(No Model.) 7 Sheets—Sheet 1.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.

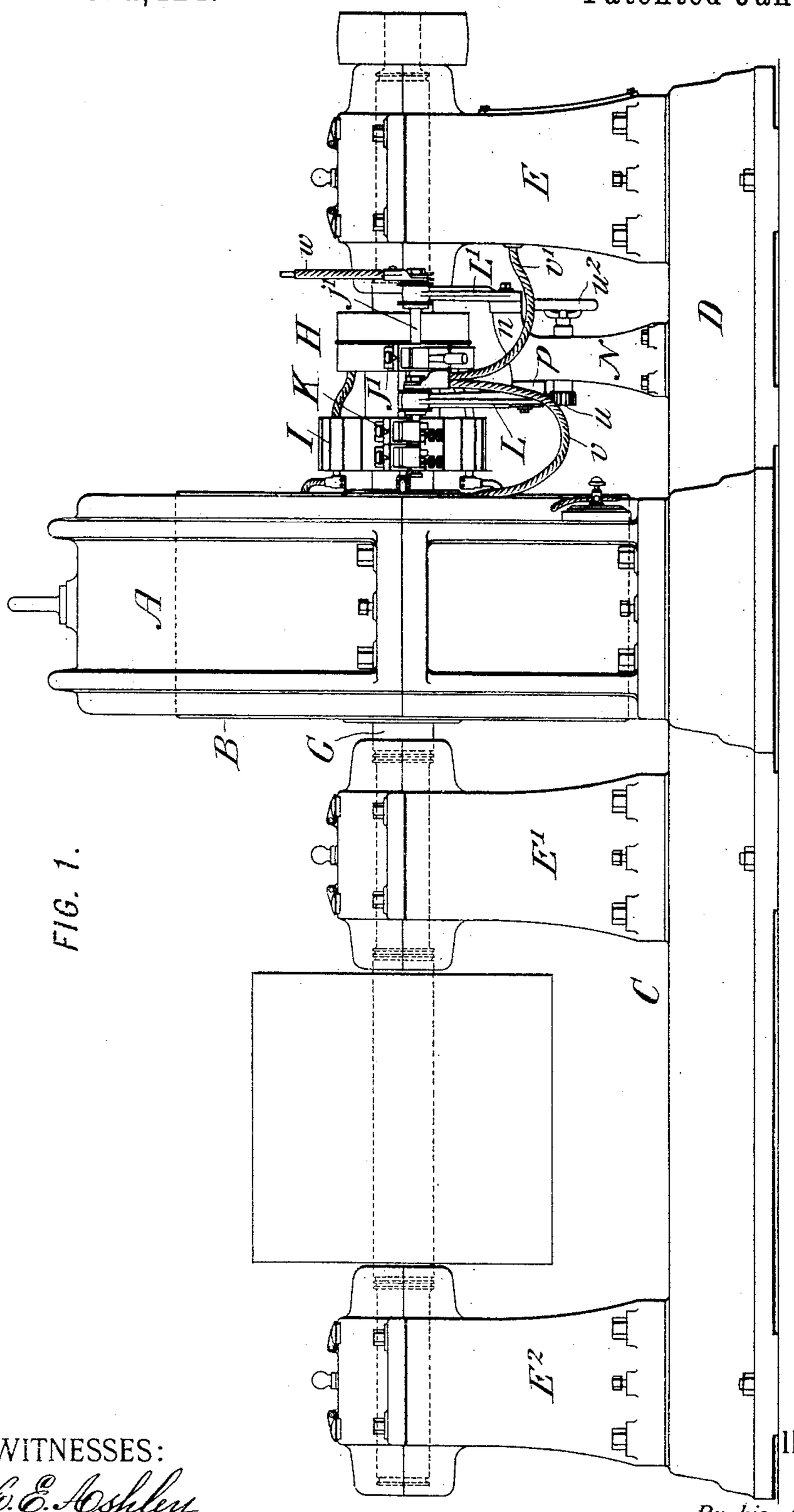

FIG. 1.

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(No Model.) 7 Sheets—Sheet 2.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.

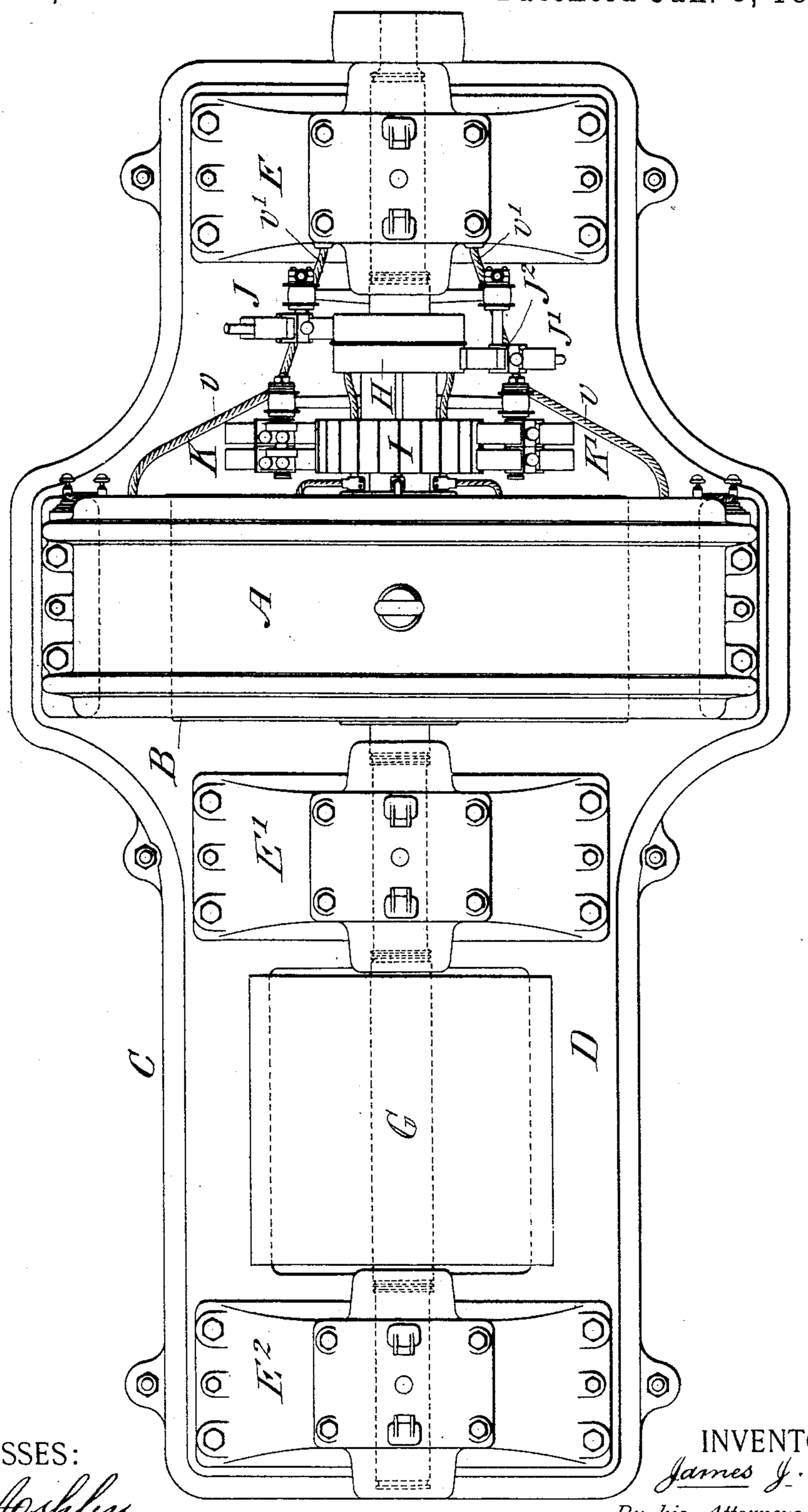

FIG. 2.

