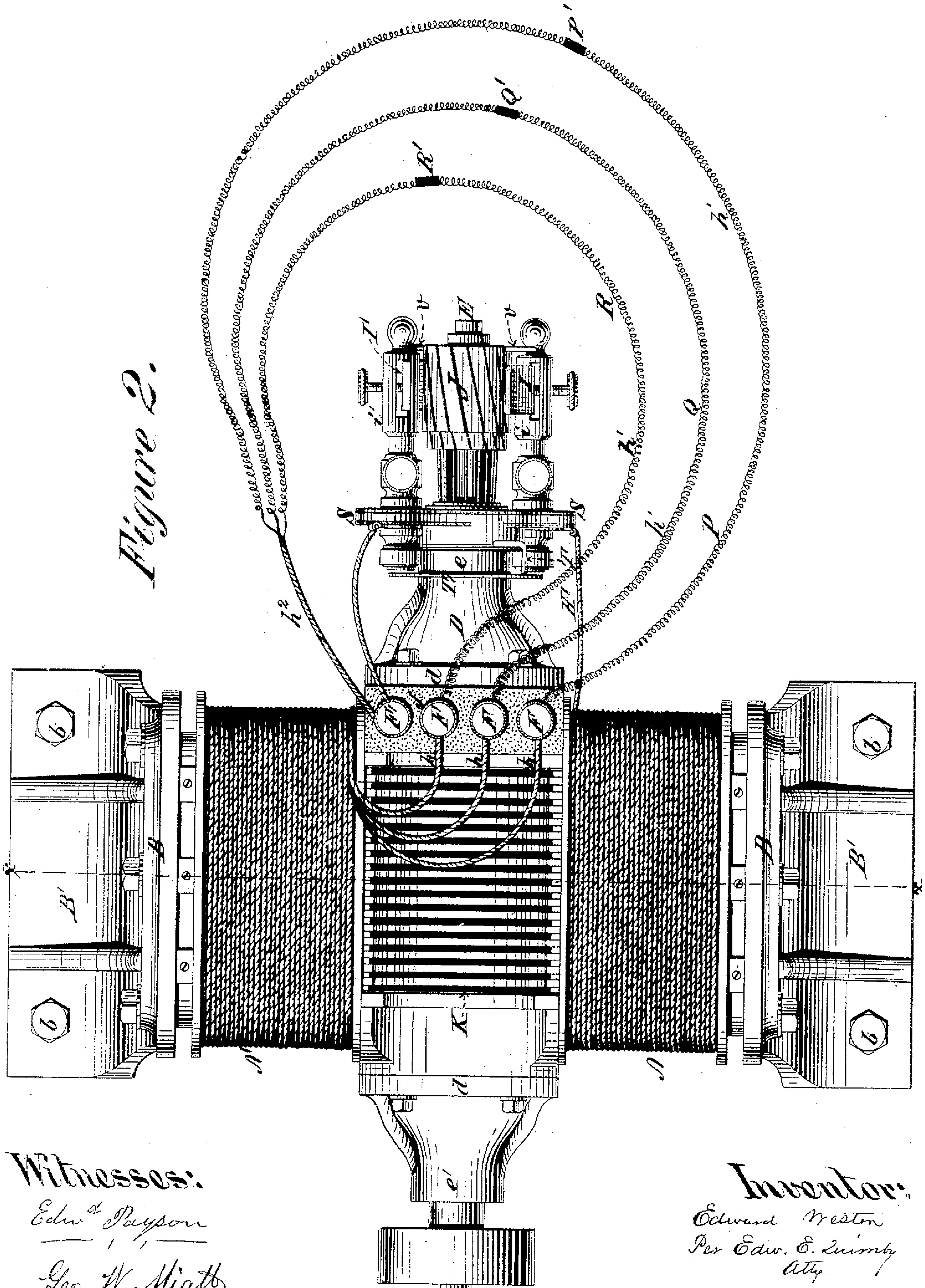
Figure 2.



