(No Model.) 5 Sheets—Sheet 1.

E. R. KNOWLES.

DYNAMO ELECTRIC MACHINE.

No. 282,459. Patented July 31, 1883.

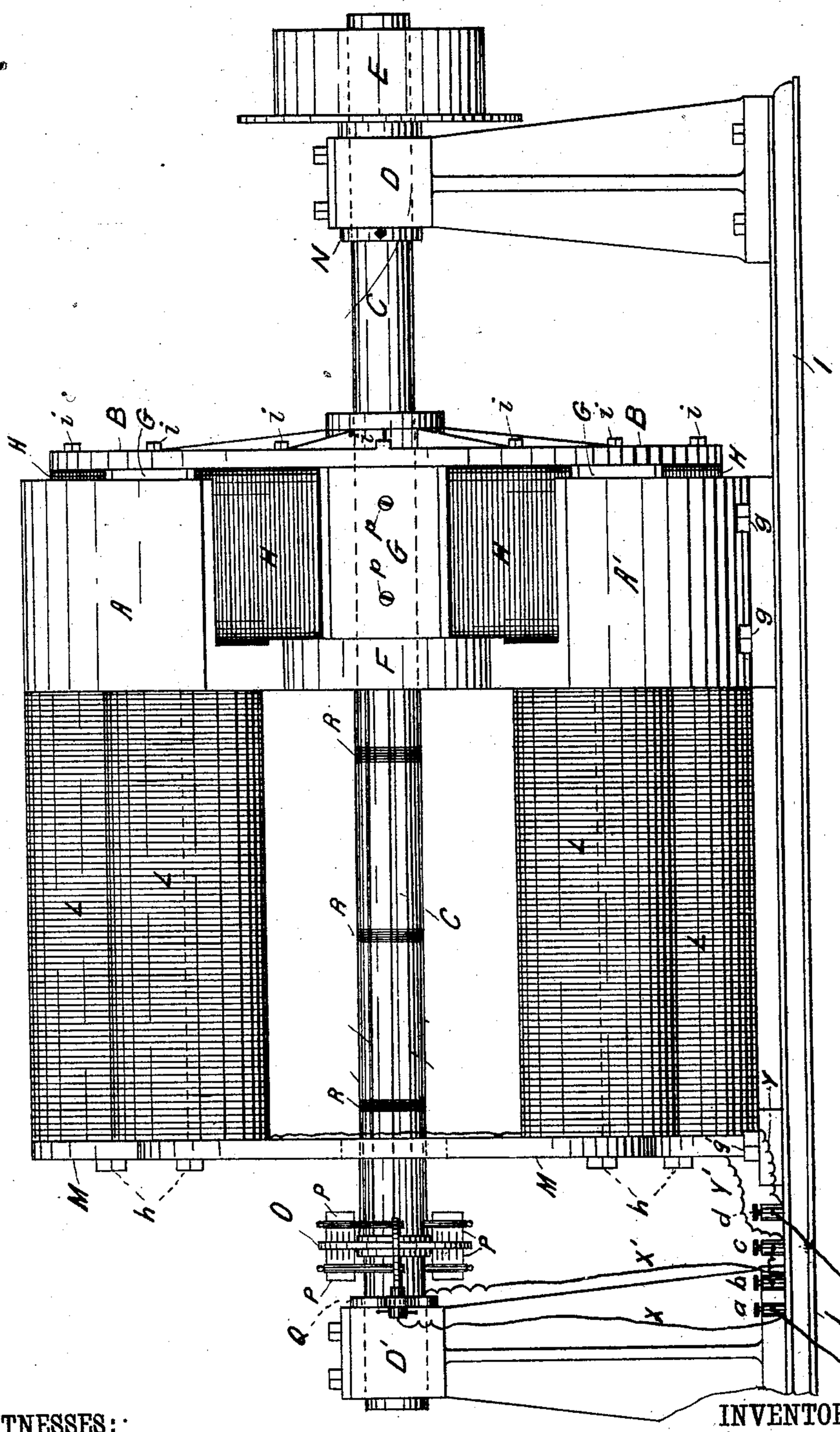

FIG. 1.

WITNESSES:

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J. Carl Bull

INVENTOR

Edward R. Knowles.

BY

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DYNAMO ELECTRIC MACHINE.

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FIG. 16.

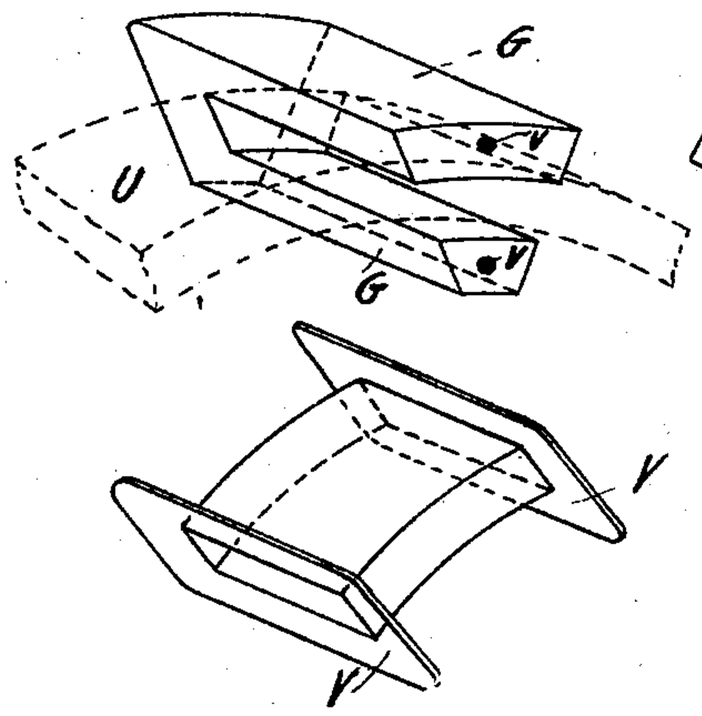

FIG. 15.

