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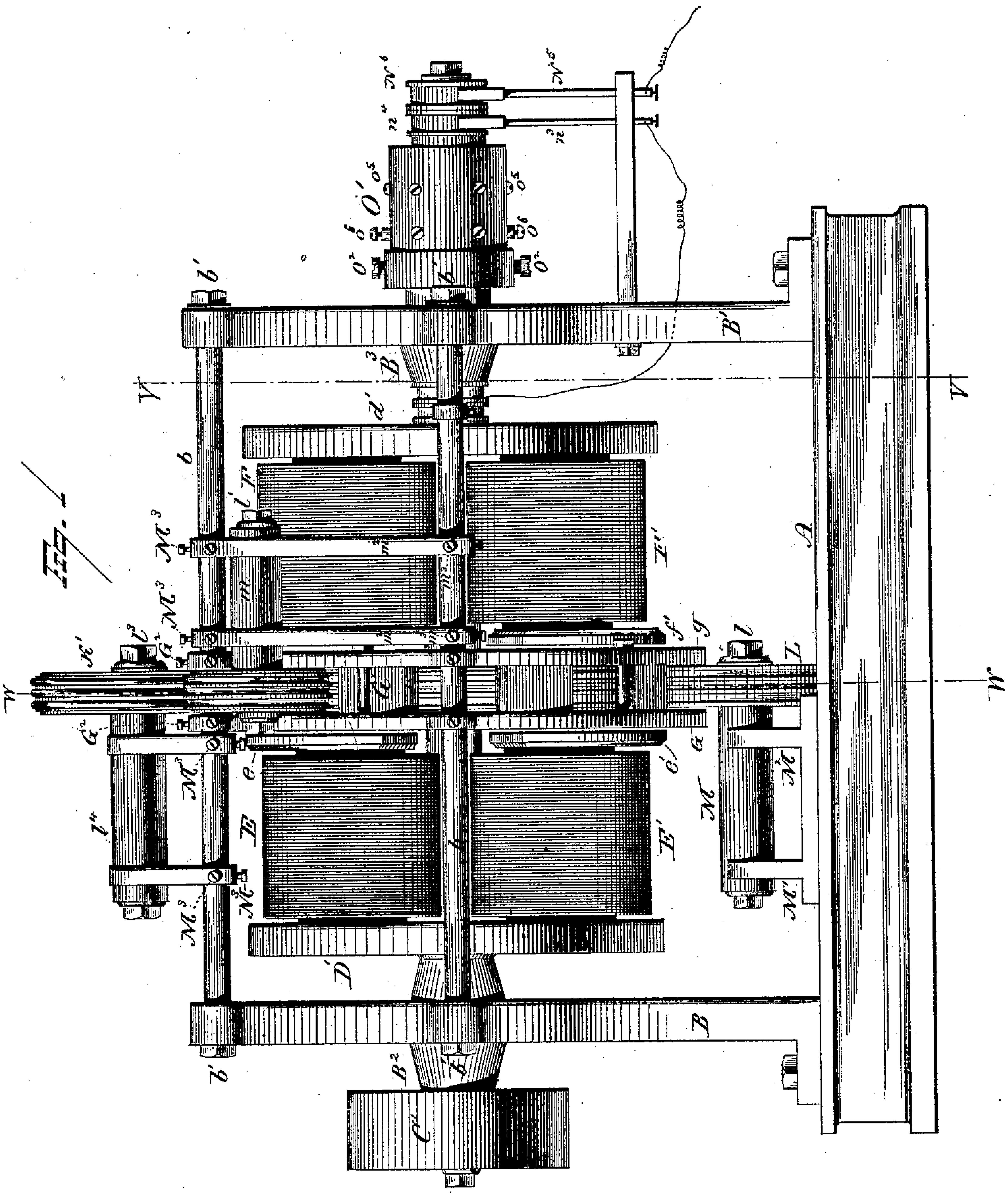
G. W. FULLER.

DYNAMO ELECTRIC MACHINE.

No. 278,121. Patented May 22, 1883.



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(No Model.) 5 Sheets—Sheet 2.

