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W. KOEDDING.

DYNAMO ELECTRIC MACHINE.

No. 476,151. Patented May 31, 1892.

Fig. I.

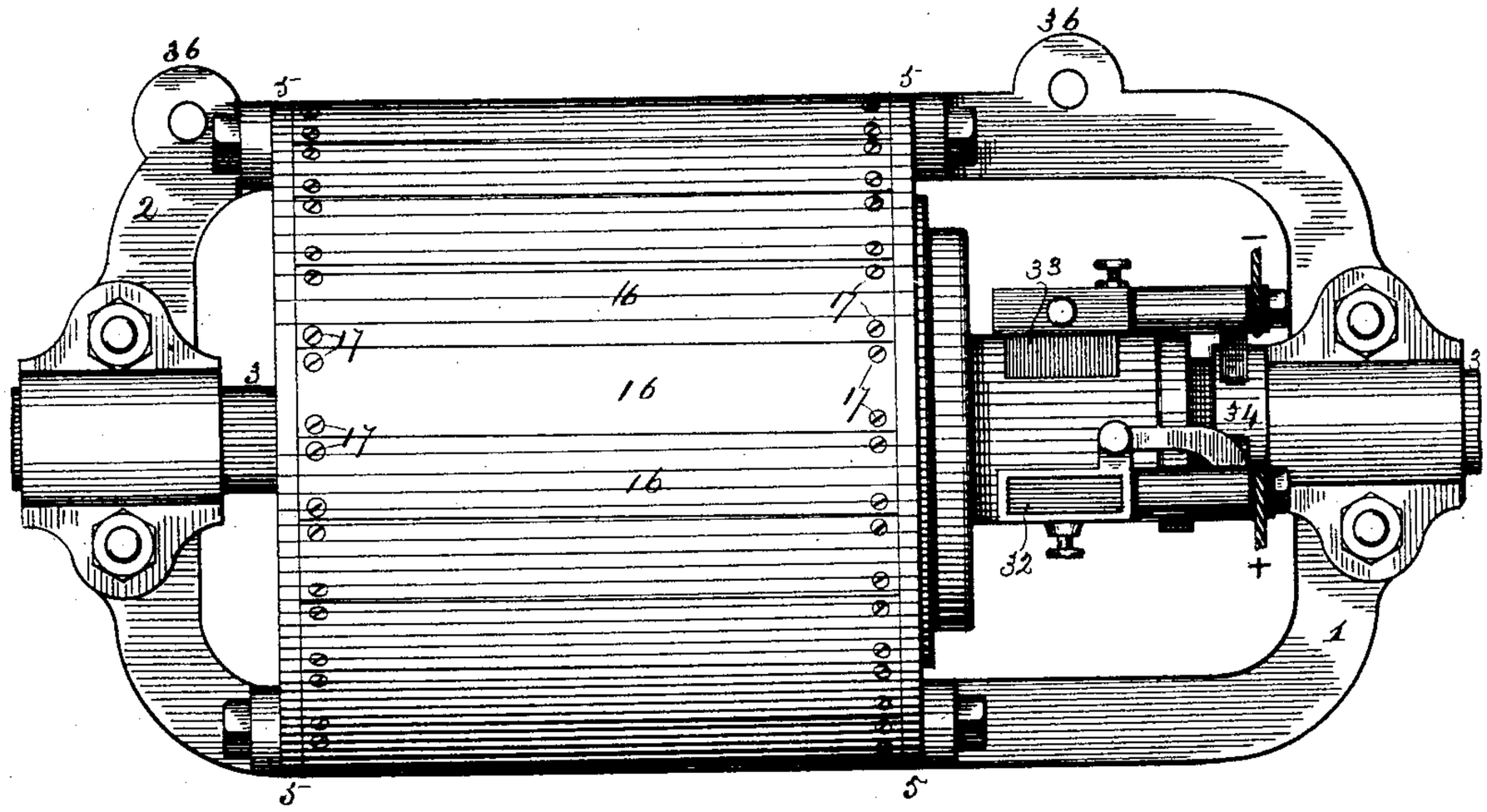
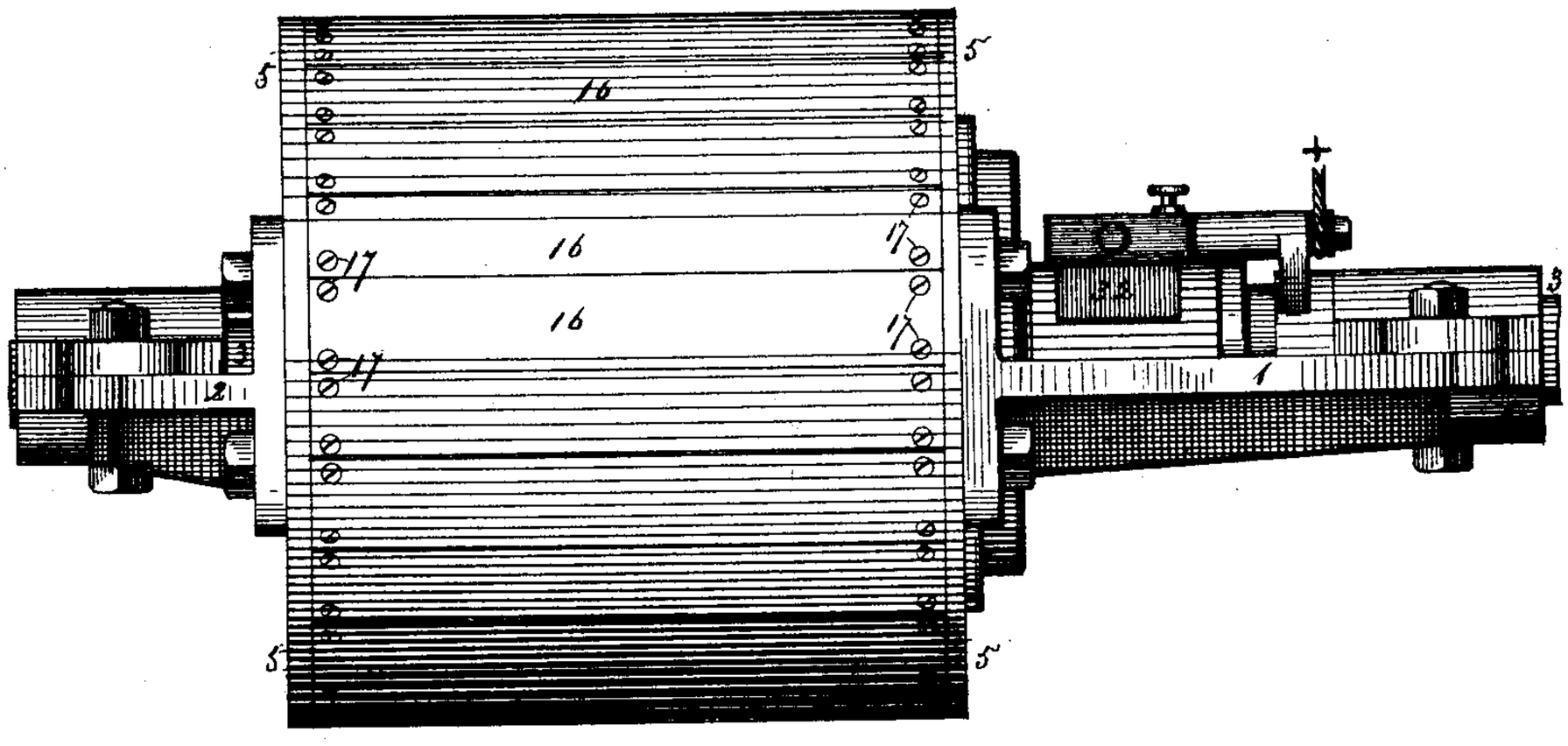