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(No Model.) 7 Sheets—Sheet 3.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.

FIG. 3.

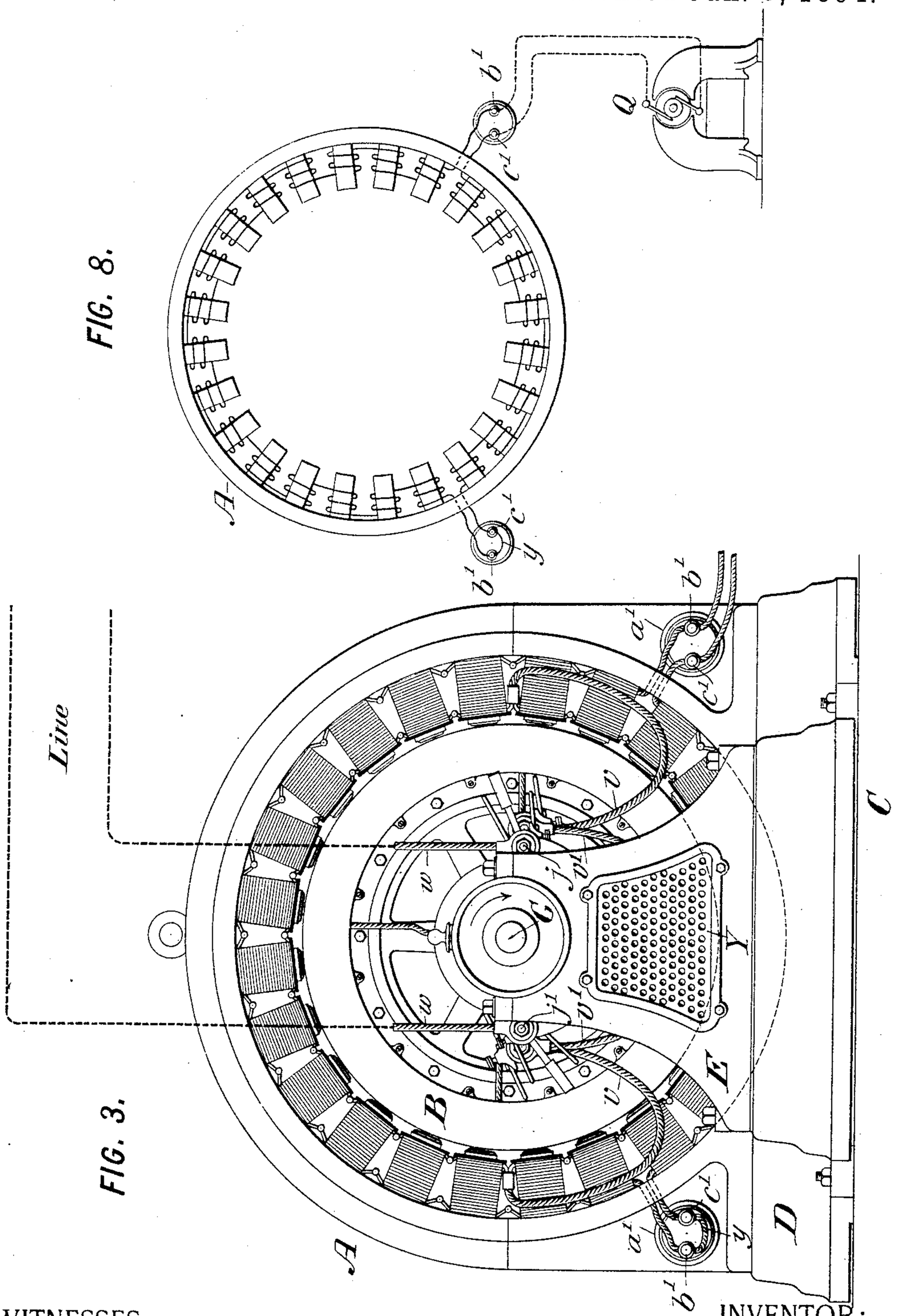

FIG. 8.

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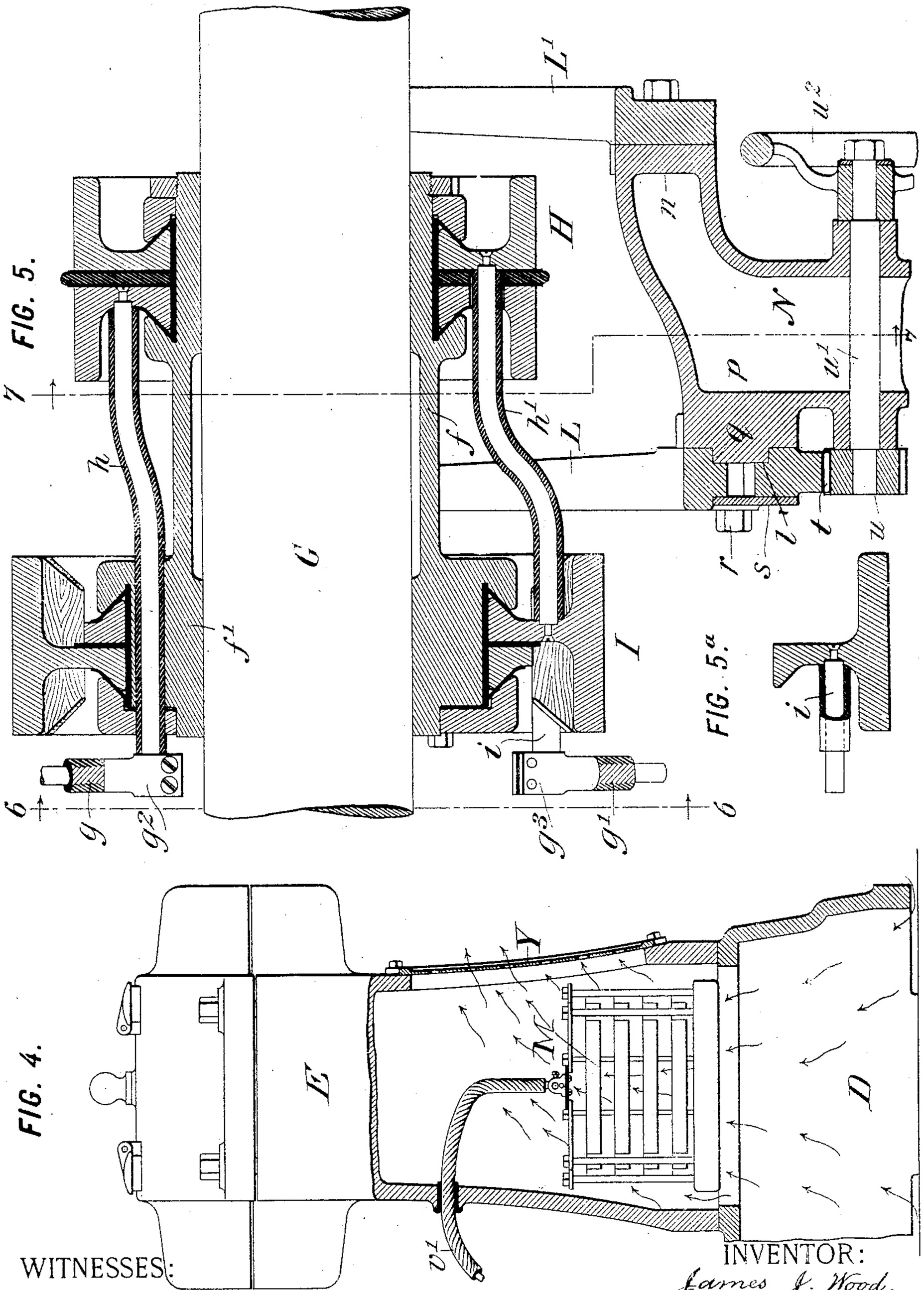
(No Model.) 7 Sheets—Sheet 4.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.