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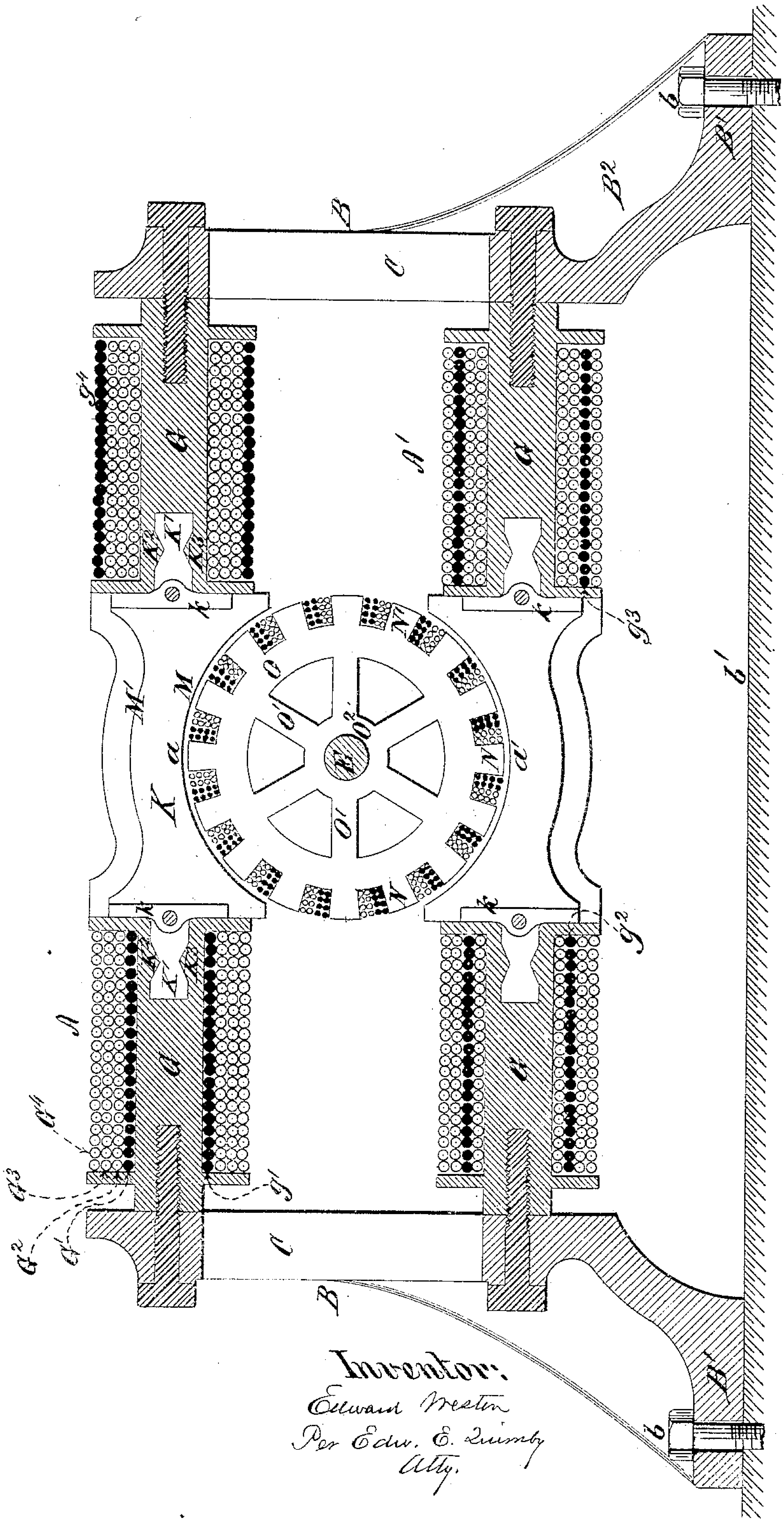

Figure 3.

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6 Sheets—Sheet 4.

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Figure 4.