Fig. II.



Attest;
George E. Cruse
S. H. Knight

Inventor.
William Koedding.
By Knight Bros
Attys.

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W. KOEDDING.

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Fig. III.

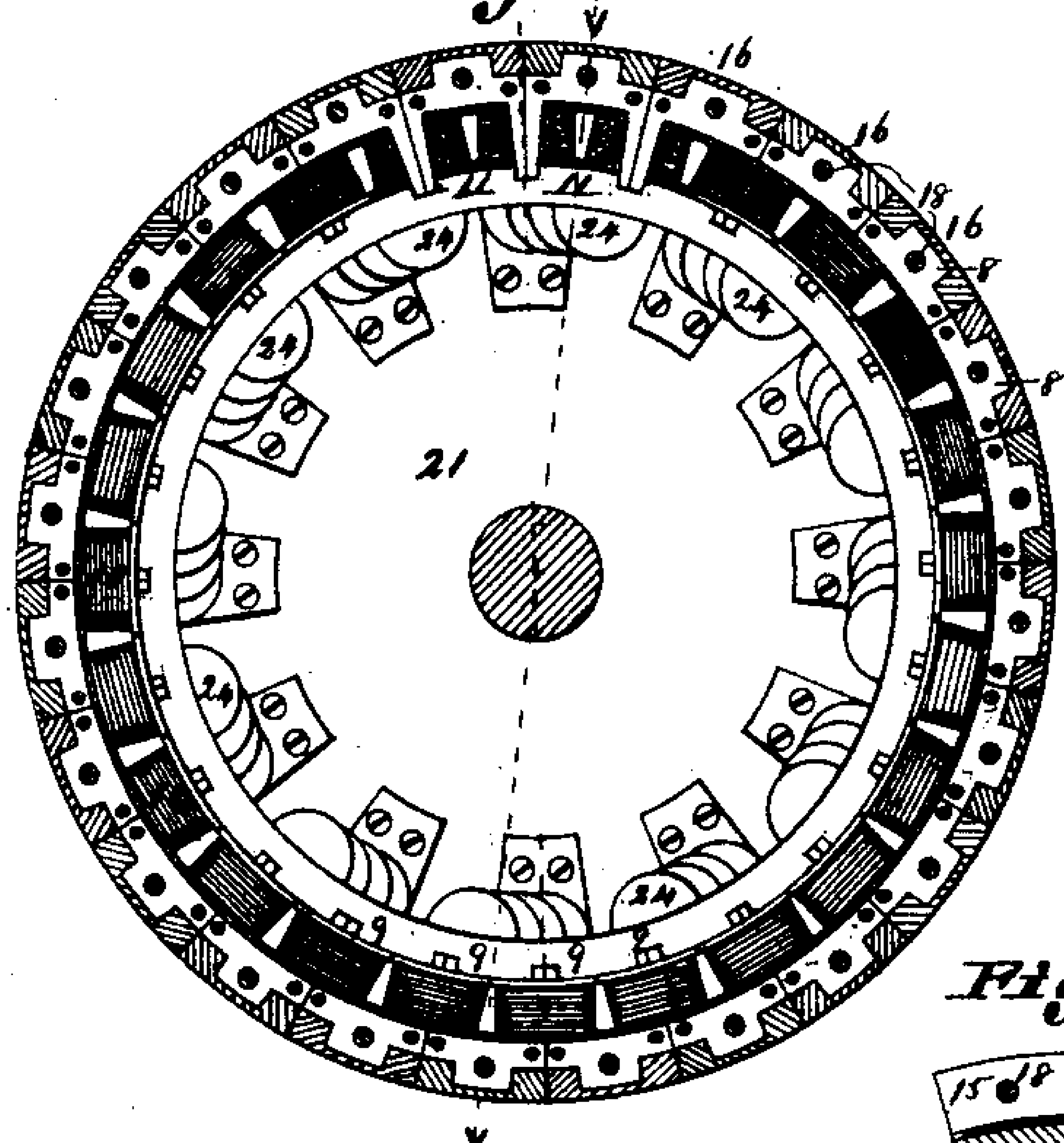

Fig. IV.