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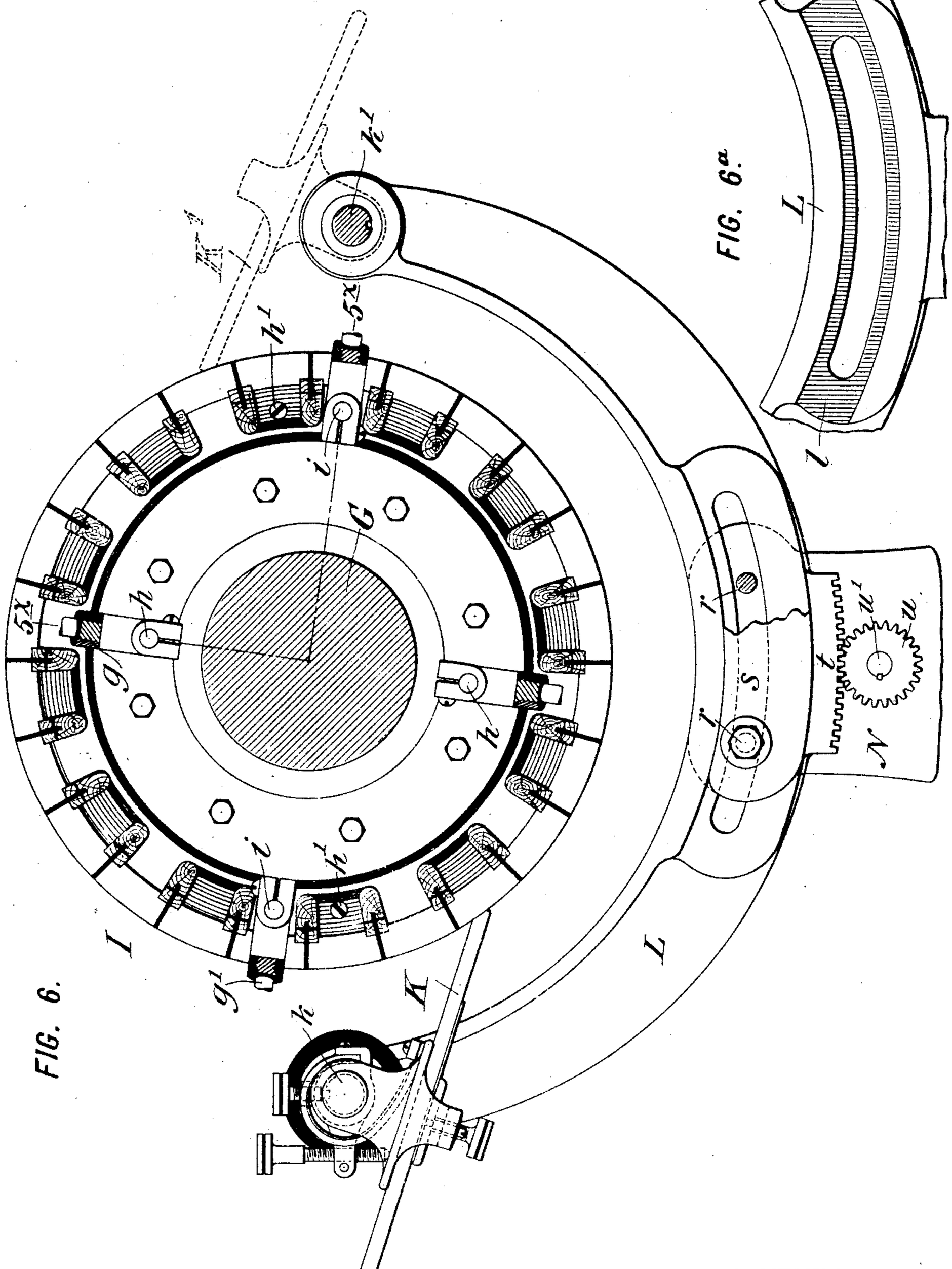
(No Model.) 7 Sheets—Sheet 5.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894