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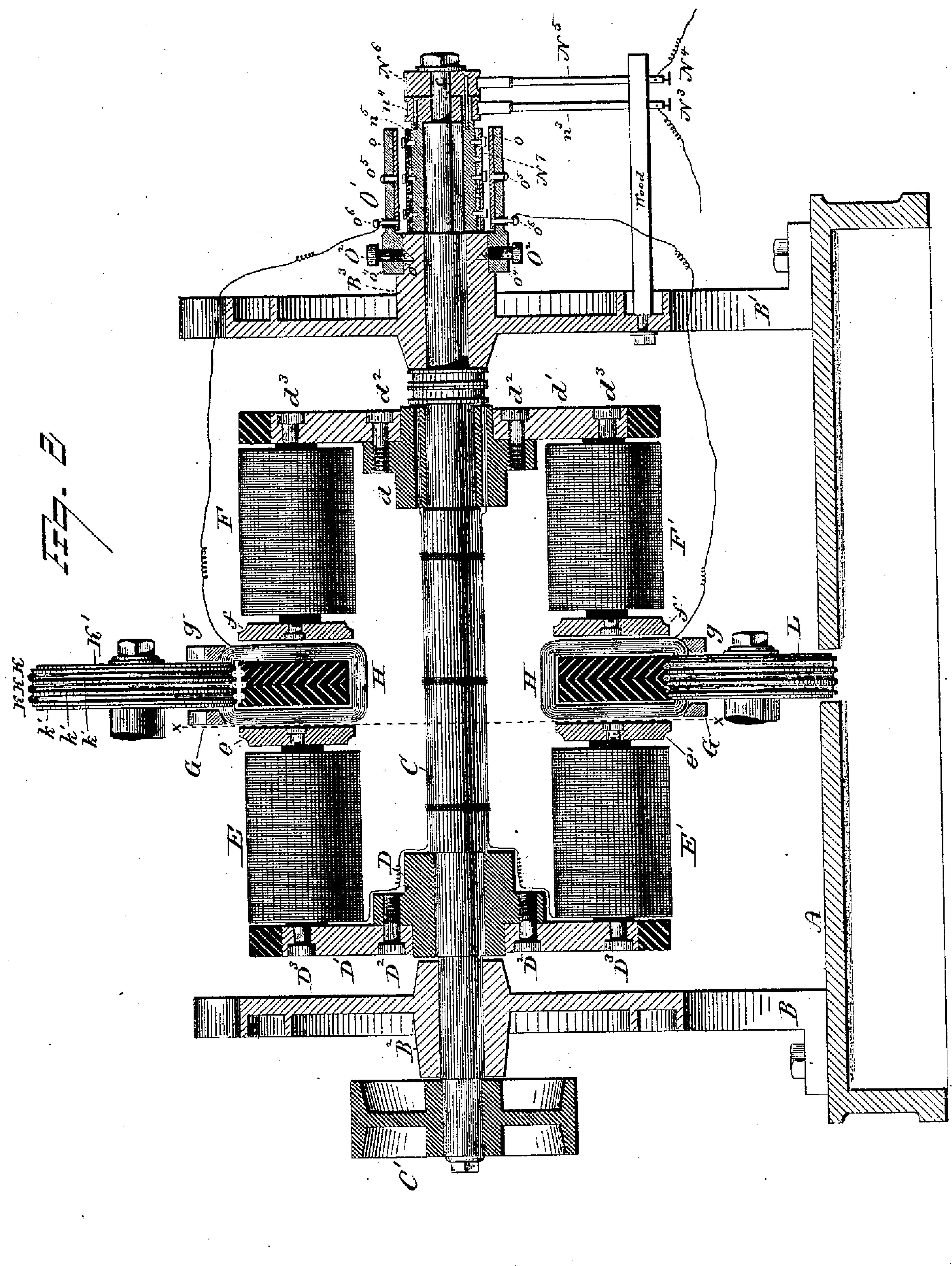