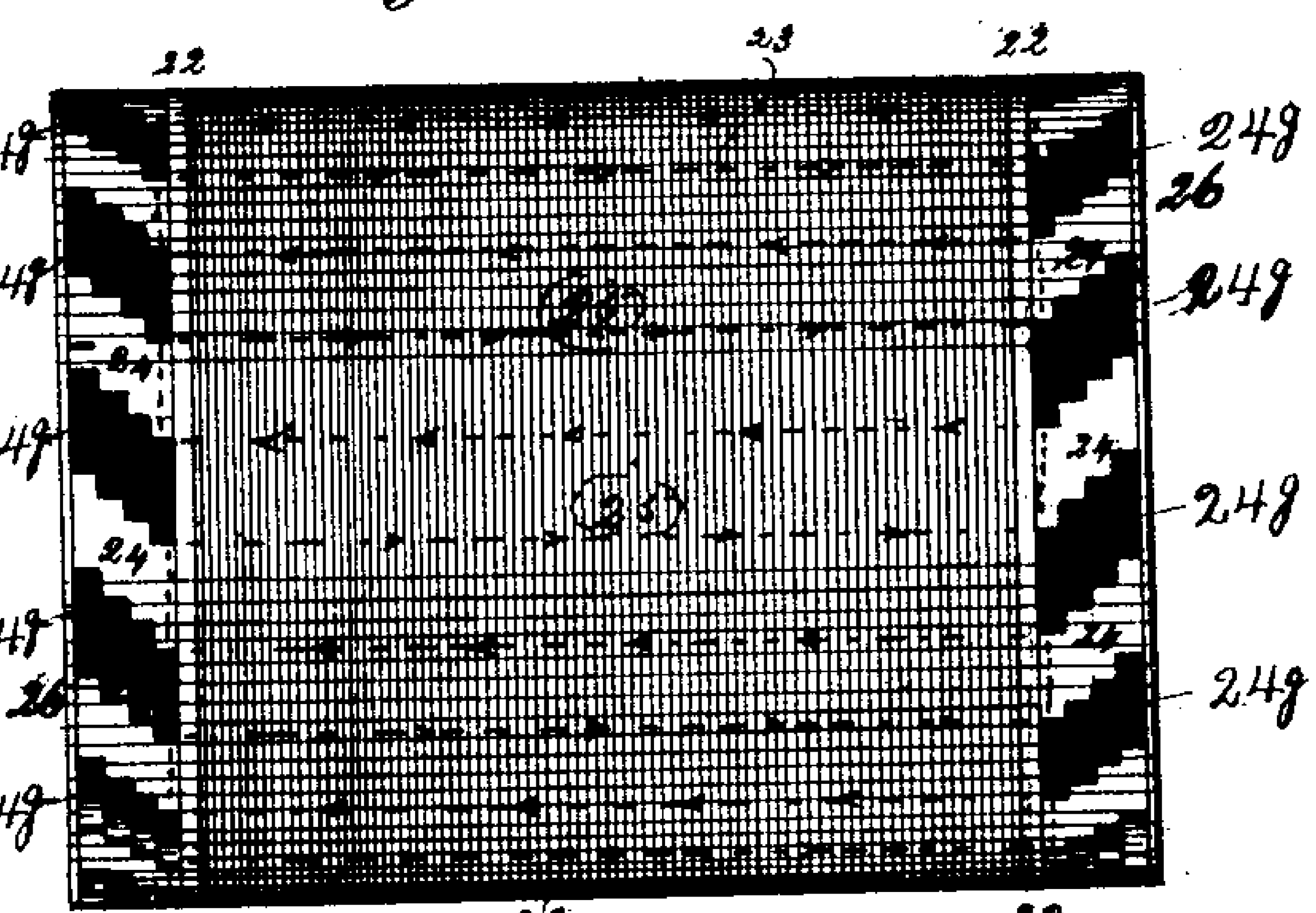

Fig. VI.

Fig. VII.

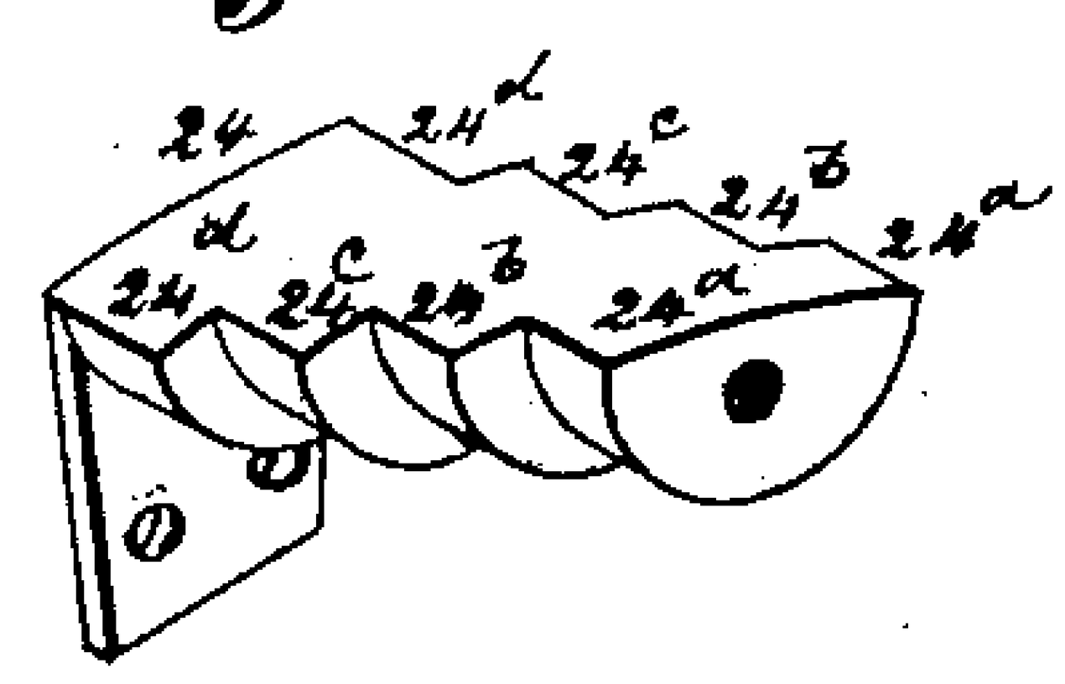

Fig. V.