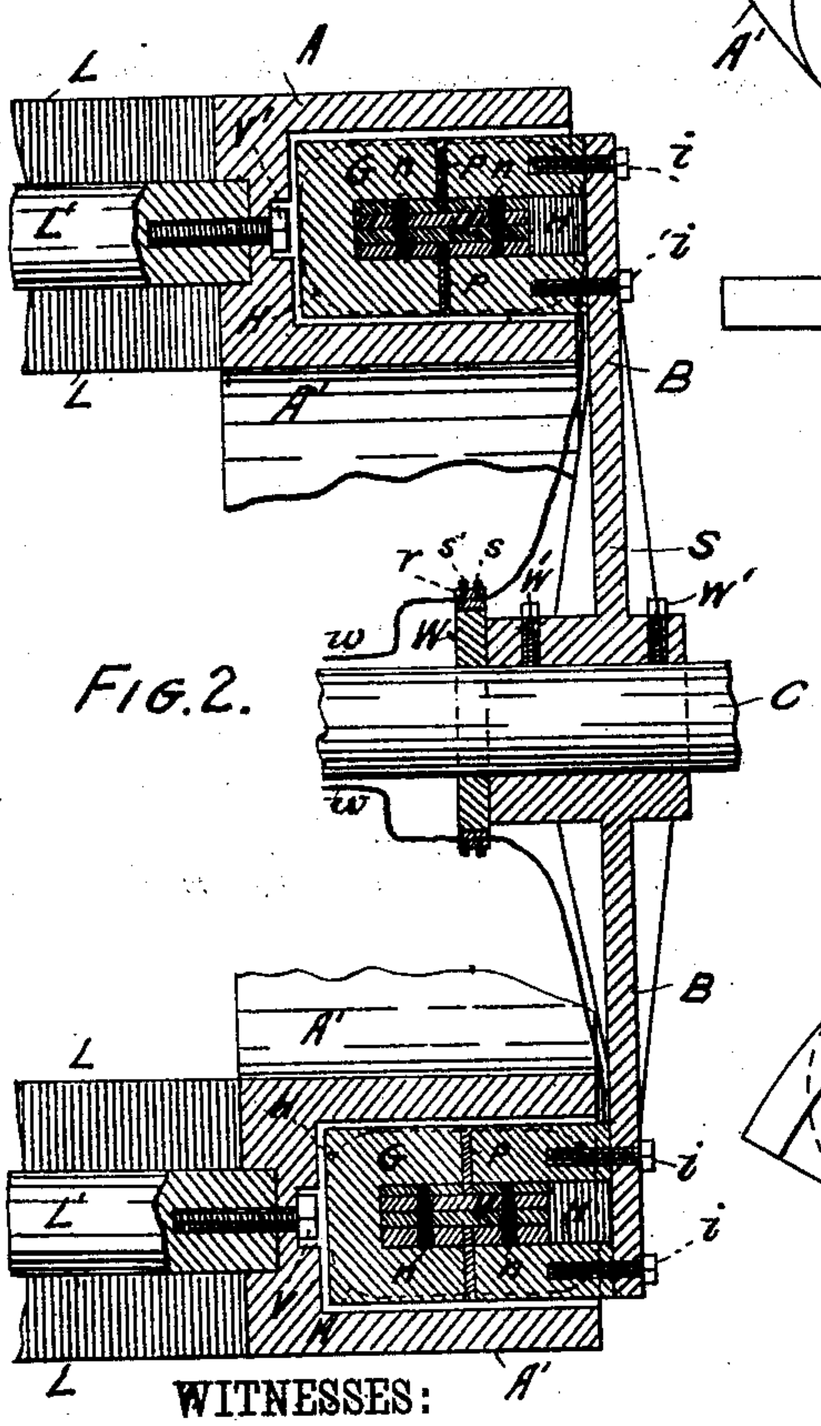

FIG. 2.