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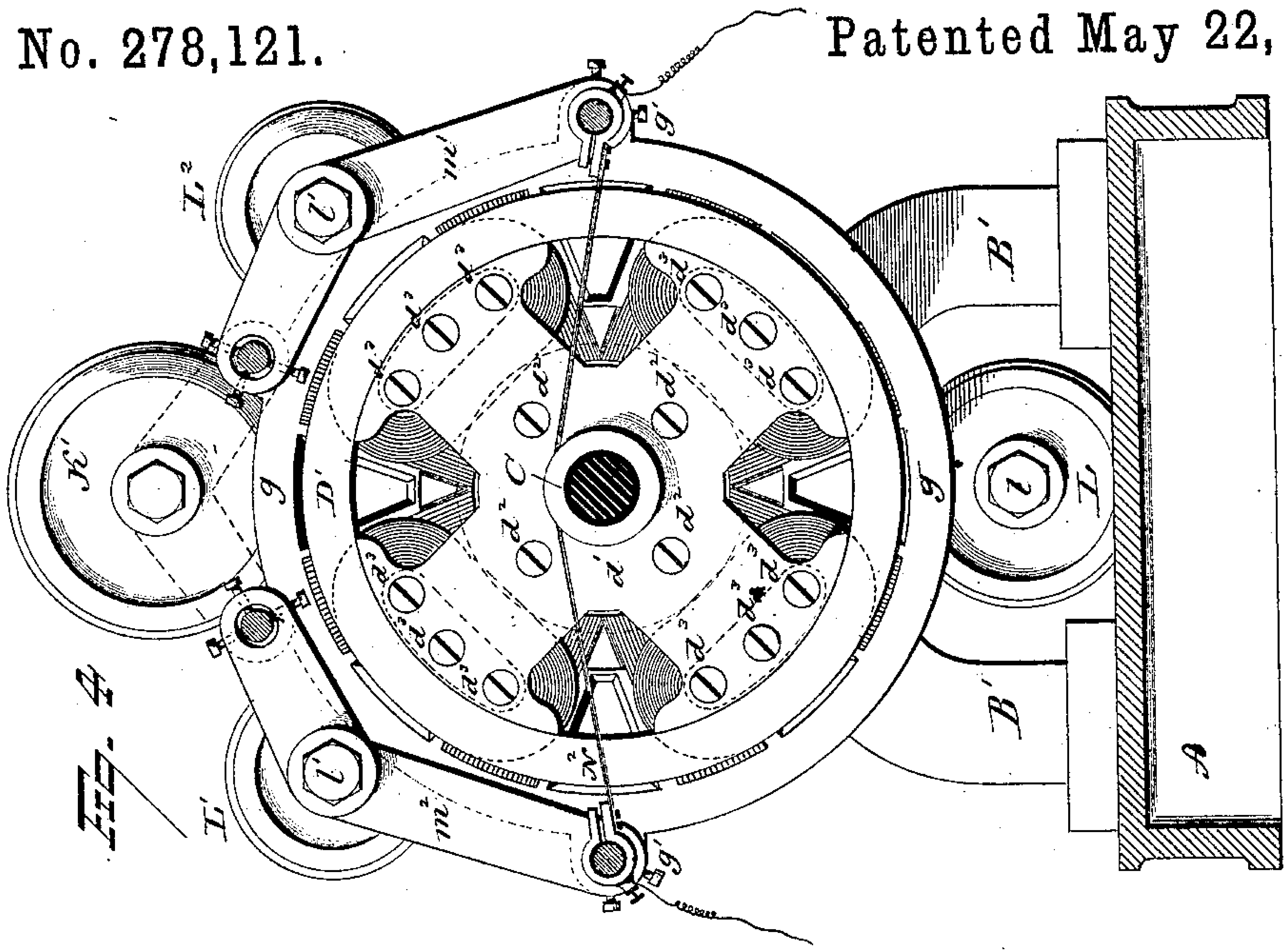