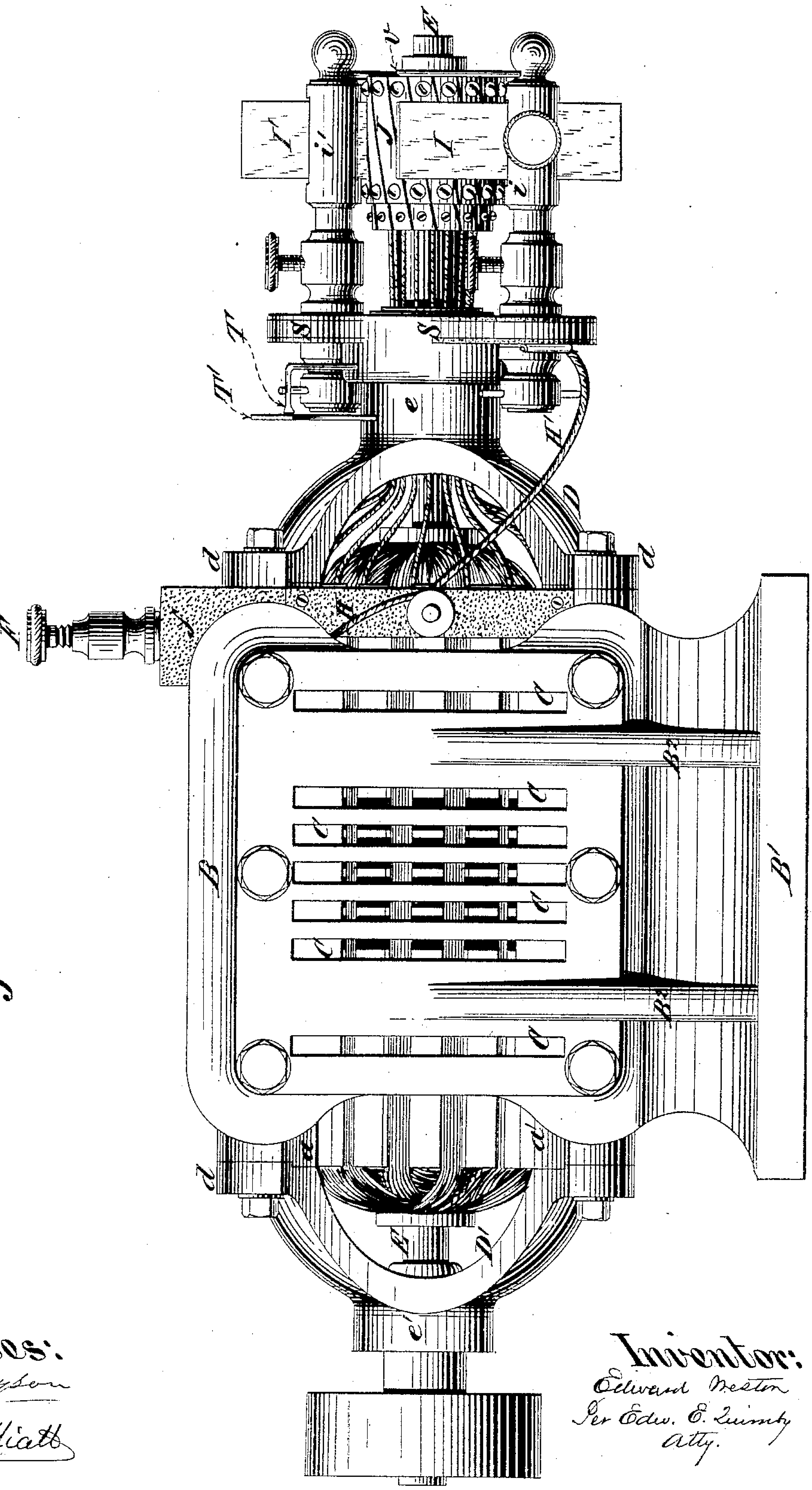

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