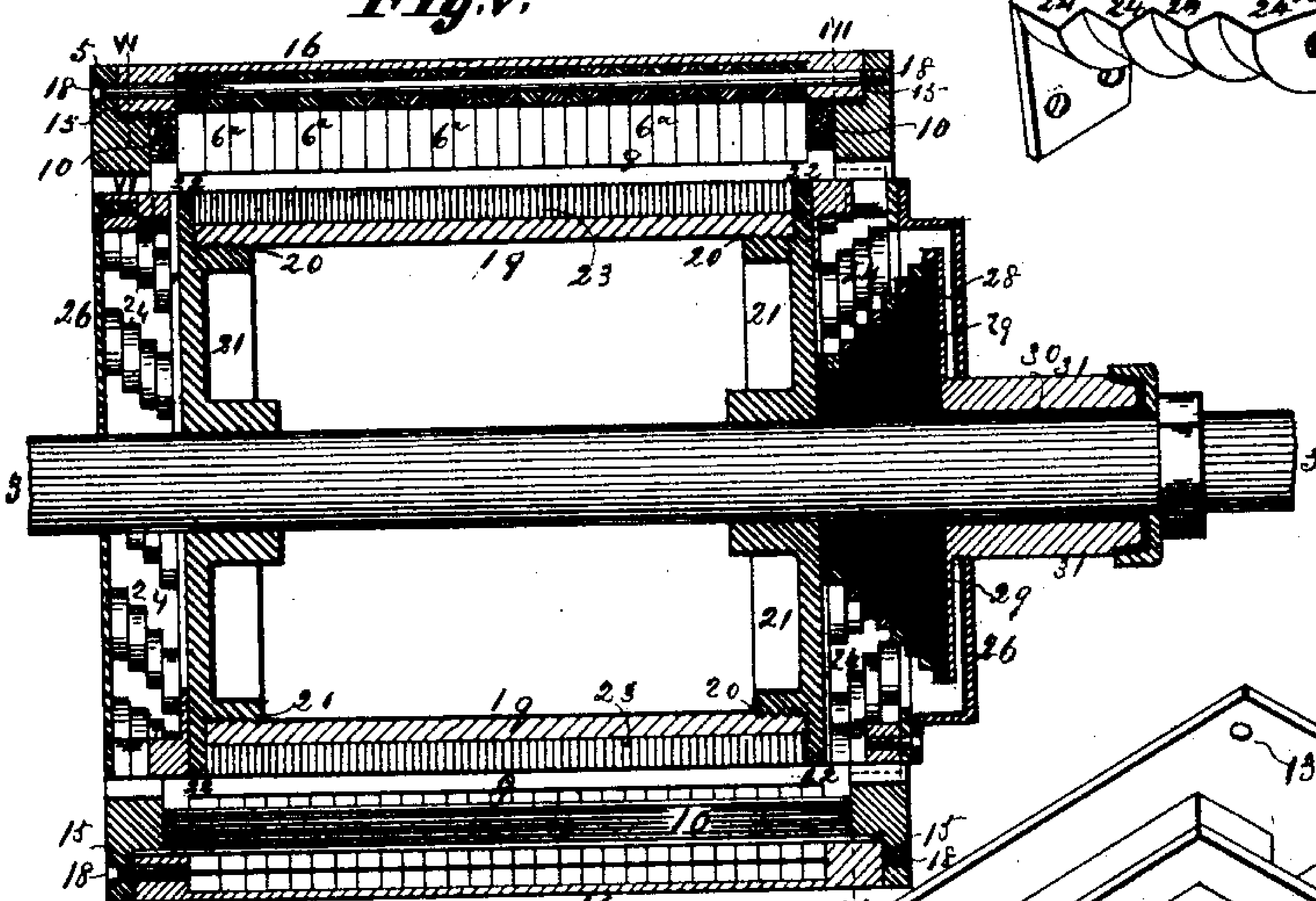

Fig. VIII.