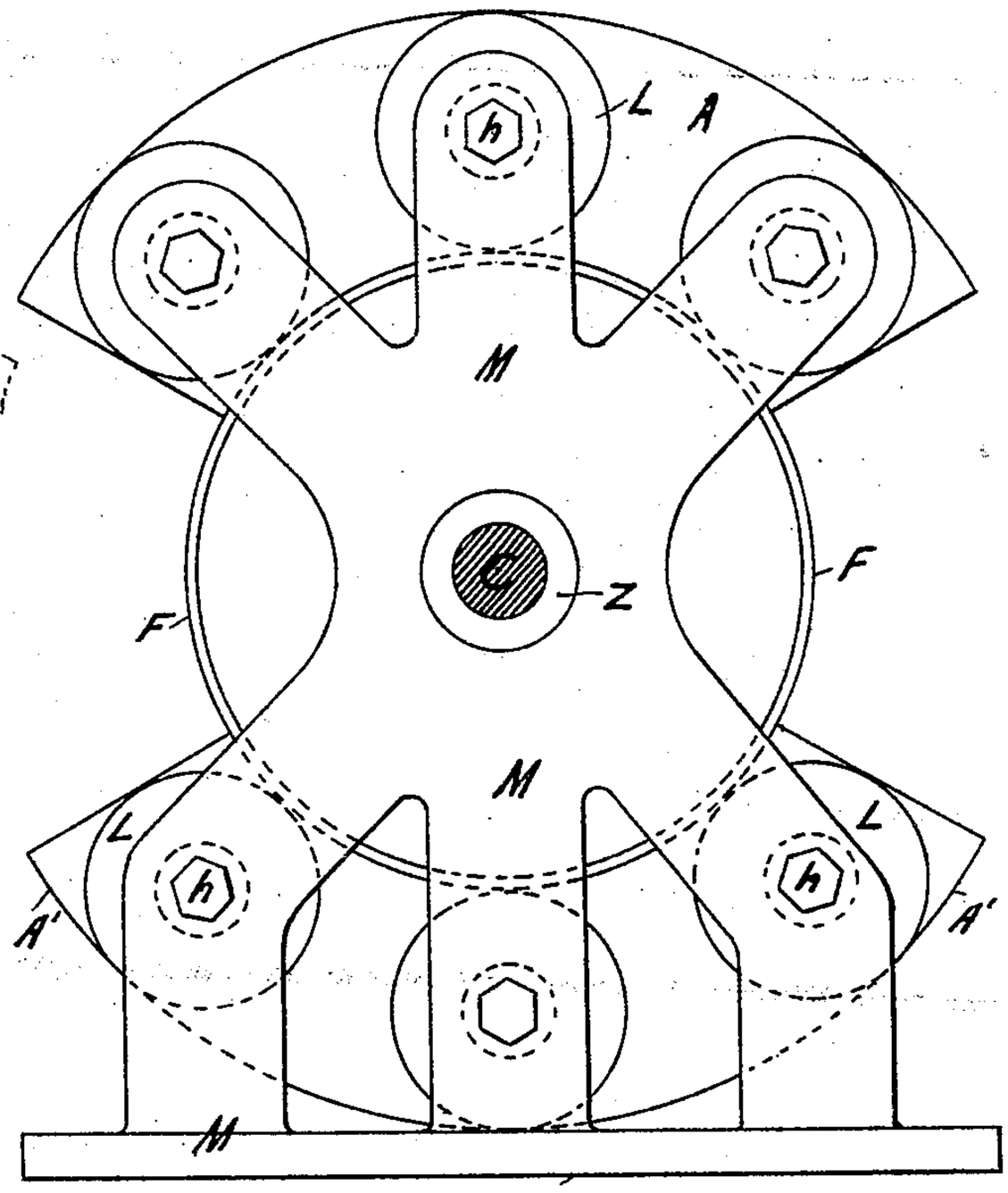

FIG. 4.

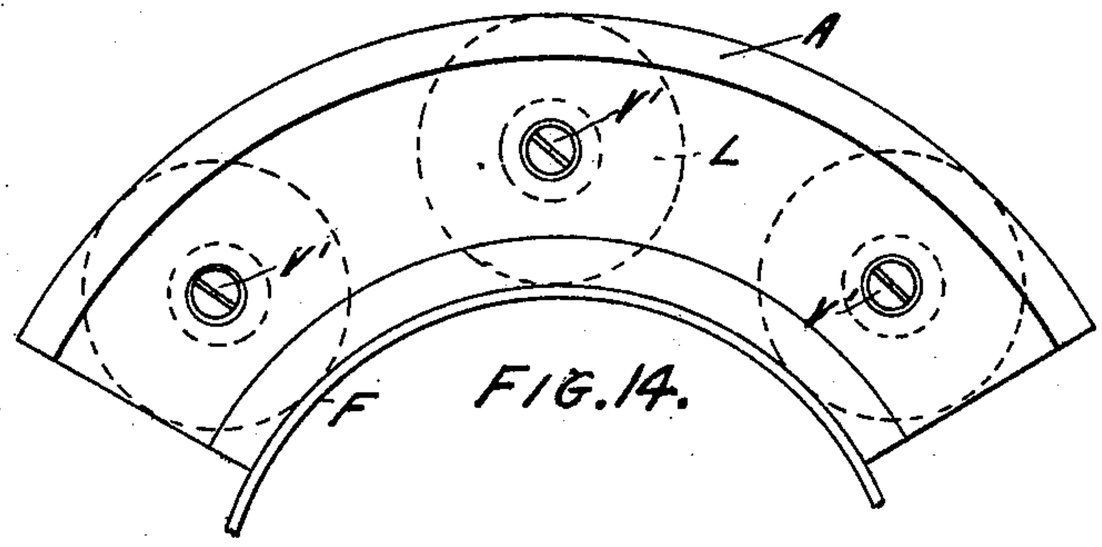

FIG. 14.

WITNESSES:

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(No Model.)

5 Sheets—Sheet 3.

E. R. KNOWLES.

DYNAMO ELECTRIC MACHINE.

No. 282,459. Patented July 31, 1883.

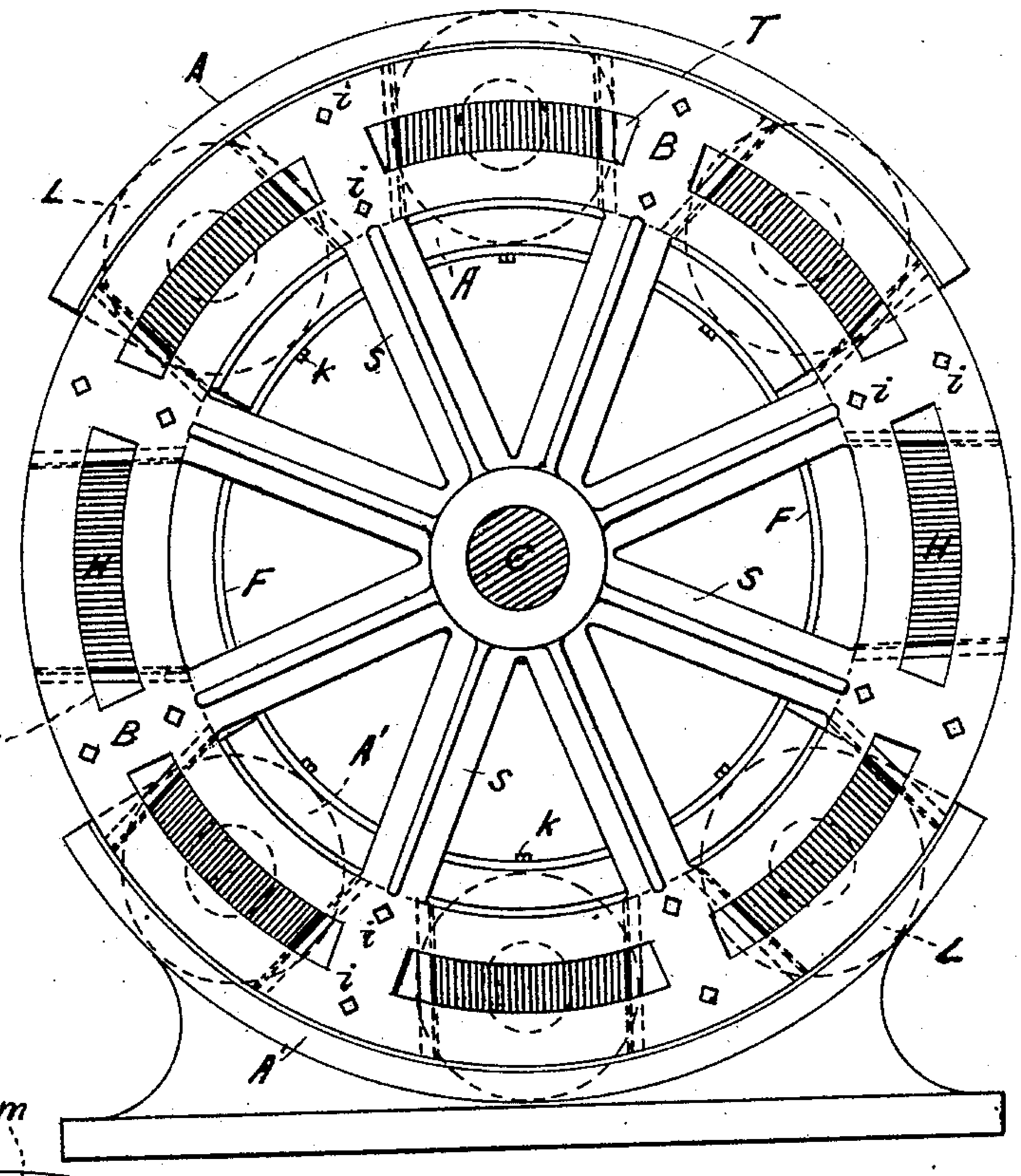

FIG. 3.