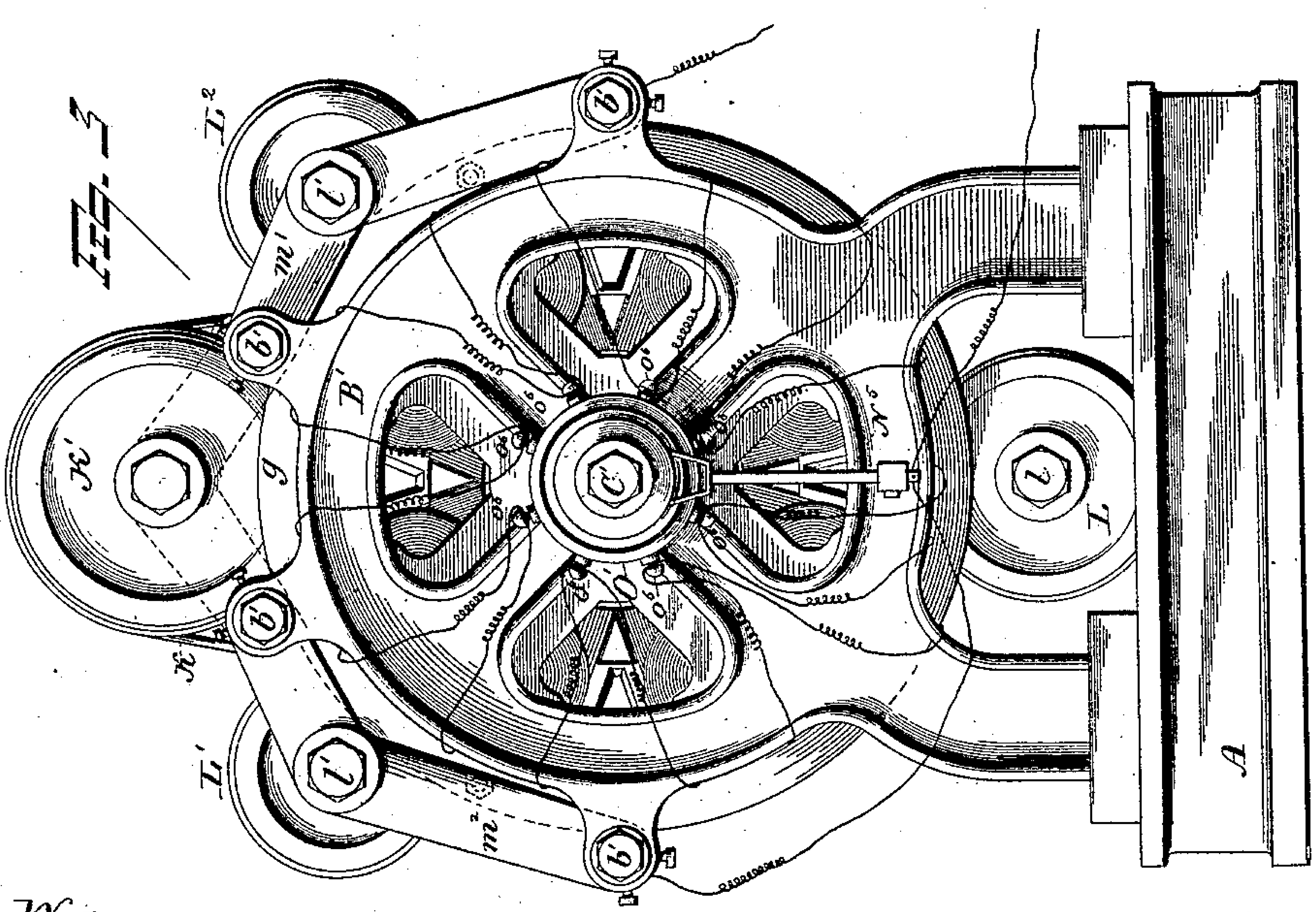

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(No Model.) 5 Sheets—Sheet 4.

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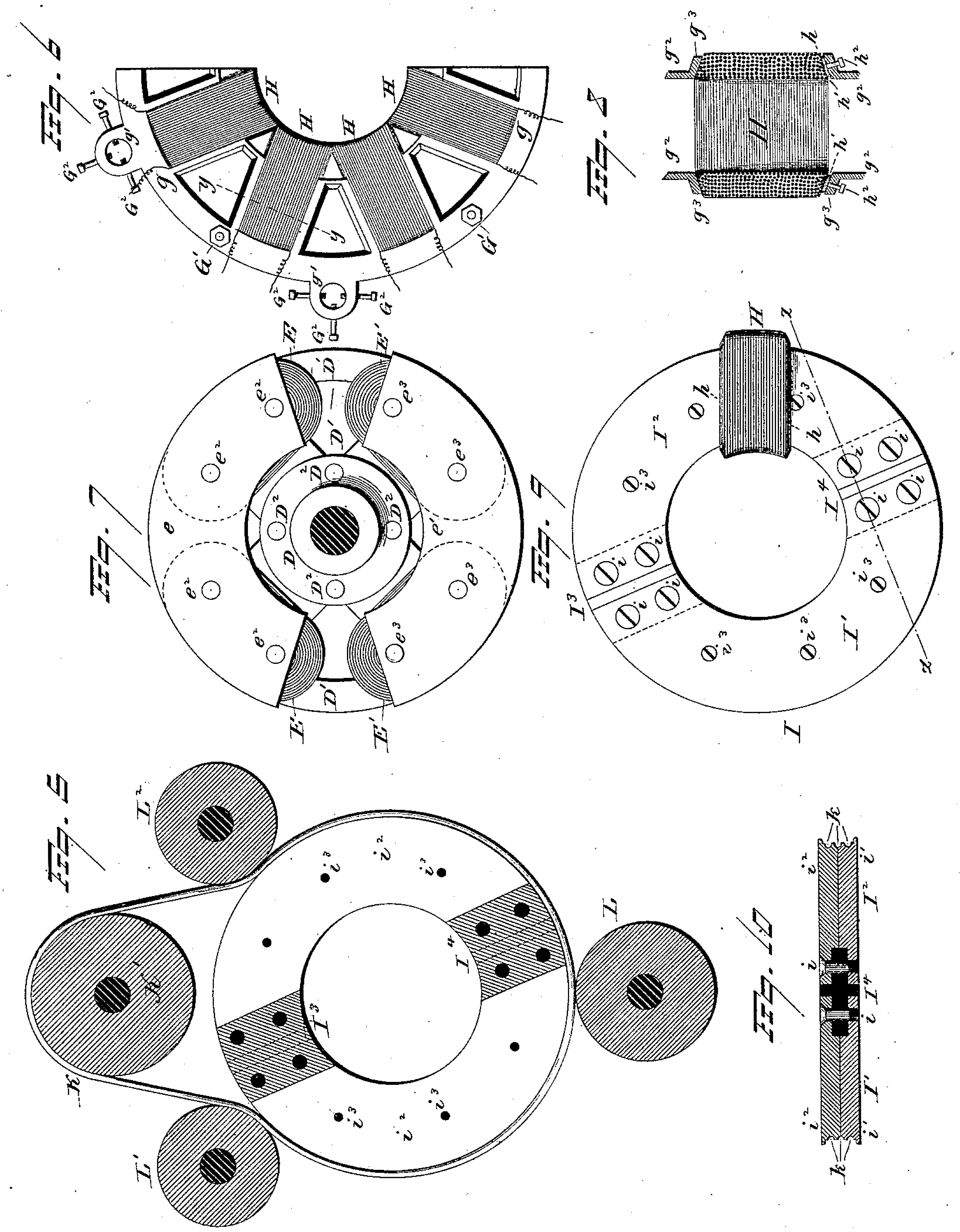

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(No Model.) 5 Sheets—Sheet 5.