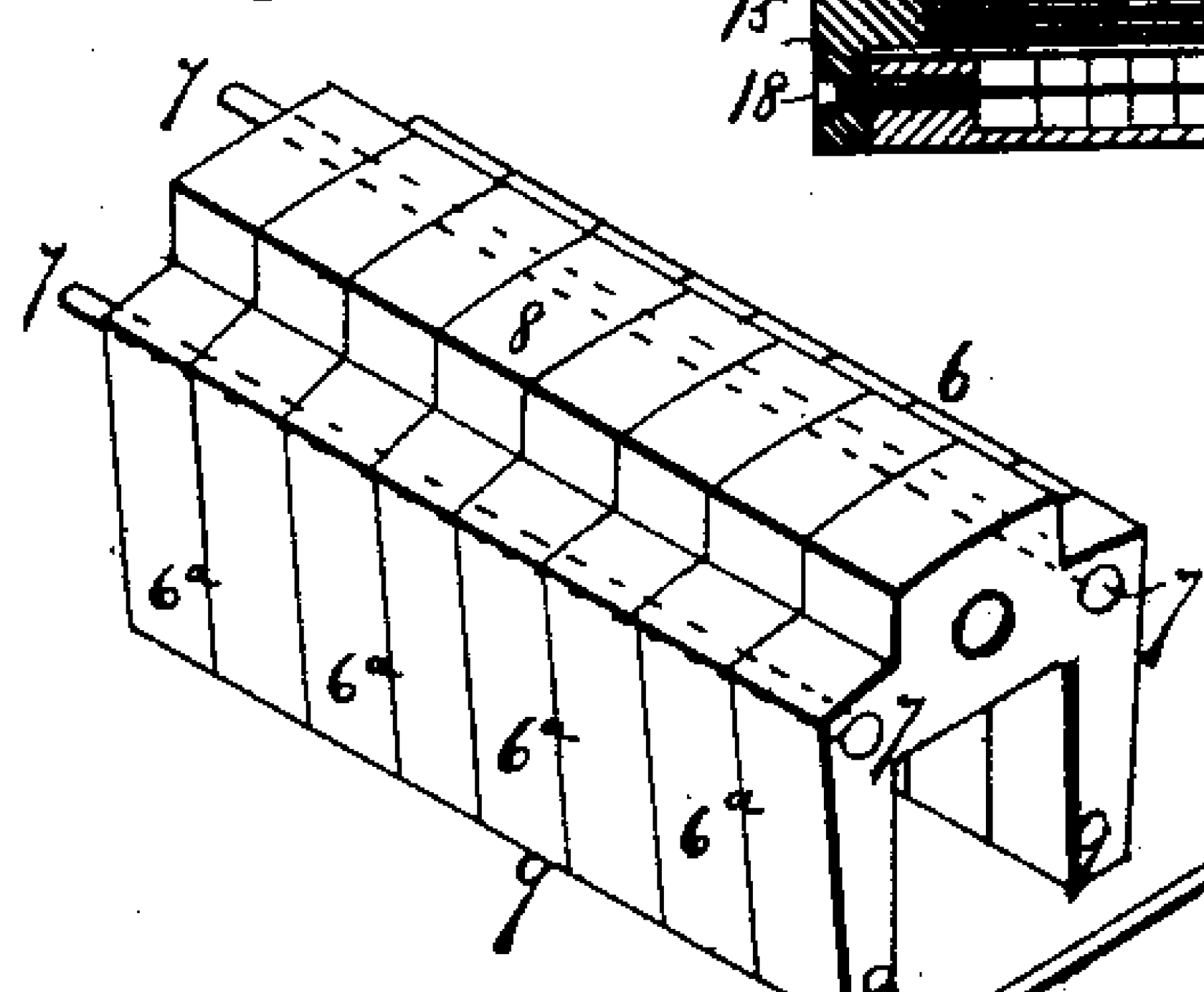

Fig. IX.