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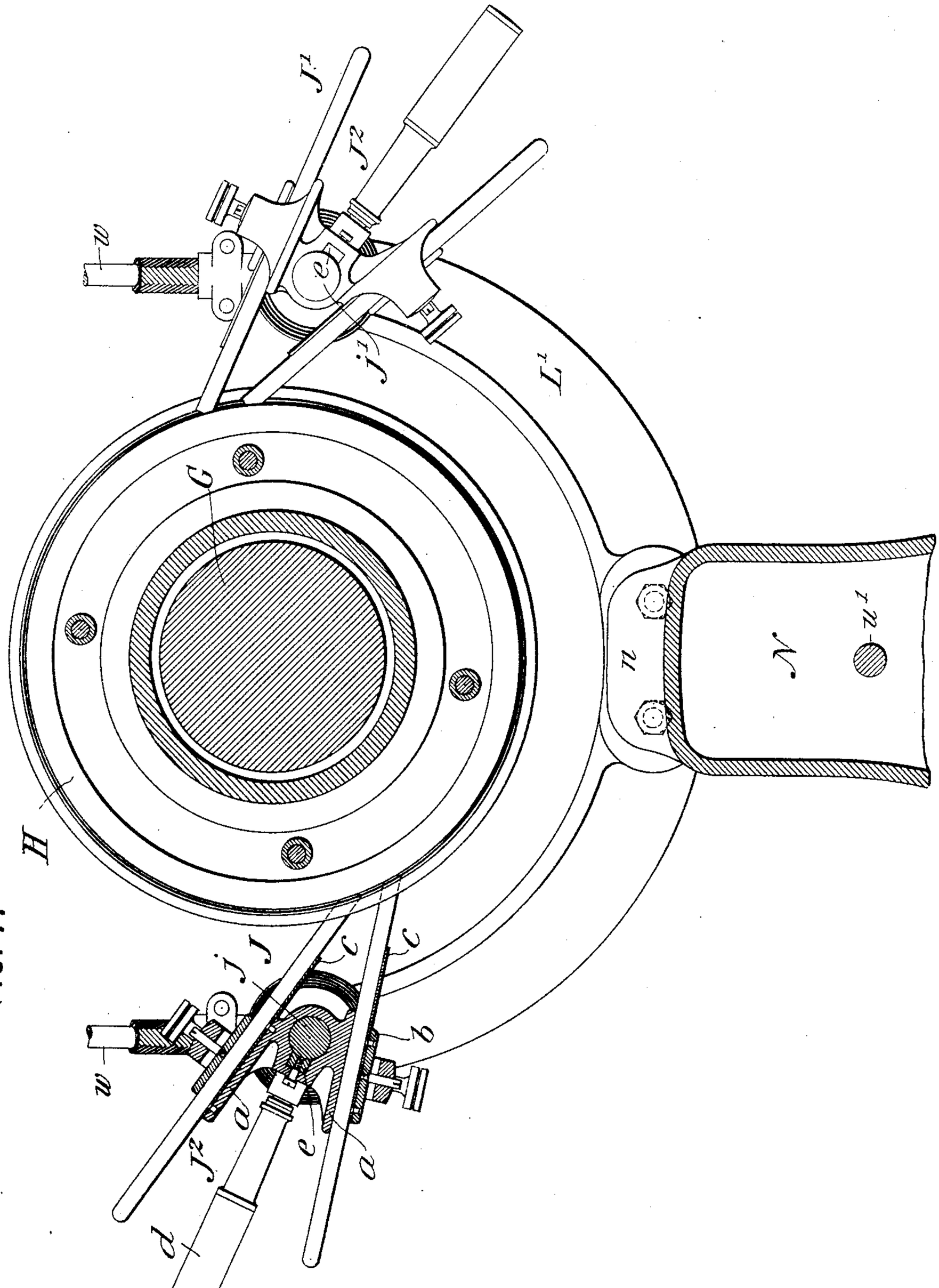
(No Model.) 7 Sheets—Sheet 6.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.



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(No Model.) 7 Sheets—Sheet 7.

J. J. WOOD.

ALTERNATING CURRENT DYNAMO.

No. 512,424. Patented Jan. 9, 1894.

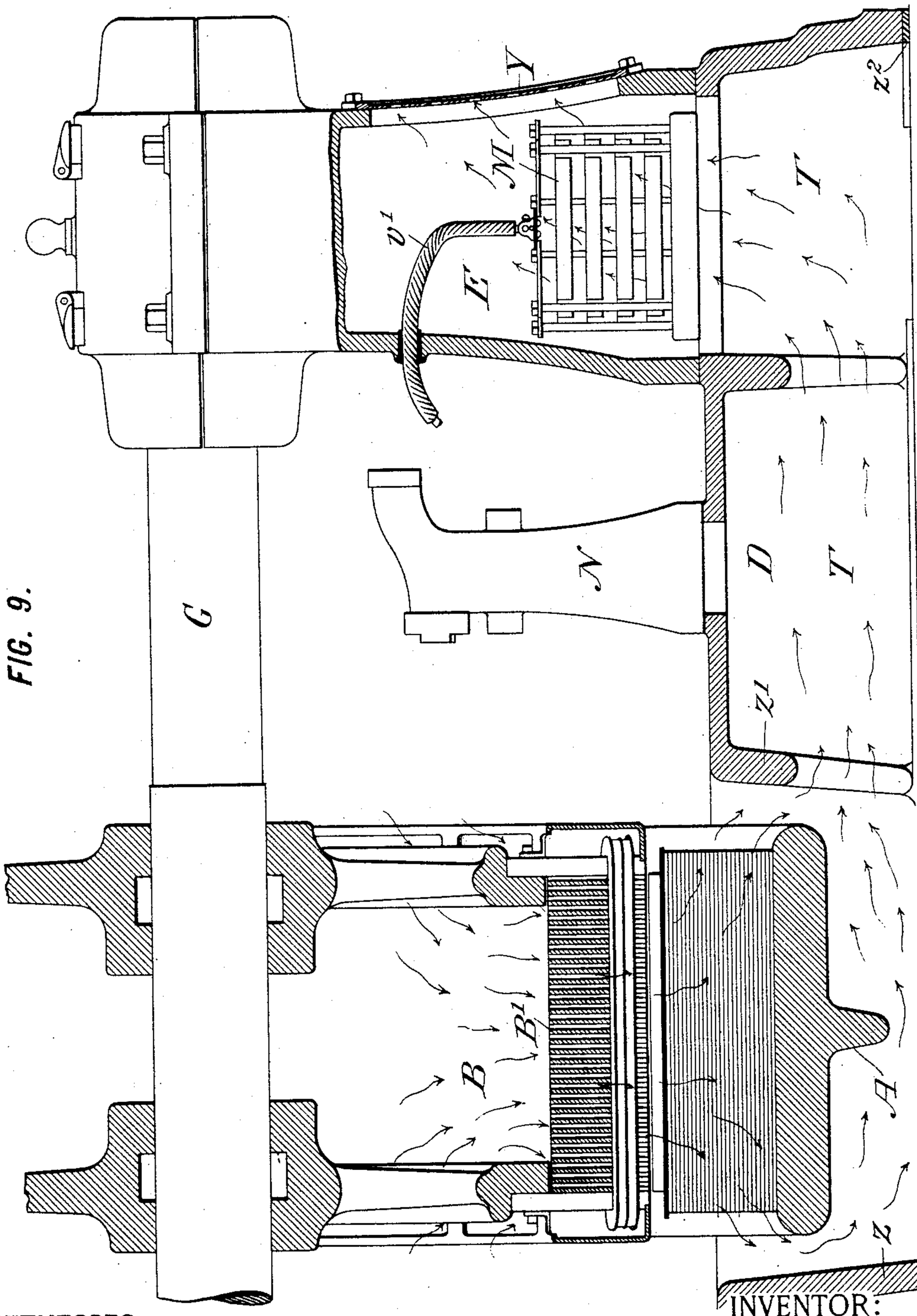

FIG. 9.

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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

ALTERNATING-CURRENT DYNAMO.

SPECIFICATION forming part of Letters Patent No. 512,424, dated January 9, 1894.

Application filed June 23, 1893. Serial No. 478,579. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Alternating-Current Dynamos, of which the following is a specification.