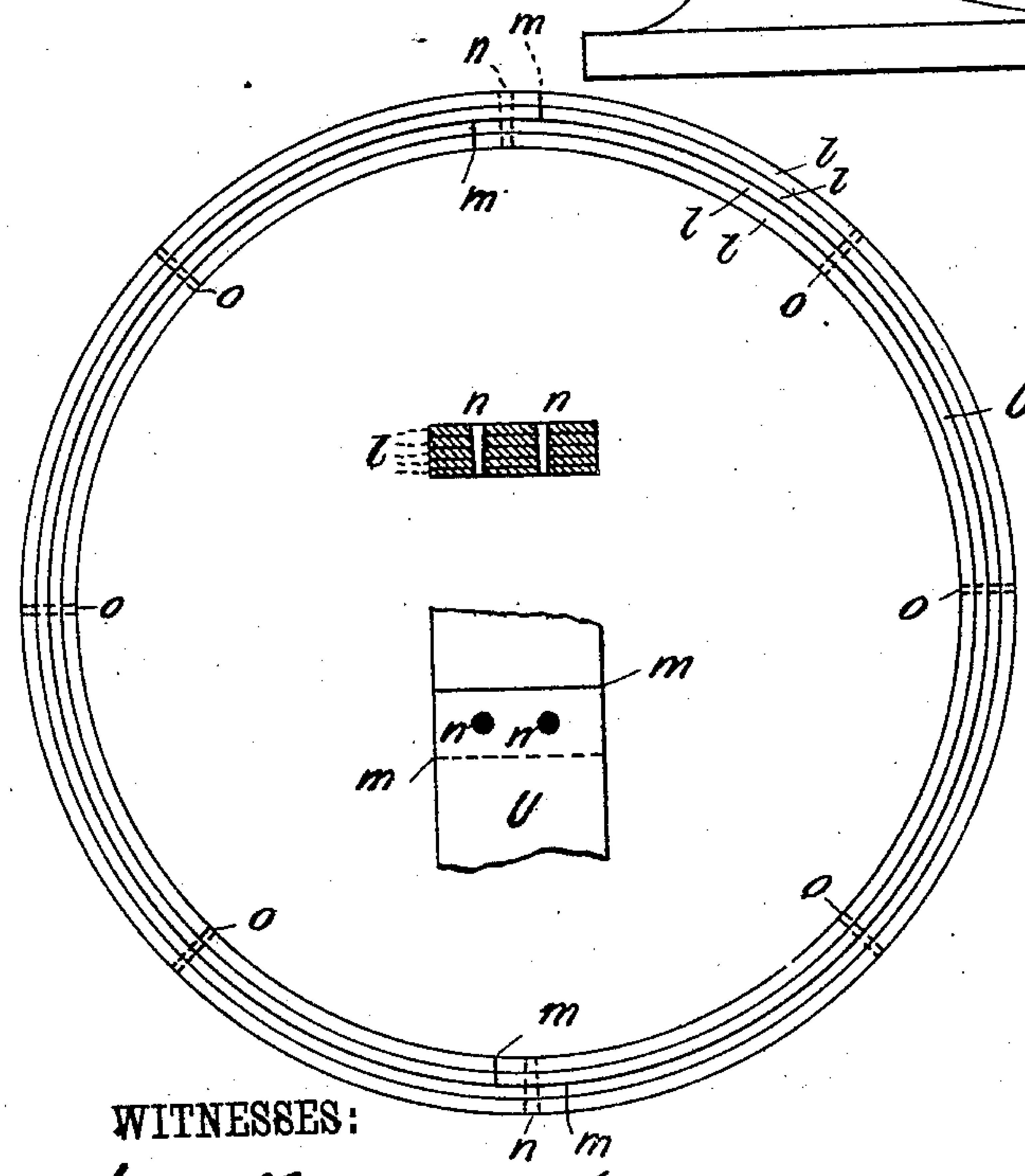

FIG. 5.

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

(No Model.) 5 Sheets—Sheet 4.

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DYNAMO ELECTRIC MACHINE.

No. 282,459. Patented July 31, 1883.

FIG. 13.

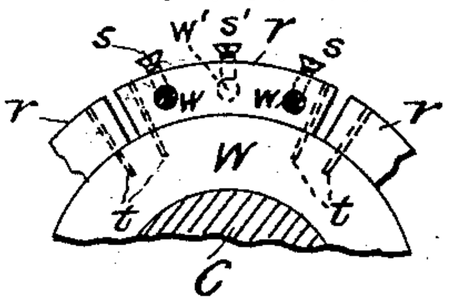


FIG. 7.