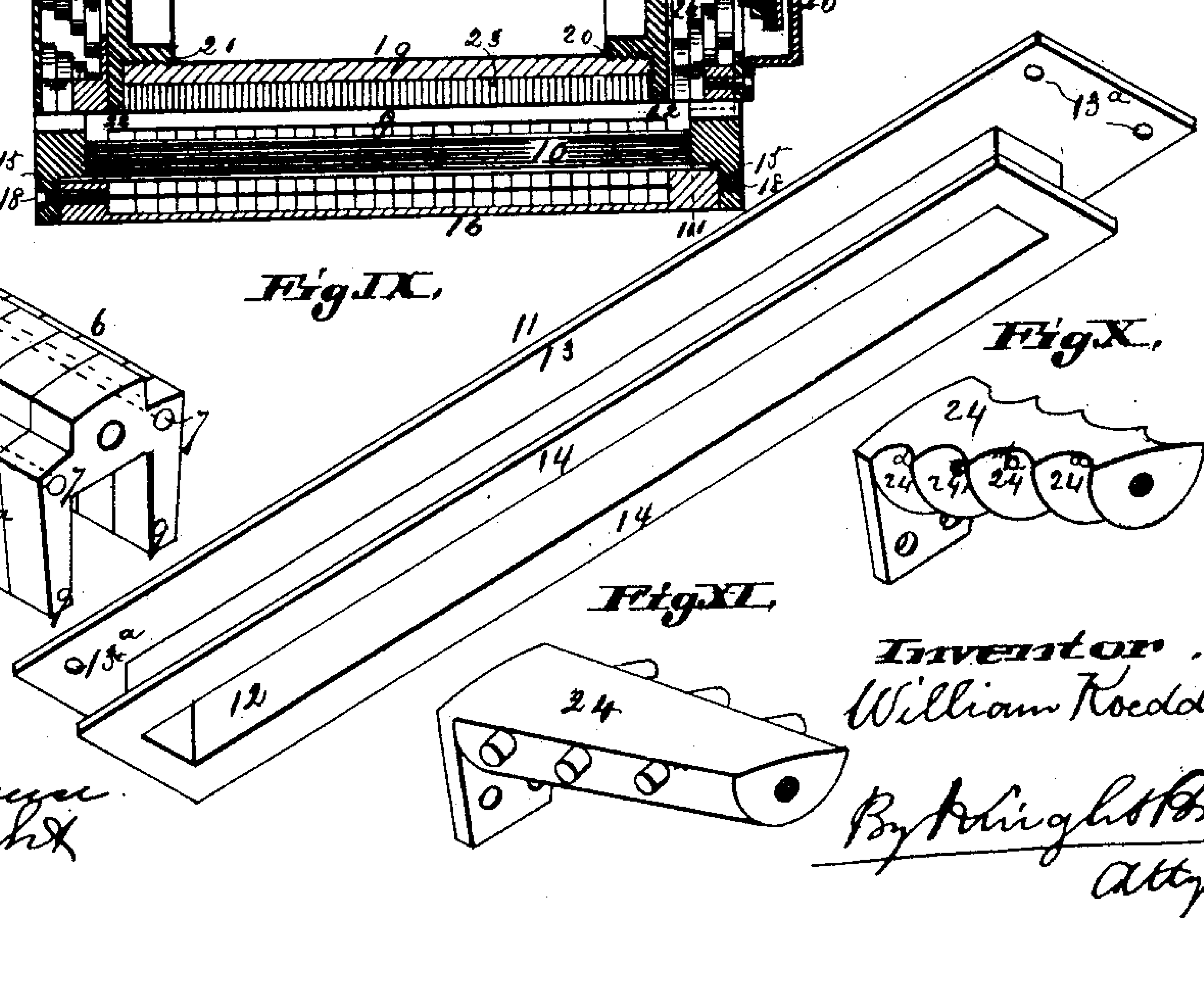

Fig. X.

Fig. XI.

Attest;
George E. Cruse
S. H. Knight

Inventor.
William Koedding.
By Knight Bros.
Attys.

(No Model.) 4 Sheets—Sheet 3.

W. KOEDDING.

DYNAMO ELECTRIC MACHINE.

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Fig. XII.