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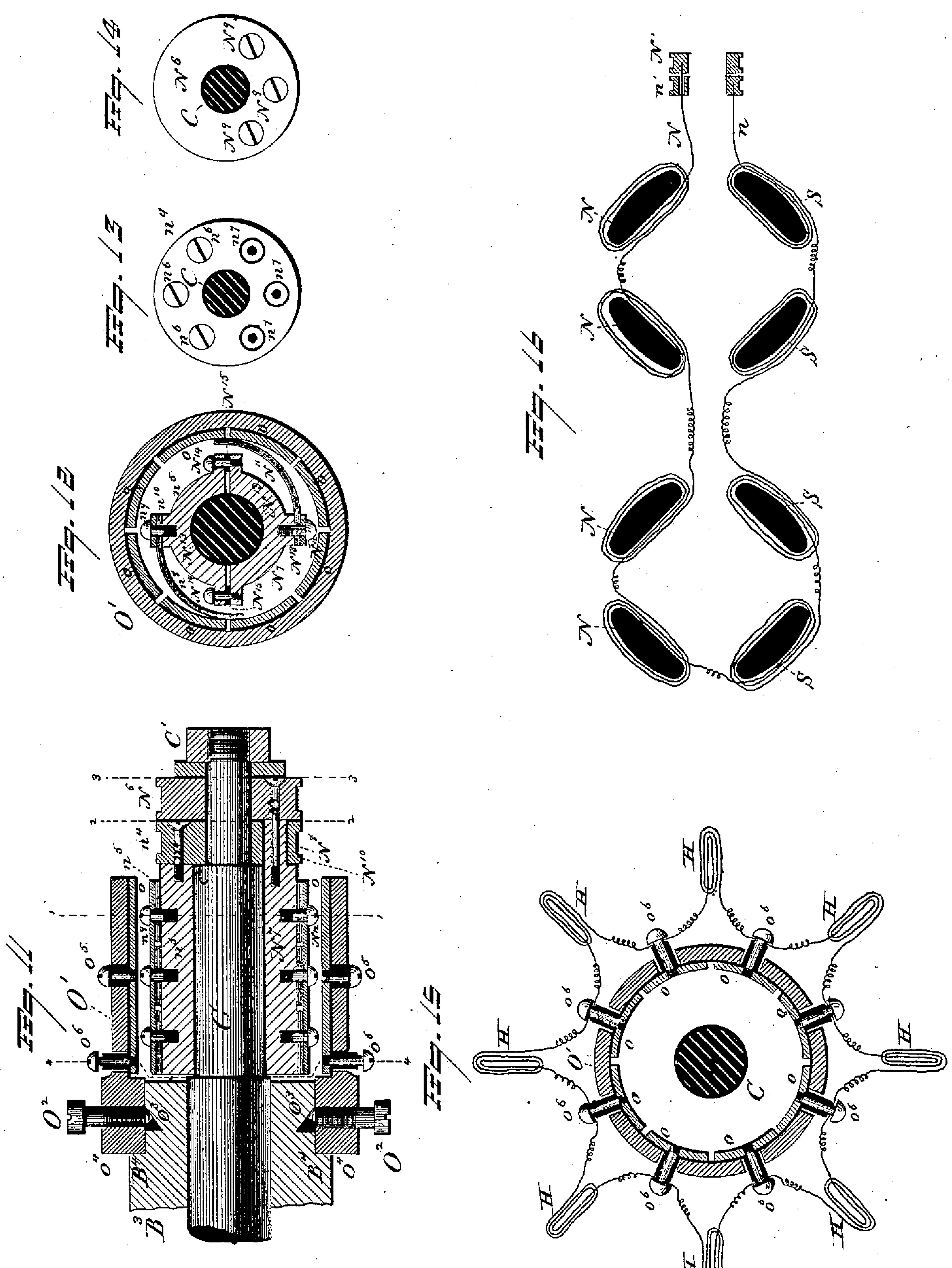

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UNITED STATES PATENT OFFICE.

GEORGE W. FULLER, OF NORWICH, CONNECTICUT.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 278,121, dated May 22, 1883.

Application filed February 19, 1883. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. FULLER, of Norwich, Connecticut, have invented a certain Improvement in Dynamo-Electric Machines, of which the following is a specification.

My improvements relate to certain special features of construction in the dynamo-electric machines which employ my invention of an armature-core which is independent of the coils surrounding it, and which is made to preserve unchanging polar relations to the field-magnets.