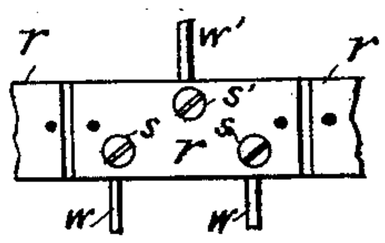
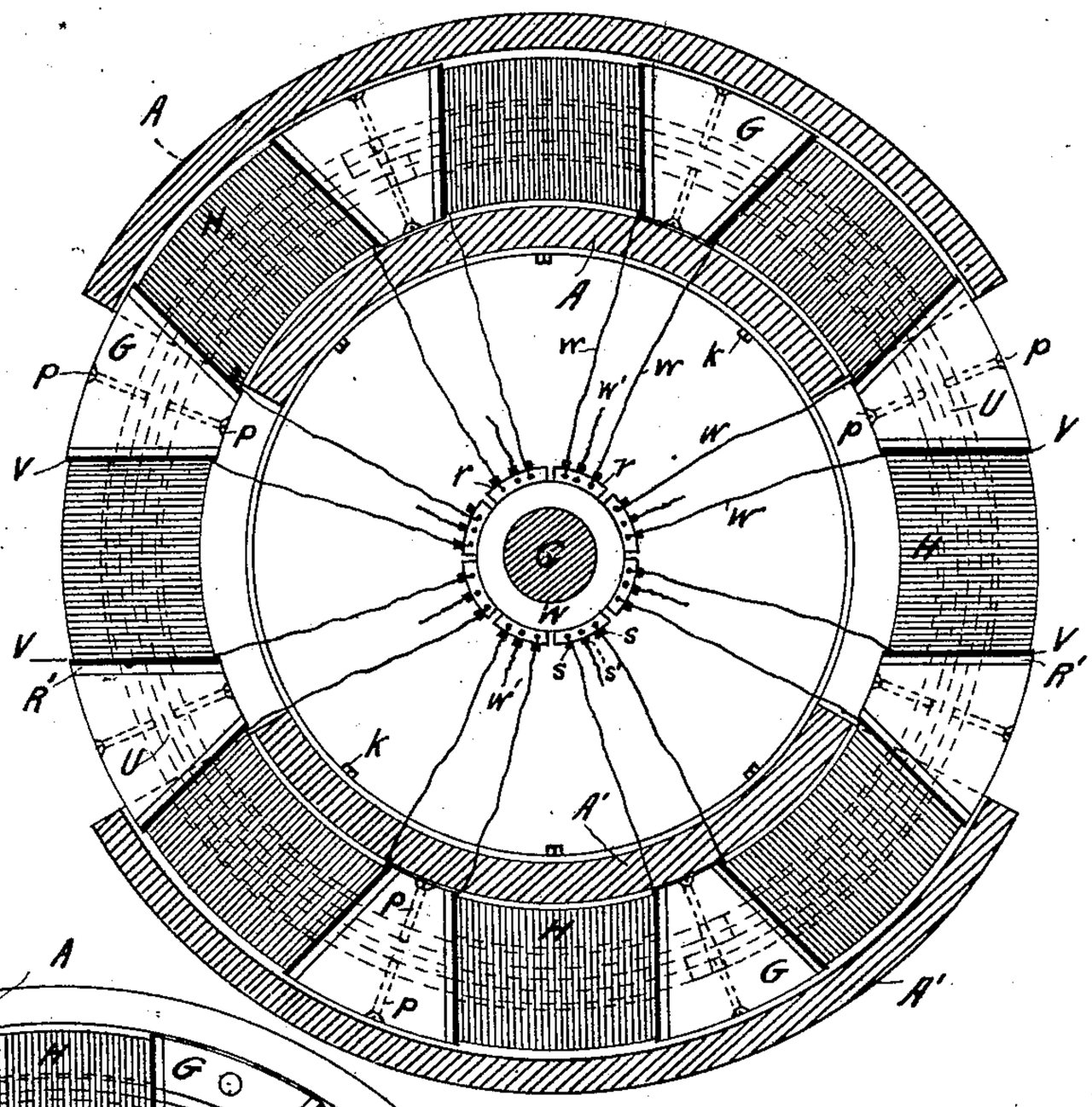


FIG. 12.