This invention relates to dynamo electric machines for generating alternating currents, or pulsatory currents formed by rectifying alternating currents.

The invention is applicable chiefly to those alternating dynamos wherein the field-magnet is stationary and is of the multipolar variety, and the armature revolves within the poles thereof.

The improvements introduced by this invention have reference to the terminal connections and winding of the field-magnet; to the mounting for supporting the commutator and collector brush-holders; to the construction of the collector brush-holders; and to the construction of the commutator and collector and their connections.

The accompanying drawings illustrate the preferred construction of an alternating dynamo embodying my present invention, the particular machine here illustrated being proportioned for what is known commercially as a one hundred and fifty kilo Watt machine, that is to say, for generating one hundred and fifty ampères at from ten hundred and forty to eleven hundred and eighty volts. The improvements are, however, applicable to many other different styles and proportions of machines.

Figure 1 is a side elevation. Fig. 2 is a plan; Fig. 3 an end elevation. Fig. 4 is a partial vertical section of one of the bearing pillars and the base beneath it showing the mounting of the field shunt resistance, the view being on a scale double that of Figs. 1, 2, and 3. Fig. 5 is a vertical mid-section through the commutator and collector and the brush yokes and their bearing pillar, on a scale four times that of Figs. 1 to 3. Fig. 5ª is a fragmentary detail section through one of the commutator sections. Fig. 6 is an elevation of the commutator and its brushes and their supports, on the same scale as Fig. 5. Fig. 6ª is a fragmentary view of the opposite side or seat of the commutator brush yoke. Fig. 7 is a section on the line 7—7 in Fig. 5, showing in elevation the collector and its brushes and their supports with the brush supporting pillar in section on the same scale as Fig. 5. Fig. 8 is a diagram showing the main field-magnet winding for a separate excitation. Fig. 9 is a partial longitudinal mid-section.

The dynamo shown in the drawings, and in which my present invention is embodied, is of the well known type of alternating dynamos wherein the field-magnet consists of a stationary ring with inwardly projecting poles of alternately north and south polarity and wound with exciting coils, and the armature is mounted upon an armature shaft and revolves within the multipolar field-magnet, the armature being of the iron-clad type, having as many pole-pieces projecting from its laminated annular core as the number of poles of the field-magnet, and having its pole-pieces wound with coils. Such alternating dynamos commonly have their field-magnets compound wound, that is to say, the poles of the field-magnet carry two coils, one of which called the "main field winding" receives a uniform current from either a separate exciter as shown in Fig. 8, or from a special winding on the armature, while the other called the "series winding" receives the greater part of the current that is sent out over the line, in order that as the load on the machine increases the increased volume of current shall build up the magnetization of the field-magnet sufficiently to enable it to maintain the necessary electro-motive force at the terminals of the machine. The current while being sent through the series winding is rectified to have a uniform direction by means of a commutator, to the opposite brushes of which the terminals of the series winding are connected, while between these brushes is connected a resistance shunt, its resistance being so proportioned to that of the series winding as to take say about one-fifth (more or less) of the current, the other four-fifths or thereabout passing through the series winding of the field. The purpose of this field shunt is to form a closed circuit around the series winding constituting a path for the extra current produced therein due to the

varying magnetization of the poles, and to afford a means for adjusting the ratio of over-compounding of the dynamo under load.

The features thus far described are usual to dynamos of this class.

Referring to the drawings, the field-magnet A is in general of the construction usual in dynamos of this character, differing therefrom only in its design or appearance. The armature B is or may be also of the same general construction as the armatures commonly employed with dynamos of this class. In the machine shown, however, the armature actually employed is of peculiar and novel construction, which is fully illustrated and described in another application for patent (Serial No. 476,925, filed June 8, 1893) which I have executed for improvements in armatures for dynamos.

As the construction of the armature has no relation to those improvements which are herein claimed, I do not herein illustrate or describe its construction.

The frame of the machine, designated generally by the letter C, consists of a hollow base D and hollow bearing pillars E, E′, E² which carry the bearings in which the armature shaft G turns. The field-magnet A is mounted directly on the base D, preferably in a machine of this size by making its lower half a separate casting bolted to the base, although it might be cast integrally with the base, while the upper half or crown of the magnet is cast separately and bolted to it. In the construction shown the pillars E, E′, E² are separate castings bolted to the base, although they might be cast integrally therewith.

On the armature shaft G are mounted the collector H and commutator I. Bearing upon the opposite rings of the collector are the collector brushes J J′, and bearing upon the commutator are twin brushes K K′. The commutator brushes are sustained by a yoke L, while the collector brushes are sustained by a separate yoke L′, these yokes being provided each with two studs on their opposite arms on which the brush-holders are mounted. All these studs are insulated from the yokes and have directly attached to them the several socket pieces forming the terminals of the several conducting wires or cables. The two brush yokes L and L′ are mounted both upon a single brush supporting pillar N mounted fixedly on the base D and standing beneath the commutator and collector. The brush-yoke L′ is attached fixedly to one side of the pillar N, while the brush-yoke L for the commutator brushes is attached adjustably to the opposite side of the pillar. Both brush-yokes are formed as curved arms having seats at their middle or lower portions for attachment to the supporting pillar, and having perforated bosses formed on the ends of their arms for receiving the insulated studs for carrying the brush-holders. The fixed yoke L′ is bolted firmly to an overhanging seat *n* projecting upwardly and outwardly from the upper part of the supporting pillar N. The opposite side of the pillar is formed with a seat *p* for receiving the adjustable yoke L. It is to be understood that the adjustability of this yoke is provided for the purpose of enabling the commutator brushes to be exactly adjusted to bring their points of contact with the commutator to proper positions in order to insure the exact operation of the commutator in inverting or rectifying the alternating currents. The middle portion or seat of the yoke L is formed with an arc-shaped groove or slot *l* (see Figs. 5, 6 and 6ª) which fits over an arc-shaped rib or projection *q* on the seat *p*, the arc-shaped slot and rib being formed as arcs of circles concentric with the axis of rotation. Thus the yoke is adjustable around the same axis on which the commutator revolves, by being slid in one direction or the other along the arc-shaped rib. According to the preferred construction, the seat *p* is formed with an arc-shaped rib *q* which projects only partially through the thickness of the yoke L, the latter being formed with a corresponding arc-shaped groove fitting thereon, and in addition there is formed an arc-shaped slot of less width extending through the yoke in order to admit the passage of fastening bolts or screws *r r*, the slot being long enough to admit of the extreme adjustment of the yoke before encountering the screws. Preferably a plate is placed against the outer face of the yoke forming an outer bearing for it and covering its slot, this plate being held in place by said screws, the heads of which are exterior thereto. These constructions are clearly shown in Figs. 5 and 6. For effecting the rapid and convenient adjustment of the yoke L, I provide by preference the following described means for adjusting it.