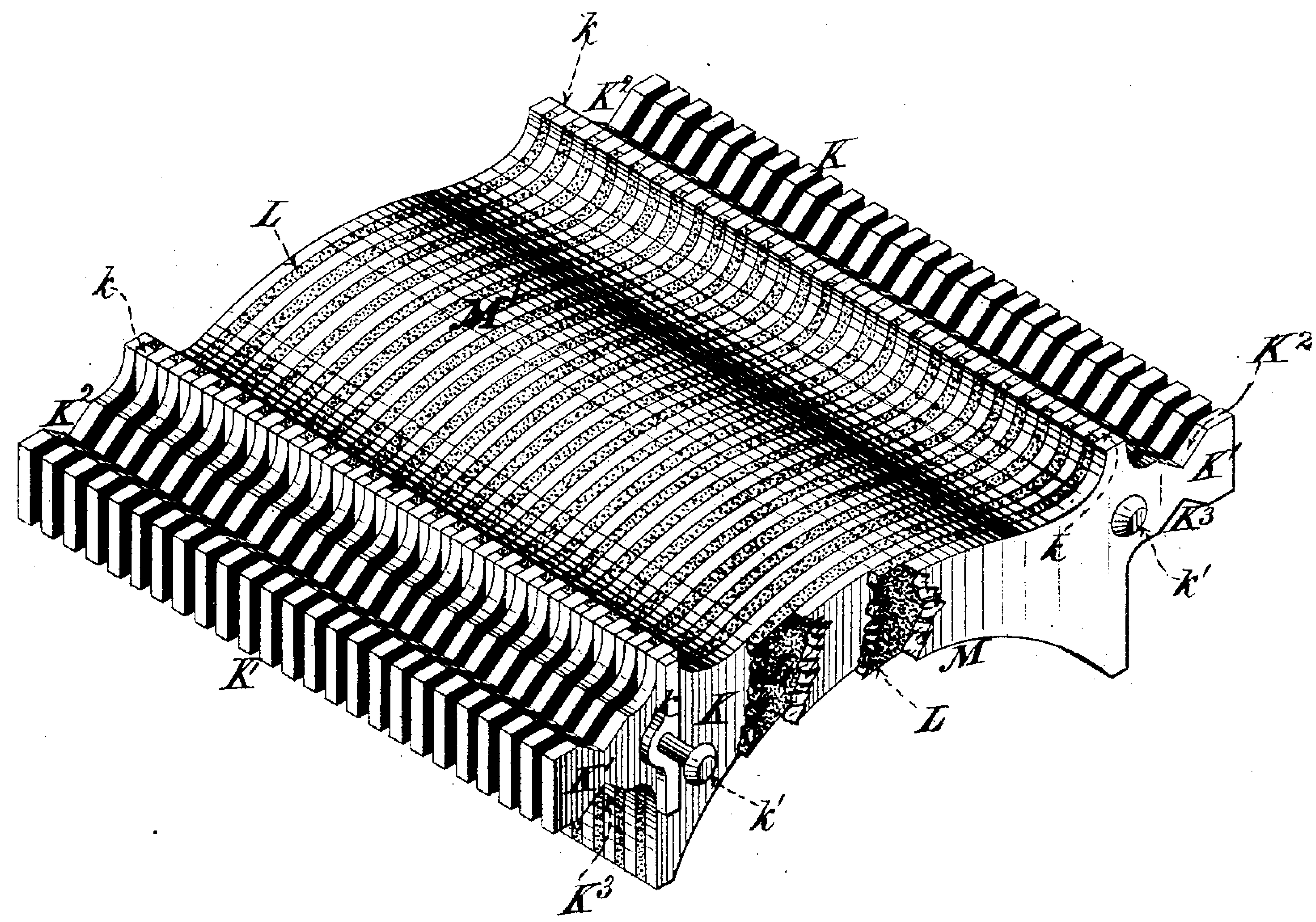
Figure 5.



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6 Sheets—Sheet 6.