In two other pending applications, respectively designated "Case A" and "Case B," I have described two dynamo-electric machines in which my said invention is employed, the one an alternating-current machine and the other a constant-current machine, in each of which the armature-core, which is in the form of an annulus, is provided upon its periphery and sides with polar prominences, and is rotated by the magnetic attraction of rotating field-magnets arranged in circumposed groups, each of which groups is composed of three magnets of like polarity to each other, but of opposite polarity to that of the groups adjoining it. In the present case, which I designate "Case C," the annular armature-core, instead of having the polar prominences upon its periphery and sides, is composed of two long segments, of iron or other magnetic material, secured to two short segments of non-magnetic material, and in the two circles of rotating field-magnets the magnets of like polarity adjoin each other, and are united by common pole-pieces, those of the field-magnets which are of one polarity being upon one side of the axis of the machine, and those of the other polarity being upon the other side thereof.

In carrying out my present invention I employ two parallel systems of circumposed rotating field-magnets. The number of magnets in each system may be varied according to the size of the machine. The magnets of the two systems are respectively affixed to the opposed faces of two rotating disks, and their axes are parallel to the axis of rotation of the disks. Between the opposed poles of the field-magnets I support the armature-coils upon a stationary frame. The armature-core, which is segmentally encircled by the armature-coils, is in the form of a flattened ring, and is suspended in the bight or bights of one or more cables or cords hung over a suitably-elevated loose pulley, and is prevented from swaying laterally by means of grooved guide-rollers acting through the spaces between the stationary coils upon the convex portions of the cables embracing the core. The core, being thus free to rotate, is carried around by the attraction of the rotating field-magnets, and its division into segments of magnetic material causes the establishment in it of permanent poles at the ends of the segments. The coils of the field-magnets and the armature-coils are all included in the same circuit, and the machine is self-charging. A peculiar commutator and brushes are employed to collect the electrical impulses induced in the stationary coils, and by means of suitable contact makers and connections the current from the commutator is conducted through the field-circuit coils and through the outside or working circuit.

In the accompanying drawings of a machine illustrating my invention, the systems of rotating field-magnets are each composed of but four magnets, two of which of like polarity are upon one side of the shaft, while the other two, which are of the opposite polarity, are upon the other side of the shaft. The number of magnets of which each system is composed, however, may be indefinitely increased, according to the size of the machine.

The drawings are as follows: Figure 1 is a side elevation of the machine. Fig. 2 is a longitudinal vertical section. Fig. 3 is a front end elevation. Fig. 4 is a transverse vertical section through the dotted line *v v* on Fig. 1. Fig. 5 is a transverse vertical section through the dotted line *w w* on Fig. 1. Fig. 6 is an elevation of a part of the frame supporting the stationary coils. Fig. 7 is a transverse vertical section taken through the dotted line *x x* on Fig. 2, showing in elevation one of the systems of rotating field-magnets and the two pole-pieces respectively connecting the poles of like polarity. Fig. 8 is a transverse section, showing upon an enlarged scale the parts cut by the line *y y* on Fig. 6. Fig. 9 is an elevation of the floating armature-core, showing one of the stationary coils inclosing a portion of it. Fig. 10 is a section of the floating armature-core, taken through the line *z z* on Fig. 9. Fig. 11

is an axial section on an enlarged scale of the commutator, and adjoining parts of the machine. Fig. 12 is a transverse section of the commutator taken through the line 1 1 on Fig. 11, showing the mode of securing the brushes to the rotating brush-holders and the manner in which the brushes bear upon the concave faces of the stationary commutator-strips. Fig. 13 is a transverse section through the line 2 2 on Fig. 11. Fig. 14 is a transverse section through the line 3 3 on Fig. 11. Fig. 15 is a transverse section through the line 4 4 on Fig. 11, surrounded by a diagram arbitrarily representing the eight stationary armature-coils, and showing the manner of electrically connecting these coils with each other and with the commutator-strips. Fig. 16 is a diagram arbitrarily representing the coils of the rotating field-magnets, and showing the manner of electrically connecting such coils with each other and with the contact-wheels by means of which electrical connection is made with stationary brushes.

Referring to the drawings, it will be seen that the bed A is provided with the two standards B and B′, which are respectively perforated to receive the opposite ends of the horizontal bolts *b*, which project, respectively, through the standards to receive the nuts *b*′. The standards are respectively provided with the central bosses, B^2 and B^3, which are perforated to receive the main shaft C of the machine, which is driven by a belt on the pulley C′.