On the bottom part of the yoke adjacent to its seat are formed rack-teeth *t* with which mesh the teeth of a pinion *u* fixed on a shaft *u′* having bearings in opposite sides of the pillar N, and on the opposite end of which is fixed a hand-wheel *u²*. By turning this wheel the yoke L can be slid either way on its arc-shaped slotted bearing so as to advance or retract the brushes along the commutator. The yoke will of itself retain any position to which it may be set without requiring to be clamped in place because of the frictional surfaces formed at the sliding contact between the seating faces through which the yoke engages with the pillar N. This improved mounting for the respective brushes has the advantages, especially desirable for a machine of large size, of mounting the commutator and collector brushes independently of one another, of making their mounting independent of the shaft bearing, supporting them wholly below the commutator, collector and shaft, so that they do not interfere with the lifting out of the armature shaft by first removing the crown of the field-magnet and the several bearing caps, of bringing the elec-

trical cables or connectors in a desirable location where they hang free from all other parts, and of providing a simple and symmetrical construction.

The collector brush-holders are of novel construction. These brush-holders, lettered J^2, are constructed as best shown in Fig. 7, in such manner that each brush-holder carries two copper brushes arranged tandem or one in advance of the other. The body of the brush-holder is formed in one integral socket piece having a hub portion for fitting over the stud, and two socket portions arranged at an angle for carrying the respective copper brushes. The preferable angle for these socket portions is twenty-five degrees, although this may be varied in practice. One is set in advance of the other or nearer the collector surface, by which means the brushes touch the collector at very nearly adjacent points, and the same length of flexible copper brush is provided between the brush-holder and collector so that both brushes are given the same elasticity. Each socket portion is formed with a seat *a* for the brush on the side nearest the stud, while on the opposite side the brush is clamped by a gib *b* pressed against it by a set-screw as usual. On the outer side of each brush is fixed a stiffening spring *c* as usual. The stiffening spring *c* for the first or leading brush is fastened to the gib *b* thereof, while the stiffening spring for the second or following brush is fastened to the seat *a* thereof, as clearly shown in the sectional view at the left in Fig. 7.

The brush-holder is made adjustable on the stud by utilizing its handle *d* as a set-screw, its pressure being communicated to the stud through the medium of a loose block or shoe *e* socketed in the boss of the brush-holder to bear upon the stud, so that by means of this adjustment the brushes may be made to bear with a greater or less tension upon the collector surface. The collector studs *j j'* pass through the terminal bosses of the yoke L', being insulated therefrom, and have fixed on their ends metal socket pieces constituting the terminals of the line wires *w w*. (See Figs. 1 and 3.) The studs *k k'* carrying the commutator brush-holders K K' are fixed in and insulated from the terminal bosses of the yoke L, and have fastened at their ends metal socket pieces to which are connected the terminals of the conducting cables *v v* leading to the series winding of the field-magnet, (see Fig. 1) and the cables *v' v'* constituting the field-magnet shunt, which latter cables enter the bearing pillar E and inside thereof are connected to the opposite terminals of the field-shunt resistance coil M, as shown in Fig. 4.

The connections of the main field-magnet winding are best shown in Fig. 8. The field-magnet coils are divided into two series, the one an upper series and the other a lower series. The coils of each series are connected together serially, while the terminal wires of each series are extended to opposite sides of the machine, as shown in Figs. 3 and 8, where they are connected to opposite binding posts.

On the field-magnet or frame of the machine are mounted at opposite sides connection plates or bases *a' a'* of insulating material, and on each plate are mounted two binding posts *b'* and *c'*. The terminals of the upper series of coils are connected permanently to the outer binding posts *b' b'*, while the terminals of the lower series of coils are connected permanently to the inner binding posts *c' c'*. The two circuit wires from the exciting dynamo Q are extended to either pair of binding posts indifferently, depending upon the location of the exciter Q. If the exciter is placed on the right of the dynamo, its terminals will be connected to the right hand pair of binding posts as shown, in which case the left hand pair will be bridged by a short wire *y*, as indicated in the diagram. If the exciter is arranged upon the left of the dynamo, these connections will be transposed. By this means all the coils of the main field winding are connected serially in the circuit fed by the exciter. This construction avoids the necessity of either mounting the exciter always on the same side of the dynamo, which is not always convenient, or of carrying one terminal wire of the exciter to a post on one side of the dynamo and the other terminal wire to a post on the other side, as is usually provided, so that in this respect my improvement shortens the connections and reduces the danger of accident to them. The remaining terminal connections are those between the armature, commutator and collector, and which are best shown in Fig. 5. The collector consists as usual of two parallel rings insulated by an interposed insulating washer. The commutator is constructed as usual in this class of machines of two rings or sections having their peripheral rims cut up into segments which interlock, being separated by insulating plates. Both the commutator and collector instead of being mounted directly upon the shaft, are mounted upon a sleeve *f* which is fixed upon the shaft by set-screws. The commutator and collector sections are fixedly mounted upon this sleeve and insulated therefrom, being fixed thereto by means of conical hubs on the sections, embraced between undercut flanges on the sleeve, the one flange being fixed and the other movable or adjustable thereon in the manner usual in commutator construction. It will be observed that the collector is of smaller diameter than the commutator. The diameter of the commutator is practically determined by the number of poles of the field-magnet and armature, a certain diameter being necessary to make the segments of the proper width proportional to the thickness of the commutator brushes required for carrying the generated current, so that for a machine of the proportions of the one here illustrated, a commutator of somewhat large diameter is imperative, but as the collector does not re-

quire to be of any particular diameter, and as a smaller diameter is preferable, I make the collector consequently as small as can conveniently be constructed upon the sleeve with proper provision for the intervening electrical connections. With these proportions it is preferable to place the commutator between the collector and the armature.

Instead of making the connections between the armature and collector by carrying the conducting bars or cables through a hole bored in the shaft as has heretofore been most customary, I arrange the intervening conductors exterior to the shaft in the manner clearly shown in Fig. 5. One terminal of the armature winding is connected through a cable g and socket-piece g^2 to one end of an insulated conducting bar or rod h which passes inside the commutator through a hole bored in that portion f' of the sleeve f constituting the commutator seat, the opposite end of this rod being fixedly and metallically connected to the inner one of the collector rings. The outer collector ring is in similar manner metallically and permanently connected with another insulated conducting bar h' which passes through the inner collector ring, being insulated therefrom, and extends back to the commutator, its opposite end being connected permanently to the inner or adjacent commutator section, as clearly shown. The remaining or outer commutator section being the one nearest the armature, is permanently connected (as shown in Fig. 5^a) to an insulated conducting rod i, on the end of which is clamped another socket piece g^3 forming the terminal of the opposite conducting cable g' extending from the opposite terminal of the armature winding. Accordingly the circuit extends from one armature terminal through conductors g and h to one collector ring, thence through the corresponding brush out over the line, back through the other brush to the opposite or outer collector ring, thence through the conductor h' to the inner commutator section, thence through one commutator brush to the conducting cables v and v', the former conducting about four-fifths of the current through the series field winding, and the latter conducting the remainder of the current through the field shunt resistance M, the corresponding cables on the opposite side of the machine conducting the current to the opposite commutator brush, whereby it enters the opposite commutator section, and from which it passes through the conducting rod i and cable g' to the opposite terminal of the armature winding.