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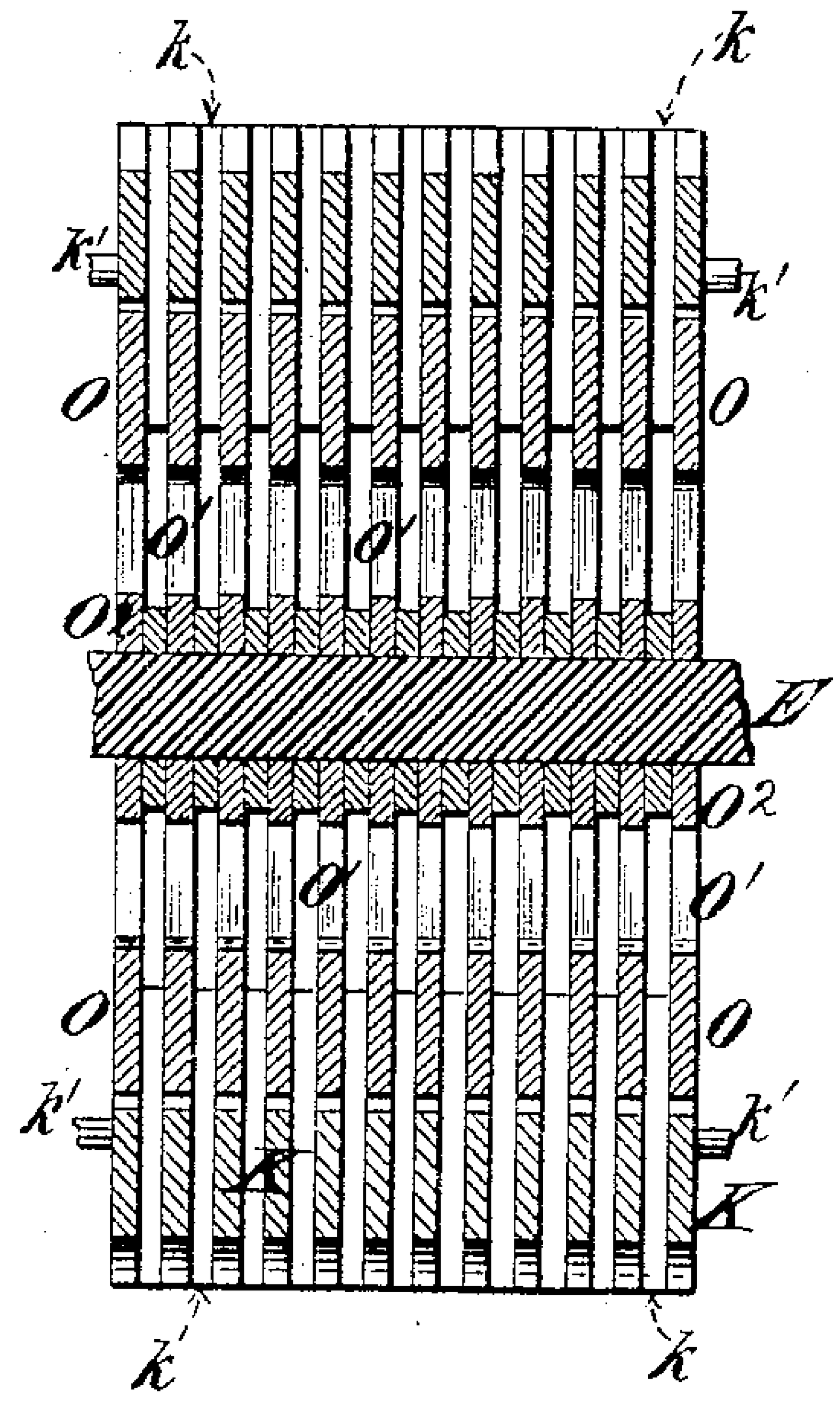
Dynamo-Electric Machine.

No. 211,311. Patented Jan. 14, 1879.

Figure 6.



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UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN DYNAMO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **211,311**, dated January 14, 1879; application filed November 9, 1878.

CASE E.

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, New Jersey, have invented certain Improvements in Dynamo-Electric Machines, of which the following is a specification:

The most important feature of my present invention, by means of which I impart to dynamo-electric machines having but one commutator the capacity of simultaneously maintaining independent currents of electricity in several distinct circuits, consists in providing the stationary electro-magnets of such machines with a number of separate coils having one set of their free ends connected with one of the commutator-brushes, and their opposite free ends connected respectively with a corresponding number of binding-posts, to which are connected respectively a like number of line-wires, whose opposite ends are connected with the other commutator-brush. I am thus enabled to convert an ordinary dynamo-electric machine into a multiple-circuit machine without adding any commutators to it.

Other features of my present invention relate especially to improvements in the organization and mode of construction of the dynamo-electric machine shown and described in my application for a patent therefor filed June 14, 1878, and designated "Case D." These features consist in widening and forming foot-pieces on the iron bridge, to which the outer ends of the cores of the stationary electro-magnets are secured; in substituting wrought-iron for the cast-iron bars I have heretofore used in the slotted poles of the stationary magnets; in bracing apart the poles of the stationary magnets by means of arms made of brass or some other non-magnetic material, which arms also afford the bearings for the armature-shaft; in devices for accurately adjusting the brushes; in arranging the binding-posts upon the upper stationary magnetic pole, separating them therefrom by insulating material; in forming the armature-core of thin wrought-iron disks or rings; and, finally, in so winding the armature that the two systems of coils in each division are alongside each other, instead of being superposed, as they are in my "Case D."