Secured on the shaft C between the standards are the substantial hubs D *d*, to which are fastened, respectively, the wheels D′ and *d*′, which carry the field-magnets E E E′ E′ and F F F′ F′. The wheels D′ and *d*′ are fastened to their respective hubs by screws D^2 and d^2. The cores of the field-magnets are at one end fastened to the wheels D′ and *d*′, respectively, by suitable numbers of screws, D^3 and d^3. The axes of the field-magnet cores are, it will be seen, parallel to the shaft C. The pairs of adjoining magnets E E and E′ E′, F F and F′ F′, are provided with the pole-pieces *e* and *e*′, *f* and *f*′, respectively, which are severally fastened to the field-magnet cores by the screws e^2 e^3 and f^2 f^3, respectively. The horizontal bolts *b* serve the further purpose of supporting the two annular plates G *g*, to which the stationary armature-coils H are secured. These plates are each provided with outwardly-projecting perforated ears, like the ears *g*′ in Fig. 6, through which the bolts *b* are inserted, and with eight equidistant inwardly-projecting triangular ears, g^2, the relatively-opposed sides of which are parallel with each other, and are provided with inclined flanges g^3 to form the bearings for the beveled sides *h* of the stationary coils H, as shown in Fig. 8. Gibs *h*′ are introduced at one side of each coil, and set-screws h^2 are inserted in the flanges g^3 for setting up the gibs *h*′ and firmly holding the coils in position. The two plates G *g* are secured to each other by the bolts G′.

The holes in the outwardly-projecting ears *g*′ of the plates G *g* are made larger than the bolts *b*, and are each provided with the three set-screws G^2 G^2 G^2, the inner ends of which bear upon the bolts *b* in each case, for the purpose of affording means of adjusting the position of the circumposed stationary coils H relatively to the position of the armature-core. The stationary coils H are circumposed and loosely encircle sections of the floating armature-core I, which is a flattened ring composed of two long segments, I' I^2, of paramagnetic material, united at their ends to two shorter segments, I^3 I^4, of diamagnetic material, by the screws *i*. The longer segments may each be made of two plates, *i*′ *i*′ and i^2 i^2, as shown in Fig. 10, secured to each other by the screws i^3.

The core I is suspended in the bight of three endless cords, K K K, which are deposited in three parallel circumferential grooves, *k k k*, formed in the periphery of the core. The suspending-cords are hung over the elevated pulley K′ in the three circumferential grooves *k*′ *k*′ *k*′, respectively. Any lateral sway of the core is prevented by means of the guide-rollers L, L′, and L^2, each of which also has three circumferential grooves for engagement with the suspending-cords, respectively.

It will be seen that the spaces between the exterior edges of the stationary armature-coils H expose sufficient portions of the periphery of the core to permit the application of the guide-rollers, as described.

The shaft *l* of the lower guide-roller has its bearing in the box M, supported by the standards M′ M^2, erected upon the bed of the machine. The shafts *l*′ and l^2 of the upper guide-rollers have their bearings, respectively, in the boxes *m m*, supported by means of the eye-bars *m*′ *m*′ and m^2 m^2 upon the horizontal bolts *b b b b*.

The rollers L′, K′, and L^2, in addition to acting as idlers and taking up the slack of the suspending-cords, also serve as means for effecting the lateral adjustment of the core. To this end the holes in the eye-bars through which the bolts *b* are inserted are made larger in diameter than the bolts, and the eye-bars are provided with the adjusting-screws M^3 M^3 M^3, the ends of which in each instance bear upon the bolt *b*. It will be seen that by means of these adjusting-screws either of the pulleys L′ and L^2 may be moved inwardly or outwardly, and that by moving the pulley L′ outwardly and the pulley L^2 inwardly the core may be swung to the right, and, vice versa, by moving the pulley L′ inwardly and the pulley L^2 outwardly the core may be swung to the left.

The shaft l^3 of the elevated pulley K′ has its bearing in the box l^4, supported by means of the eye-bars l^5 l^5 upon the upper pair of horizontal bolts, *b b*.

The coils of the field-magnets of each group are so connected that the pairs of magnets having a common pole-piece are of like polarity to each other, the magnets having their cores affixed to one pole-piece being of opposite polarity to that of the magnets having their cores affixed to the other pole-piece. The pole-pieces which face each other are also of like polarity, the two pole-pieces upon one side of the shaft being of one polarity and the remaining pole-pieces upon the opposite side of the shaft being of the opposite polarity.

In Fig. 16, which is a diagram illustrative of the manner in which the coils of the field-magnets may be so connected up as to be included in the same circuit, there is an arbitrary representation of the coils of the two groups of field-magnets as they would appear if the disks upon which they are respectively supported should be swung around upon vertical axes in opposite directions so as to present the opposed poles of the cores in the same plane.

By following out the diagram showing the convolutions of the coils and the mode of connection of the coils with each other it will be seen that the upper pairs of the two groups of field-magnets present north poles toward each other and the lower pairs present south poles toward each other.

The terminals N n of the field-circuit are carried through apertures in the hub d, and are electrically connected, respectively, with the contact-disks N′ n', which are insulated from each other and from the main shaft C, upon which they are mounted.