Although I have described only one rod h and one rod h', and although only one is necessary, yet in practice I prefer to duplicate these rods, employing two rods h h and their connections diametrically opposite each other, and two rods h' and i diametrically opposite each other, as shown in Fig. 6.

Fig. 5 shows only the two rods h and h' which appear diametrically opposite one another, as would be the case were only two rods used, but with a four-rod construction this view as far as the section of the commutator and collector is concerned, is to be understood as being taken in the two planes denoted by the lines $5^\times$—$5^\times$ in Fig. 6.

By reason of the collector being of smaller diameter than the commutator, the collector brush-yoke L′ is made in the arc of a smaller circle than the commutator brush yoke L, as shown, a construction which enables the seat n for the fixed brush yoke to be extended upwardly, leaving room enough beneath it for the adjusting hand-wheel u^2 already described.

The field shunt resistance M is mounted in a ventilating chamber formed in the bearing pillar E, instead of being arranged as heretofore on the base of the machine beneath the commutator, or being arranged on or adjacent to the switch board of the dynamo room. The latter arrangement has the disadvantage that the high potential conductors v' v' must be extended from the commutator brushes to the switch board, which is usually remote from the dynamo, and which involves liability of accident.

It is desirable that each dynamo shall be self-contained, that the electrical connections or conducting wires shall be as short as possible, and as far as possible out of the way, to which ends the shunt resistance should be mounted as a part of the dynamo and closely adjacent to the commutator brushes; but when so mounted as heretofore arranged with the resistance exposed upon the base of the machine, the serious disadvantage is encountered of the resistance coils being in time short-circuited by the deposit upon them of particles of metallic dust, coming chiefly from the commutator and collector brushes. When so mounted also the ventilation of the resistance is ineffective to cool it properly.

By my improved method of housing the resistance M, I overcome the objections heretofore existing, and greatly improve the ventilation by which the resistance is kept cool. By placing the resistance in the hollow of the bearing pillar E, it is entirely out of the way, the exposed portion of the connecting wires v' which pass through holes in the side of the pillar nearest the commutator, is made as short as possible, the resistance is so housed and protected that access of metallic dust to it is impossible since this dust is too heavy to rise up with the currents of air that pass to the resistance from beneath the base, and the ventilation of the resistance is made as effective as possible, since the resistance is in fact in a ventilating flue or chimney through which the currents of air heated from the resistance are compelled to ascend, escaping through perforations in a plate y applied to the outer side of the bearing pillar E, as shown in Figs. 3 and 4. The outer side of the pillar is largely cut away to form a large opening through which by removing the plate y, which

is fastened by screws or bolts or otherwise, access can be had to the resistance to effect the connection of the wires v' with it, and to make any adjustment or repairs that may be necessary.

The resistance may be mechanically supported in any suitable or desirable manner, the means for supporting it forming no part of my present invention.

In another application for patent which I have executed (Serial No. 478,251, filed June 20, 1893), I have claimed broadly the arrangement of the resistance in the hollow base or frame of the dynamo for the purpose of protecting it and insuring a more effective circulation of air, and I therefore claim in this application only its particular arrangement in the hollow or chamber formed in one of the shaft bearing pedestals, this chamber being independent of the base, although communicating with the latter through an opening formed in the top of the base, as shown in Fig. 4. By virtue of this construction the resistance is mounted directly in the air flue, so that the utmost cooling effect is availed of, the air circulation being stronger and more effective than in the construction shown in my said other application, as is desirable by reason of the fact that the particular dynamo here illustrated, being a much larger and more powerful machine, requires a field-shunt resistance of larger radiating surface, because of an augmented generation of heat, which requires correspondingly more effective means for cooling it.

In order to render the cooling even more thorough and effective than by the upward draft of air due to the ascent of the air which is heated by the resistance coil, a further feature of my invention shown in Fig. 9 provides for maintaining a forced draft or current of air from a fan or blower through the flue in which the resistance coil is placed. I utilize the revolving armature B as the blower or fan, the air therefrom being circulated through the resistance coil in the manner shown in Fig. 9. Referring to this figure, it will be observed that the annular field-magnet A is partially dropped down into an opening or recess in the base D, the latter being formed with downwardly extending ribs or webs $z\,z'$ on opposite sides of this opening. The web z extends to the floor so as to cut off the air space, while the web z' is arched or formed with an opening through it communicating with the space between the pole-pieces of the field-magnet toward the bottom of the latter, so that air blown outward from the revolving armature may pass down between the pole-pieces and through the rib z', the base beyond between this rib and the opening to the pillar E being open and hollow so as to constitute a flue or air passage T through which the air from the armature passes and ascends within the pillar E, escaping by the perforations in the plate y, as clearly shown. The spaces between the bottom of the base and the floor should be closed with insulating cement, as shown at z^2 to prevent the escape of air otherwise than by passing upward in the pillar. To effect the requisite air current, the armature B should be a ventilated armature, that is to say, it should be constructed with air spaces or openings through it, an example of such construction being shown in Fig. 9, where air passages are formed through the laminated iron core B', but any other construction of ventilated armature will serve the purpose. By means of this improvement a strong and continuous forced draft is maintained through the resistance M, whereby it is very efficiently cooled.

The particular construction of the resistance M which is here illustrated is immaterial to my present invention, as any other suitable construction of resistance coil may be substituted therefor. The particular resistance here illustrated is claimed by me in another application, Serial No. 479,221, filed June 30, 1893.

The construction of commutator brush holders shown is not herein claimed, being reserved to be made the subject of a separate application for patent now in preparation and which I am about to file.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. In a separately-excited dynamo having a multipolar field-magnet, the combination of two pairs of binding-posts on opposite sides of the field-magnet, with the field-magnet coils connected in two series, one including the upper coils and terminating in two posts on opposite sides, and the other including the lower coils and terminating at opposite sides in the two remaining posts, whereby either pair of posts may be bridged by a wire and the other pair connected to the wires from the exciter.

2. In an alternating dynamo, the combination with the base, field-magnet, armature, commutator, collector, commutator brushes and collector brushes, of a mounting for supporting the respective brushes consisting of a single pedestal mounted on the base, beneath the armature shaft, a commutator yoke supported on said pedestal and carrying the commutator brush holders on its opposite arms, and a collector yoke also supported on said pedestal and carrying the collector brush holders on its opposite arms.

3. In an alternating dynamo, the combination with the commutator and collector brush holders and the supporting base, of a mounting for supporting the respective brushes consisting of a single pedestal mounted on the base beneath the armature shaft, formed at its upper part with seats on opposite sides, a commutator yoke fastened against one of said seats and carrying the commutator brush-

holders, and a collector yoke fastened against the opposite of said seats and carrying the collector brush holders.