The accompanying drawings, illustrating a dynamo-electric machine embodying my improvements, are as follows:

Figure 1 is a front elevation of the machine. Fig. 2 is a top view of the same. Fig. 3 is a longitudinal vertical section through the line x x on Fig. 2. Fig. 4 is an end elevation of the machine. Fig. 5 is an isometrical perspective of the wrought-iron bars intended for the slotted curved poles of the stationary magnets, showing the method of connecting the bars together preparatory to incorporating them into the iron casting. Fig. 6 is a central longitudinal section of a portion of the armature-core.

The drawings represent a dynamo-electric machine, similar in its general features to the machine shown and described in my application for a patent therefor filed June 14, 1878, designated as "Case D."

In the present case the stationary magnets A A′ are arranged in horizontal positions. The iron bridges B B, respectively connecting the outer ends of the stationary magnets, stand vertically, and are extended downward to form legs, having on their lower edges laterally-projecting flanges B^1 B^1, which are provided with holes for the reception of the bolts b, by means of which the machine is secured to the surface b' of the table or other object which supports it. The bridges B are also provided with the strengthening-webs B^2, and are cast with a series of parallel slots, C, which are intended to provide for the circulation of air through the bridges into and from the spaces between the upper and lower magnets.

I have heretofore provided the poles of the stationary magnets, immediately opposite the armatures, with parallel slots, which have been formed in the casting, thus giving the poles the form of a curved gridiron; but as it is important that the slots or openings in the poles shall be exactly in line with the spaces between the several disks composing the armature which I prefer to use, I have in my present machine substitute wrought-iron bars for the cast-iron bars which I have heretofore used. Part of my invention, therefore, consists in this substitution of wrought-iron bars, whereby I am enabled to construct the grid-iron poles with exactly equidistant parallel slots of the precise width required; and another part of my invention consists of the method by which I effect the incorporation of the wrought-iron bars into the cast-iron part of the magnet. These parts of my invention will be understood on reference to Figs. 5 and 6, in which it will be seen that a series of thin wrought-iron plates, K, are arranged in parallel positions, and are separated from each other by the two series of gibs, *k*, which are placed between the plates near their ends, and, like the plates, are perforated to admit the transverse bolt or rivet *k'*. The spaces between the plates K and between the two series of gibs are filled with plaster-of-paris L. The portions K^1 of the plates which project outwardly beyond the gibs are, it will be seen, provided on their upper and lower edges with the notches K^2 and K^3. The mass of plates thus secured together presents on its under side the curved surface M, which is intended to rest upon the convex face of the central part of the sand-mold in which the cores are to be cast. The upper side, M', of the mass of plates conforms to the shape of the face of the mold opposite the convex surface upon which the bottom M rests.

The mass of plates is heated to redness and placed in the mold, and the molten iron, being immediately poured in, finds its way into the interstices between the projections K^1, and fills in above and below the notched edges of the projections.

I make the mold wide enough to allow a space of, say, one inch or more in width, for the cast-iron along the sides of the gridiron. By this means I am enabled to firmly incorporate the wrought-iron plates into the casting.

By the use of the plaster-of-paris packing I prevent the plates from warping out of shape during the casting operation. After the casting is taken out of the mold the plaster-of-paris is removed, and I then have a series of equidistant parallel slots in the pole of the magnet, capable of exactly conforming in their locations with the equidistant spaces between the several disks of which my armature is composed.

In my former application designated as "Case D," I describe the construction of an armature formed of disks bisected from their peripheries to a point near their centers, and mounted upon the armature-shaft alternately, with collars separating the disks from each other.