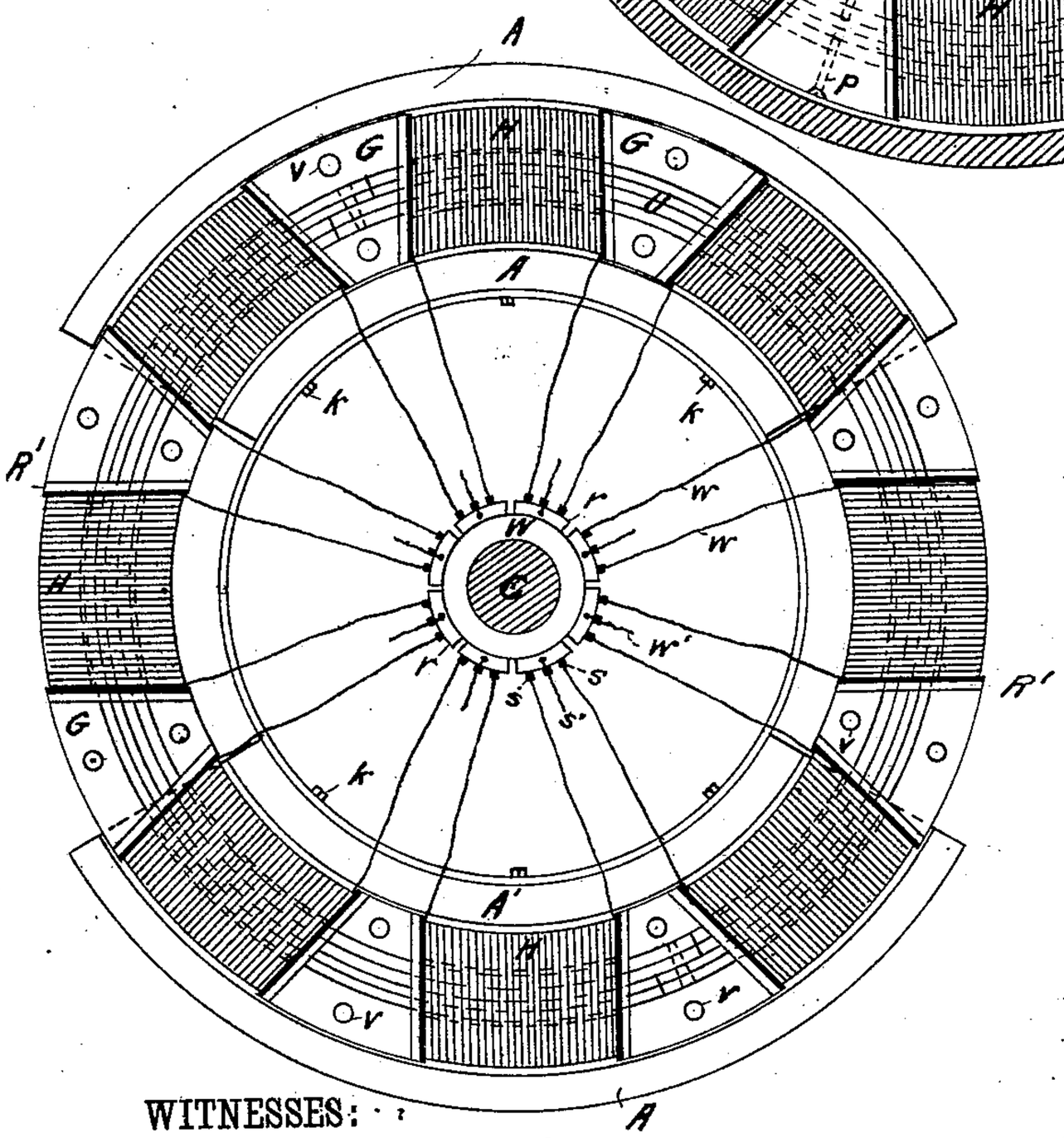


FIG. 6.

WITNESSES:

A

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DYNAMO ELECTRIC MACHINE.

No. 282,459. Patented July 31, 1883.

FIG. 9.

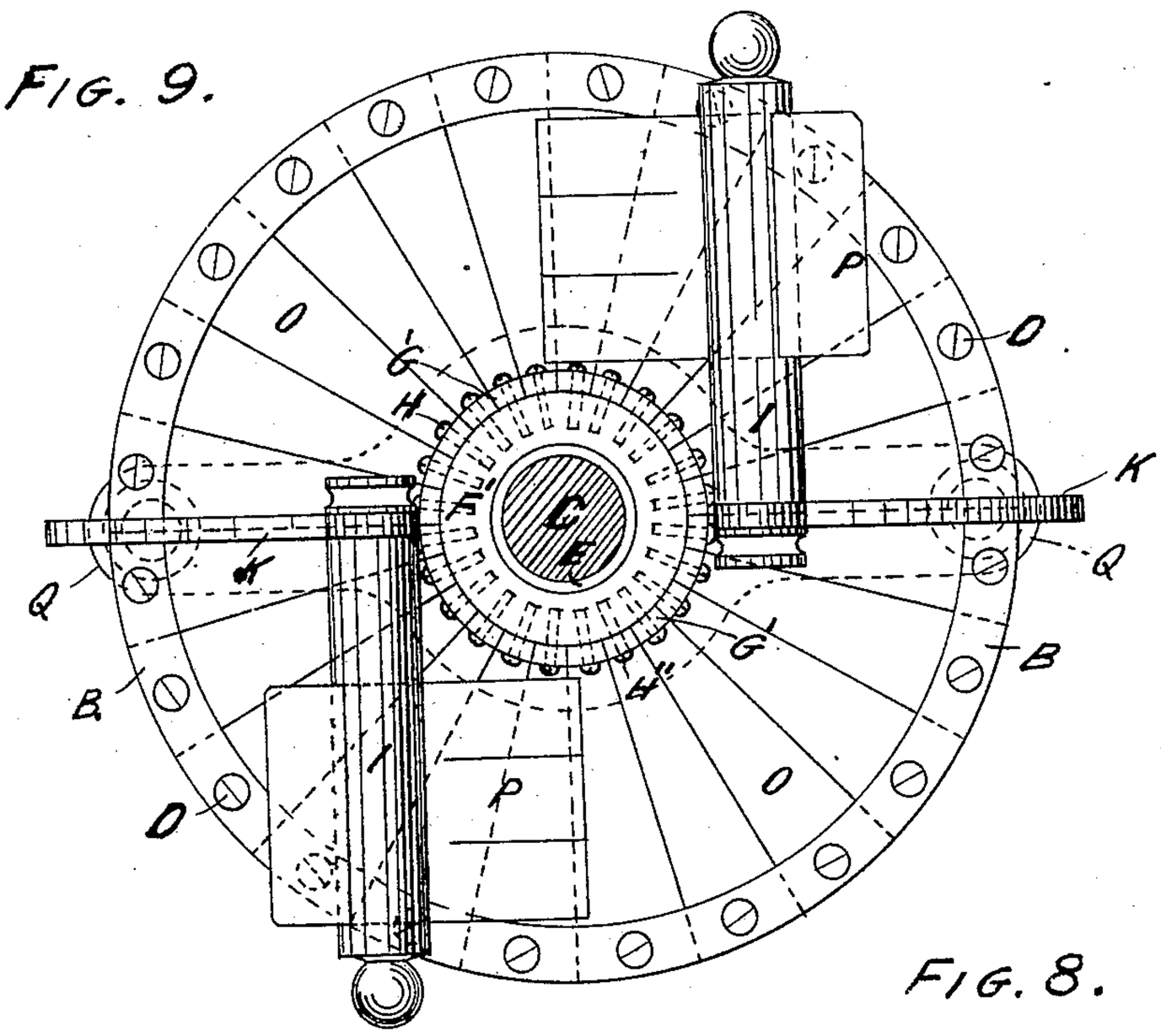
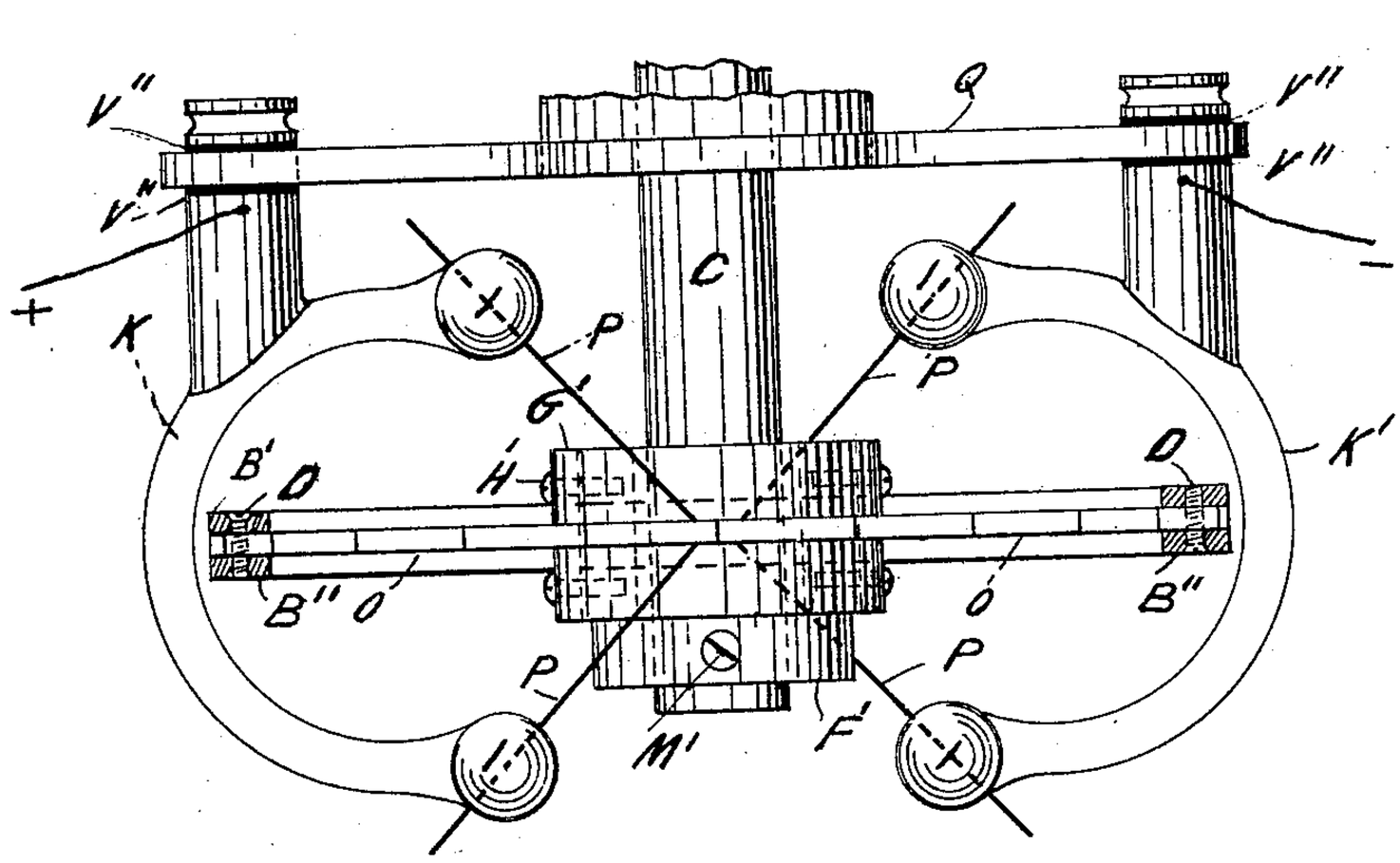