4. In an alternating dynamo, the combination with the base, field-magnet, armature, commutator, collector, commutator brushes and collector brushes, the collector being of smaller diameter than the commutator, of a mounting for supporting the respective brushes consisting of a commutator yoke and a collector yoke, both formed with curved arms extending to opposite sides and carrying respectively the commutator and collector brush holders on their opposite arms, the collector yoke having its arms formed of a curve of smaller radius than the commutator yoke, corresponding with the smaller diameter of the collector, and a pedestal mounted on the base beneath the armature shaft and formed at its upper portion with seats on its opposite sides to which the said yokes are attached, the seat for the collector yoke being extended higher than that for the commutator yoke.

5. In a dynamo, the combination with the commutator and commutator brushes, of a mounting for supporting said brushes consisting of a curved yoke having oppositely extended arms carrying the commutator brush holders, and a supporting seat for the attachment of said yoke, the seat and yoke formed with a reciprocally engaging arc-shaped rib and groove concentric with the axis of rotation of the commutator, and an adjusting device for sliding the yoke to either side along its arc-shaped bearing with said seat, whereby to advance or retract the brushes along the commutator.

6. In a dynamo, the combination with the commutator and commutator brushes, of a mounting for supporting said brushes consisting of a curved yoke having oppositely extended arms carrying the commutator brush holders, and a supporting seat for the attachment of said yoke, the seat and yoke formed with a reciprocally engaging arc-shaped rib and groove concentric with the axis of rotation of the commutator, and an adjusting device for sliding the yoke to either side along its arc-shaped bearing, consisting of cog teeth carried by the yoke adjacent to said bearing, and a pinion meshing therewith fixed on a shaft having stationary bearings, whereby by turning said shaft the brushes may be adjusted along the commutator.

7. In an alternating dynamo, a brush holder mounting consisting of a fixed pedestal N having at its upper part seats p and n, the latter extended above the former, a collector brush yoke L′ having curved arms carrying the collector brush holders and fastened at its middle to said seat n, a commutator brush yoke L having curved arms carrying the commutator brush holders and formed at its middle with an arc-shaped groove l engaging an arc-shaped rib q on said seat p, screws r r for holding the yoke against said seat, passing through a slot in the yoke, whereby the yoke is adjustable along said arc-shaped bearings to advance or retract the commutator brushes, its adjustment being retained by the frictional engagement of the contacting surfaces of the yoke and seat.

8. In a dynamo, the combination with the commutator and commutator brushes and brush holders, of the yoke L for supporting the said brush holders, the pedestal N for supporting said yoke, the pedestal formed with a seat p on one side and an arc-shaped rib q, and the yoke formed with a corresponding arc-shaped groove l, and an arc-shaped slot, retaining screws r r and friction plate s, whereby a frictional mounting is afforded between the yoke and pedestal, cog teeth t on the yoke, and an adjusting pinion u, and its shaft u' and hand-wheel u^2, said shaft having bearings in said pedestal.

9. In an alternating dynamo, the combination with the armature of a commutator and collector mounted on the armature shaft, and terminal conductors in connection with the opposite terminals of the armature winding, the one extending therefrom to one commutator section, and the other extending therefrom between the commutator and the shaft, and terminating at one of the collector rings, and a conductor extending from the collector ring exterior to the shaft to the other commutator section.

10. In an alternating dynamo, the combination with the armature of a commutator and collector mounted on the armature shaft, an interposed sleeve f fixed to the shaft and formed with seats for the sections of the commutator and collector, and terminal conductors in connection with the opposite terminals of the armature winding, the one extending therefrom to one commutator section, and the other extending therefrom and passing through the commutator seat f' between the commutator and the shaft and terminating at one of the collector rings, and a conductor extending from the other collector ring exterior to the shaft to the other commutator section.

11. In an alternating dynamo, the combination with the armature of a commutator I and collector H mounted on the armature shaft, an intervening sleeve f having a raised seat f' for the commutator, the terminal conducting cables g g' from the opposite terminals of the armature winding, the one connecting through a conducting bar i with one commutator section and the other connected with the insulated conducting bar h extending within the commutator through said seat f' and terminating at one of the collector rings, and an insulated conducting bar h' extending from the other collector ring exterior to said sleeve and terminating in connection with the other commutator section.

12. In a dynamo, a brush holder adapted for holding two brushes tandem, consisting of a double socket piece formed at the middle with a boss for receiving the supporting stud,

and two sockets for the respective brushes at an angle with each other on opposite sides of said boss.

13. In a dynamo, a brush holder adapted for holding two brushes tandem, consisting of a double socket-piece formed at its middle with a boss for receiving the supporting stud, and two sockets for the respective brushes on opposite sides of said boss extended at such an angle converging toward the tips of the brushes as to bring the latter closely adjacent to each other.

14. In a dynamo, a brush holder adapted for holding two brushes tandem, consisting of a double socket-piece formed at its middle with a boss for receiving the supporting stud, and on opposite sides thereof with two relatively reversed sockets for the respective brushes, gibs for the respective sockets, and stiffening springs for the respective brushes, the one mounted against the brush seat in one socket, and the other mounted against the gib for the other socket.

15. In a compound-wound alternating dynamo having a resistance shunt between the brushes of the commutator which feeds the series field winding, the combination of the fixed frame of the machine constructed with a base and a hollow bearing pillar mounted thereon, with an opening through the base beneath said pillar for entrance of air thereinto, and an opening in the upper part of the pillar for escape of air, and the resistance of said shunt arranged within the hollow of said pillar, whereby it is protected from mechanical injury and from the deposit of metallic dust, and is kept cool by the upward draft of air passing from the base through said pillar.

16. In a compound wound alternating dynamo having a resistance shunt between the brushes of the commutator which feeds the series field winding, the combination of the fixed frame of the machine constructed with a base and a hollow bearing pillar mounted thereon, with an opening through the base beneath said pillar for entrance of air thereinto, and an opening in the upper part of the pillar for escape of air, and the resistance of said shunt arranged within the hollow of said pillar, and with the connecting wires or cables of said shunt extending from the terminals of said resistance backward through holes in said pillar on the opposite side from the opening in said pillar, and on the side of the pillar nearest the commutator brushes, and terminating in connections with the opposite brushes of the commutator, whereby the connections are arranged symmetrically with the conductors of opposite potential extended on opposite sides to their connection with the opposite brushes.

17. In a compound wound alternating dynamo having a resistance shunt between the brushes of the commutator which feeds the series field winding, the combination with the armature and field-magnet, of the fixed frame of the machine constructed to form a flue receiving the air blown from the armature, and the resistance of said shunt arranged within said frame and in said flue therein, whereby it is kept cool by the forced draft of air blown through it from the armature.

18. In a compound wound alternating dynamo having a resistance shunt between the brushes of the commutator which feeds the series field winding, the combination of the fixed frame of the machine constructed with a base and a hollow bearing pillar mounted thereon, with an opening into the base through which air may be blown by the action of the armature, an air flue extending thence through the base, and an opening in the base beneath said pillar for passage of air from the base thereinto, and an opening in the upper part of the pillar for escape of air, and the resistance of said shunt arranged within the hollow of said pillar, whereby it is kept cool by the forced draft of air blown through it from the armature.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
CHARLES K. FRASER,
GEORGE H. FRASER.