In my present invention I build up my armature of thin wrought-iron disks, or of the rings O, either with or without the polar extensions N. I support the rings upon the shaft by means of the radial arms O^1, connecting each ring with its center or hub O^2, which is perforated to admit the armature-shaft E. This part of my invention is especially intended to carry out my plan of keeping dynamo-electric machines cool by the powerful circulation through the core of the rotating armature of air, which is drawn into the ends of the armature and discharged from its periphery by centrifugal action.

The poles *a a'* of the stationary magnets are rigidly held at their opposite edges by the braces D and D', which are composed of brass, or some other non-magnetic material, and which afford the bearings *e e'* for the armature-shaft E. Each brace is provided with the flanges *d d'*, which, respectively, are securely bolted to the edges of the upper and lower stationary poles. These poles have the usual curvature, to conform them to the cylindrical shape of the rotating armature.

The binding-posts F, in order to have them in convenient position, are arranged upon the upper curved pole, preferably upon a strip of insulating material, *f*, which is fastened to the pole. In machines of the ordinary construction two binding-posts only are required; but in my present invention, which embodies the improvement by which I obtain multiple circuits, I employ a larger number of binding-posts, according to the number of operative circuits.

My commutator J is affixed to the outer end of the shaft E, and the commutator-brushes I and I' are supported in the slotted studs i i^1, which are respectively inserted in the concentric slots i^2 and i^3 in the adjustable oscillating plate S, which is loosely mounted on the outside of the bearing of the commutator-shaft, and is provided with a set-screw, *s*, by means of which it may be fastened in any desired position.

The hub of the oscillating plate S is provided with a radially-projecting pointer, T, and a curved scale is formed upon the upper curved edge of the sector T', affixed to the brace D. The range of oscillation of the plate S is such that the brushes may be moved from the point where the current collected by them from the commutator is of the minimum intensity to the point where the current so collected will be of the maximum intensity.

In order to secure accuracy in the operation of the adjusting mechanism for regulating the intensity of the current, a curved wire, *v v*, is inserted in the outer ends of each of the studs i and i^1, for the purpose of accurately indicating the length required for that portion of each brush which projects from the side of the stud toward the commutator. It will easily be seen that the brush may be made to bear at different points on the commutator by being lengthened or shortened, and that the curved wires *v v* serve as gages to facilitate the accurate adjustment of the brushes in their respective studs, so that the bearing-points of the brushes upon the commutator will be, respectively, at the opposite ends of a line or plane bisecting the axis of the commutator.

My new mode of winding the two divisions of the coil on the armature will be understood on reference to Fig. 3, in which the armature is represented in transverse section, and the two divisions of the coil in each segment of the armature are distinguished by being shown in the one case as solid black dots, and in the other case by circles. The direction in which the two divisions are wound, and the manner in which they are connected together and connected with the commutator, is in other respects the same as that shown and described in my "Case D," which is hereinbefore referred to, my present improvement consisting merely in winding the separate divisions in the manner shown, so that the two divisions on each segment are of like length, and consequently oppose severally the same degree of resistance to the passage of the induced currents.

In addition to the especial features of construction which I have thus far described, I have embodied in this machine a peculiar system of winding and connecting the stationary coils, which is applicable to all dynamo-electric machines, and which consists in coiling around the cores of the stationary magnets several separate wires, each connecting with an independent outside circuit, and having an equal number of convolutions around the cores. The drawings illustrate this system of establishing multiple circuits so applied as to make three and four independent operative circuits, or, in other words, independent loops, each of which affords a current for outside work, and each of which makes a like number of convolutions around the cores of the stationary magnets. Of course it will be understood that the number of separate circuits may be varied at will.

On reference to Fig. 3, which is a longitudinal vertical section of the machine, it will be seen that the cores G of the stationary magnets are surrounded by four layers, G^1 G^2 G^3 G^4, and the course of one of these layers of wire in passing from section to section of the core is indicated by the solid black dots g^1, g^2, g^3, and g^4. Thus it will be seen that the coil g^1 is wound first upon the upper left-hand section of the core, and that it becomes the second layer in the next adjoining section, the third layer in the adjacent lower section, and the fourth layer in the other upper section. By this mode of winding four coils they are each given not only an equal number of convolutions around the core, but may be made of the same length. The free ends H of the separate coils are gathered into the cable H′ and connected with one of the commutator-brushes I. The opposite ends h of the separate coils are each connected with one of the binding-posts F, to each of which one end of one of the line-wires h^1 is to be connected. Each one of the line-wires is carried to an electric lamp, or to any other apparatus where work is to be done by the current, and from such apparatus or work each line-wire is carried back to the machine and formed into a cable, h^2, which is directly connected with the opposite brush, I′, of the commutator, or, if desired, with an extra binding-post, F′, which is connected with the brush I′. It will, of course, be understood that the number of coils upon the stationary magnets may be varied at will. It is not essential that the separate coils surrounding the stationary magnets shall all be of the same length, although it may be desirable in some cases, and it is desirable that the number of convolutions of the several coils surrounding the stationary magnets shall be alike.