The current to charge the field is transmitted to the contact-disks N′ n' by the brushes N^2 n^2. One of these brushes, N^2, is electrically connected with the binding-post N^3 on the lower end of the brush-holder, which supports the brush n^3, which bears upon the face of the contact-wheel n^4, mounted upon the stub end c of the main shaft, but insulated therefrom, and electrically connected with the commutator-brush holder n^5. One terminal of the working circuit is connected with the brush n^2, and the other terminal is connected with the binding-post N^4 on the lower end of the holder which supports the brush N^5, which bears upon the contact-wheel N^6, mounted upon the stub end c of the main shaft, but insulated therefrom, and electrically connected with the other commutator-brush holder, N^7. The brush-holder n^5 is a semi-cylinder, the front end of which is secured to the contact-wheel n^4 by the three screws n^6. The brush-holder N^7, also semi-cylindrical in shape, is provided on its front end with three perforated bosses, N^8, which project through the apertures n^7 in the contact-wheel n^4, and which are tapped to receive the three screws N^9 by which the brush-holder N^7 is secured to the contact-wheel N^6.

The perforated bosses N^8 are surrounded with tubular shields of insulating material N^{10}, by which they are insulated from the contact-wheel n^4.

The two contact-wheels n^4 and N^6 are secured upon the stub end c' of the shaft by means of the nut c, which serves to clamp the contact-wheels against the shoulder c^2, formed upon the shaft C.

It will be seen that the commutator-brushes n^8 and N^{11}, which are affixed, respectively, to rotating brush-holders n^5 and N^7, bear upon the concave surfaces of the commutator-strips O, which are affixed to the interior of the cylinder O′, but are insulated therefrom and from each other. The brushes n^8 and N^{11} are respectively fastened by the screws n^9 N^{12} to the top of the ribs n^{10} N^{13}, formed upon the exterior of the brush-holders n^5 and N^7, respectively.

A shield of insulating material, N^{13}, is interposed between the stub end of the shaft and the concave surfaces of the brush-holders. The inner ends are each provided with pairs of projecting lugs, which are perforated to receive the clamping-screws N^{14}, by which the brush-holders are clamped together. Washers of insulating material, N^{15}, are introduced between the lugs.

The clamping-screws N^{14} N^{14}, which are screwed into the lugs of the brush-holder N^7, are suitably insulated from the brush-holder N^5, as shown in Fig. 12.

The commutator-cylinder O′ is fastened by the set-screws O^2 upon the projecting end of the boss B, in which the main shaft C has one of its bearings, and is circumferentially adjustable. The ends of the screws O^2 are conical, and bear upon the inwardly-inclined bottom O^3 of a circumferential groove in the periphery of the boss B^3, thus producing the effect of forcing the rear end, O^4, of the commutator-cylinder against the shoulder B^4 of the boss B^3, and thereby centralizing the commutator-cylinder.

The strips are fastened to the cylinder by means of the screws O^5. A binding-post, O^6, is provided for each strip, and the number of strips equals the number of stationary coils employed in the machine.

The stationary coils H are connected in series, the outer convolution of one coil being connected with the inner convolution of the next following coil, and so on, thus making an endless conductor, H′, which includes all the stationary coils.

Between each pair of coils the circuit H′ is looped to the commutator-strips, as illustrated in Fig. 15.

I claim as my invention—

1. In a dynamo-electric machine provided with a suitable commutator and suitable electrical connections, two parallel systems of rotating field-magnets, a system of circumposed stationary armature-coils arranged between the opposed poles of the two systems of field-magnets, and loosely-encircling segments of a floating armature-core in the form of a flattened ring built up of segments of magnetic material joined to segments of non-magnetic material, as set forth.

2. In a dynamo-electric machine substantially of the character described, in which the field-magnets are rotated and the circumposed armature-coils are stationary, an annular armature-core independent of the armature-coils and suspended in the bight or bights of a cord or cords hung over an elevated pulley

and prevented from lateral swaying by suitably-grooved guide-rollers acting through two or more of the spaces between the outer portions of the circumposed stationary coils upon a cord or cords lying against the periphery of the annular core.

3. In a commutator substantially such as described, in which the commutator-strips are affixed to the interior of a stationary cylinder surrounding the stub end of the rotating shaft upon which the rotating field-magnets are mounted, brush-holders in the form of semi-cylinders partially embracing the stub end of the rotating shaft, and respectively fastened to and electrically connected with two contact-wheels suitably insulated from each other, the contact-wheels being provided with stationary brushes by means of which the electrical impulses induced in the stationary coils and collected by the rotating brushes are conducted to the terminals of the field and working circuits.

4. In combination with the pulley K′, the adjustable pulleys L′ L², bearing in opposite directions upon the cords, in the bights of which the armature-core is suspended, for effecting the lateral adjustment of the armature-core.

5. The frame for supporting the circumposed stationary coils H, composed of the plates G g, provided with means of adjustment for adjusting the circumposed coils H relatively to the armature-core I.

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