FIG. 8.



WITNESSES.

A. B. Switzer.

C. Larsen

INVENTOR

E. R. Knowles.

UNITED STATES PATENT OFFICE.

EDWARD R. KNOWLES, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO BYRON A. BROOKS, OF SAME PLACE.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 282,459, dated July 31, 1883.

Application filed June 19, 1882. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. KNOWLES, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines, of which the following is a description in such full, clear, exact, and concise terms as to enable any one skilled in the art to which it appertains or with which it is most nearly connected to make and use the same, reference being had to the accompanying drawings making part of this specification, and to the letters and figures of reference marked thereon.

By Figure 1 of said drawings is shown a side elevation of a complete machine built upon the plan of my invention. Fig. 2 is a longitudinal vertical section through armature and cheek-pieces of the magnets. Fig. 3 is an end view of the machine, looking against the end of the cheek-pieces and the side of the wheel that carries the armature. Fig. 4 is an end view of the machine, looking against the ends of the magnets and the frame that carries them. Fig. 5 is a plan of the core of the armature. Fig. 6 is a front view of the completed armature. Fig. 7 is a back view of the same. Fig. 8 is a top view, and Fig. 9 is a side elevation, of the commutator, both upon an enlarged scale. Figs. 12, 13, 14, 15, and 16 are parts in detail to be hereinafter referred to.

Like parts are represented by like letters in the different figures.

My invention consists, first, of an improved armature; second, of an improved method of combining the armature with the magnets; third, of an improved commutator, and, fourth, of a combination of all of the improvements in one machine.

In writing this specification I assume the general principle of dynamo-electric machines to be understood, and shall therefore confine myself to a description of the machine as constructed and improved by me, the points of novelty being designated in the claims concluding the specification.

I begin with a description of the core of the armature, illustrated in the drawings by Fig. 5. It consists of a series of iron rings, *l*, made in the form of a true circle and fitted together, one outside of another, until the required thickness is obtained. These rings are fastened together by screws or pins O, and are then cut from the outside and inside upon the lines *m m*, so that the ends of one section lap over the ends of its contiguous section, the two forming a lap-joint secured by pins *n*. This core may of course be made of one solid ring and wound by hand, as armature-rings are usually wound; but it is much more convenient to make it as above set forth and wind it by machine, as hereinafter described. The core having been made, the next step is to wind it by machinery. This I accomplish by first making a set of cast-iron bobbins. (Shown in the drawings by Fig. 15.) These bobbins are made with a flange, *v*, at each end, and through them longitudinally is made a hole of the form, size, and radius exactly equal to that of the core. They are then put in a lathe upon a correspondingly-shaped mandrel and wound with the usual wire drawn off of a reel, both ends of the coil being left free to connect with the commutator, as hereinafter described. The necessary number of bobbins having been wound, as aforesaid, are then slipped on the two sections of the core, the ends of which are then brought together and connected, as aforesaid. These bobbins, as wound and placed upon the core, are shown by H, Figs. 6 and 7. They are distributed upon the core equidistant apart, the intervening spaces being filled by U-shaped clamps G and insulating-rings R′, that embrace the core on three sides and abut against the inside face of the wheel B, to which they are bolted by screws *i*. The bobbins and the clamps are thus made to embrace the entire surface of the core, excepting the points of contact between the ends of the clamps and the inside face of the wheel B, covering all the pins that unite the sections of the core and keeping them from working loose. The wheel B that carries the armature is made of brass or other non-magnetic material and bolted to a shaft, C, carried in suitable bearings, D and D′, as shown by Fig. 1.