It has heretofore been the practice in multiple-circuit machines to provide a separate commutator for each separate circuit. It will be seen that by my invention no additional commutator is required, and no addition to the machine is necessary, excepting the additional number of binding-posts required by the increase in the number of operative circuits.

It has also been common to divide the line-wire of a single-circuit machine into branches or loops; but in that case a break in the continuity of either of the branches diverts the entire current into those of the branches which remain unbroken. In my invention, on the contrary, the several operative circuits are wholly independent of each other.

Fig. 2 illustrates my invention in a machine provided with three independent operative circuits, P, Q, and R, each of which is supplied with a current generated in its own portion of the coil around the cores of the stationary magnets. A break in either of these three circuits simply renders that portion of the coil with which it is connected inoperative, leaving the other portions of the coil, as before, to continue the generation of currents for the unbroken circuits respectively. The same thing is true of any number of circuits formed as I have described, by including as a part of each one of them a separately-insulated wire, forming an independent portion of the coils surrounding the cores of the stationary magnets.

As an illustration of the practical operation of my invention, the letters P′ Q′ R′ may be assumed to indicate respectively an electric lamp in each circuit. If, for example, the lamp P′ be extinguished, the lamps Q′ and R′ will be unaffected, because there will be no change in the electro-motive force of the current which supplies them through their respective circuits Q and R; and it is also true that if all the operative circuits but one be broken the electro-motive force of the current in the unbroken circuit will remain unchanged.

I claim as my invention in dynamo-electric machines—

1. A system of different operative circuits established by winding upon the cores of the stationary magnets separately-insulated wires, having one set of their free ends electrically connected with one of the commutator-brushes, and the other set of their free ends electrically connected respectively with the ends of a corresponding number of outside circuits or line-wires, whose opposite ends are electrically connected with the other commutator-brush, substantially as and for the purpose set forth.

2. In a dynamo-electric machine, substantially such as shown and described, the iron

bridges B B, connecting the outer ends of the stationary magnets, provided with extensions forming foot-pieces, having on their lower edges the laterally-projecting flanges B^1 B^1, as and for the purpose set forth.

3. The iron bridges B B, provided with the series of parallel slots C, as and for the purpose set forth.

4. In combination with the cast-iron cores of the stationary magnets, the wrought-iron plates K, forming the bars of the curved slotted poles, substantially as shown and described.

5. The wrought-iron bars K, provided with the notched projections K^1, as and for the purpose set forth.

6. The mode of constructing the wrought-iron slotted poles of the stationary magnets herein described, which consists in bolting or otherwise securing together a series of thin wrought-iron plates, equidistantly separated from each other by two series of gibs or small pieces of iron respectively interposed between the plates near the opposite ends thereof, and in filling the interior spaces between the plates with plaster-of-paris, and in heating the mass of plates thus formed, and in placing it in the sand-mold in suitable position to be incorporated into the cast-iron part of the core by the entrance of the molten iron between and around the projecting notched ends K^1 of the plates K, substantially as described.

7. The binding-posts F, arranged upon insulating material placed upon the upper curved pole, substantially as shown and described.

8. In combination with the commutator and brushes of a dynamo-electric machine, the fixed gages *v v*, substantially as and for the purpose set forth.

9. A rotating armature having an arrangement of coils wound upon it and connected to the commutator, in the manner described, each system or section of the coils being wound upon itself, so that the systems shall be alongside each other in such division of the armature, and equidistant from the center of the armature, substantially as shown and described.

EDWARD WESTON.

Witnesses:

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