Having completed the construction of the armature, I proceed to the construction of the magnets. These are illustrated in the drawings by L. There are six (6) of them—three above and three below—as more clearly illustrated by Fig. 4. These numbers may of

course be increased or diminished as circumstances may require. One end of each of these magnets is bolted at *h* to the frame M, which in its turn is firmly bolted to a solid foundation, the magnets projecting from the frame M toward the wheel B. The cores of the magnets are shown by L′, and to their ends are bolted the cheek-pieces A by bolts V′. These cheek-pieces are grooved out to form a section like the letter U, and are made to embrace the armature or ring on three sides, as shown by Fig. 2, the ring being adjusted on the wheel B to travel in the groove of the cheek-pieces. The rear ends of the magnets are of course firmly held by the frame M, and the cheek-piece of the lower magnet is firmly bolted to the bed-plate at *g g;* but to steady and hold firm the cheek-piece of the upper magnets I introduce a non-magnetic ring, F, and bolt it to the upper and lower cheek-piece, the shaft C passing through the ring in the manner shown. A front view of the cheek-piece is shown by Fig. 14, the magnets L appearing behind it in dotted lines. This figure, and also Fig. 4, very fully shows the application of the ring F to the cheek-pieces.

Having constructed and combined the armature and magnet as described, I make the commutator as follows, a side and top view of it being shown upon an enlarged scale by Figs. 8 and 9: It consists of a series of sectors, O, united at their outer and inner ends to form a disk rotating in a vertical plane. The outer ends are united by means of two rings of insulating material—one on each side of the disk—secured by screws D, passing from ring to ring through the sectors, each of which is of course duly insulated. The inner ends of the sectors are secured by sector-flanges G, bolted to insulating-ring F′, which in its turn is bushed with a metal ring, E, upon which the commutator is secured to the shaft C by a set-screw, M′.

The brush-holders consist of two U-shaped brackets, K K′, that embrace the edges of the disk upon opposite sides. In each end of the bracket K′ a stud, I, is placed, rising up to the upper periphery of the disk, and in each end of the bracket K there is a stud, I, hanging pendent to the lower periphery of the disk. In each of these studs a slit is cut or formed to receive the brushes P, of which there are four, (4,) two on each side of the disk, as shown by Fig. 8. The brackets are secured to a cross-head, Q, bolted to the frame of the machine, the bracket being insulated from the cross-head by pieces V″ V″, and the shaft passing through the center of it in the manner shown.

The coils of the armatures are wound in the same direction, and are connected as in the Paccinotte ring, the outside of the one to the inside of the next, and so on, forming a continuous closed coil of wire around the ring. The connections are made as follows: On the shaft C, close to the hub of the wheel B, is placed a ring of insulating material, W, Figs. 2, 6, 7, 12, and 13. On the circumference of this ring are fastened pieces of metal *r r* by screws or pins *t*. In each of these pieces are set-screws, *s s′*. The outside end and the inside end of two adjacent coils are fastened to pieces *r* by means of these screws, thus making a continuous connection of all the coils H. A wire, *w*, leading to the commutator, is fastened to each of the pieces *r* by the set-screws *s′*, thus making a connection at the junction of each of the coils H with the commutator, as in the Paccinotte machine. These wires, *w*, are carried along the shaft of the machine from which they are insulated, and to which they are securely fastened by bands R R R.

The magnets of the dynamo are connected *seriatim*, so that the upper three are of one polarity and the lower three of opposite polarity. The ends Y Y′ are brought to the binding posts *c* and *d*. The ends *x* and *x′* from the commutator are brought to the binding-posts *a b*. By this arrangement the dynamo may be made to charge itself, as shown by the connections in Fig. 1, or the magnets may be charged by an auxiliary machine and the terminals of the armature connected directly to the external circuit.

The principal points of advantage resulting from my invention are these:

First, by this arrangement of the magnet and armature three sides of the wire of the armature are embraced within the field of the magnet, by which a much better magnetic effect is obtained than there can be by bringing the magnet to act on only one or two sides of the armature; and, second, by constructing the armature as I have described it can be effectually wound by machinery instead of the slow, laborious, and expensive process of hand-winding, and can be made perfectly true to rotate closely in the field of the magnet. Third, by constructing the commutator as I have described both surfaces of the metal are utilized for brush-contact, twice as much surface is obtained, and the sparking and heating greatly reduced. Fourth, by bringing all these novel features together in one machine a dynamo-machine is produced of much greater efficiency than any of which I have any knowledge. Fifth, by connecting the armature to the face of the wheel movable on the shaft and the circuit-wires to the shaft by means of screws the armature can be withdrawn from the field of the magnets by merely loosening the screws or other fastening that secures the wheel to the shaft and disconnecting the circuit-wires from the contact-pieces *r*, as above described.

What I claim, therefore, and desire to secure by Letters Patent, is—

1. In a dynamo-electric machine, an armature-ring having its core composed of two or more concentric rings placed one inside of the other and united, substantially as described.

2. In a dynamo-electric machine, an armature-ring consisting of the following elements, viz: a core composed of two or more paramagnetic rings placed one inside of the other,

said rings being divided transversely, as described, a series of paramagnetic bobbins duly wound and placed on said core, and a series of intervening clamps, G, placed on the core between the bobbins, substantially as described.

3. In a dynamo-electric machine, the combination of cheek-pieces A with the cores L′ of the magnets, each of said cheek-pieces being made separate and bolted to the ends of the magnet-cores, forming their poles, and each of them being grooved out to receive and embrace the armature-ring within each pole of the magnets.

4. In a dynamo-electric machine, a commutator consisting of a series of segments united to form a single disk, having two rubbing-surfaces set transverse its rotating axis and exposing both of said surfaces to collecting-brushes, substantially as described.

5. In a dynamo-electric machine, a commutator consisting of a series of segments united to form a single disk, having two rubbing-surfaces, each of which is combined with a collecting-brush.

6. The combination of clamps G with the coils and core of the armature for the purpose of filling the space between the coils and securing the ring to the wheel B that carries the ring.

7. The combination of a magnet, A, an armature-ring in the field of said magnet, and a wheel, B, made movable on the driving-shaft C, the several parts coacting to allow the ring to be removed from the field of the magnets by loosening the fastening of the wheel to the shaft and the connecting circuit-wires *w* and *w*, substantially as described.

8. The combination of the insulating-ring W and contact-pieces *r* with the shaft C, by which the circuit-wires are connected and disconnected.

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Witnesses:
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J. EDGAR BULL.