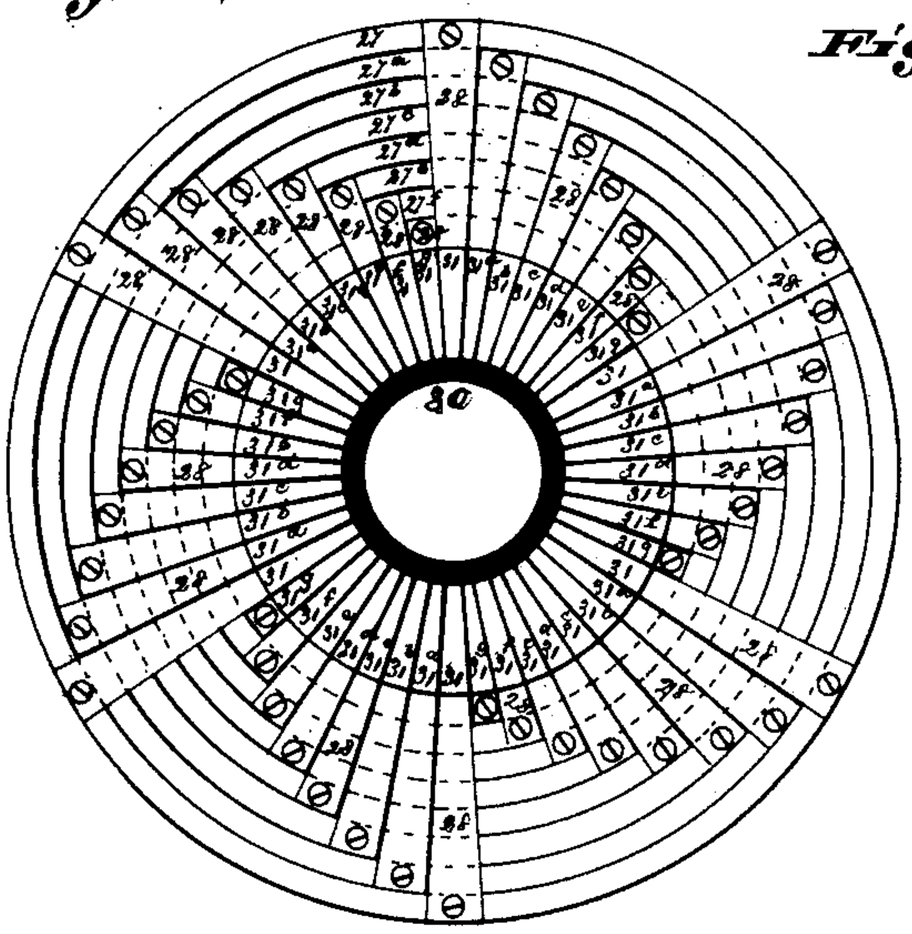


Fig. XIII.

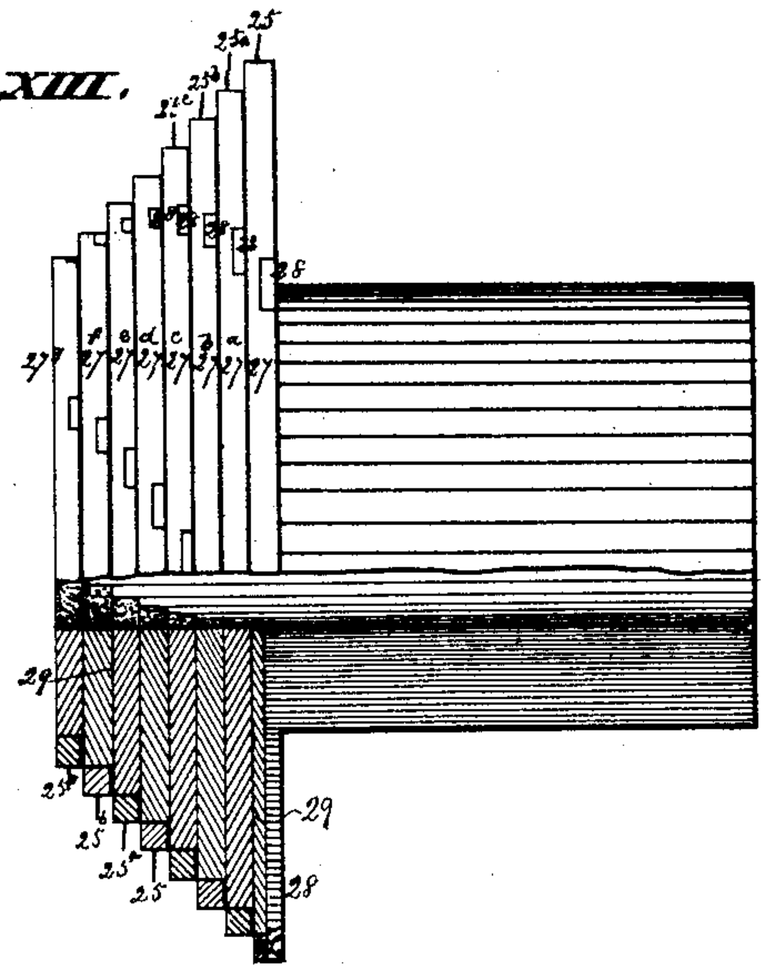


Fig. XIV.

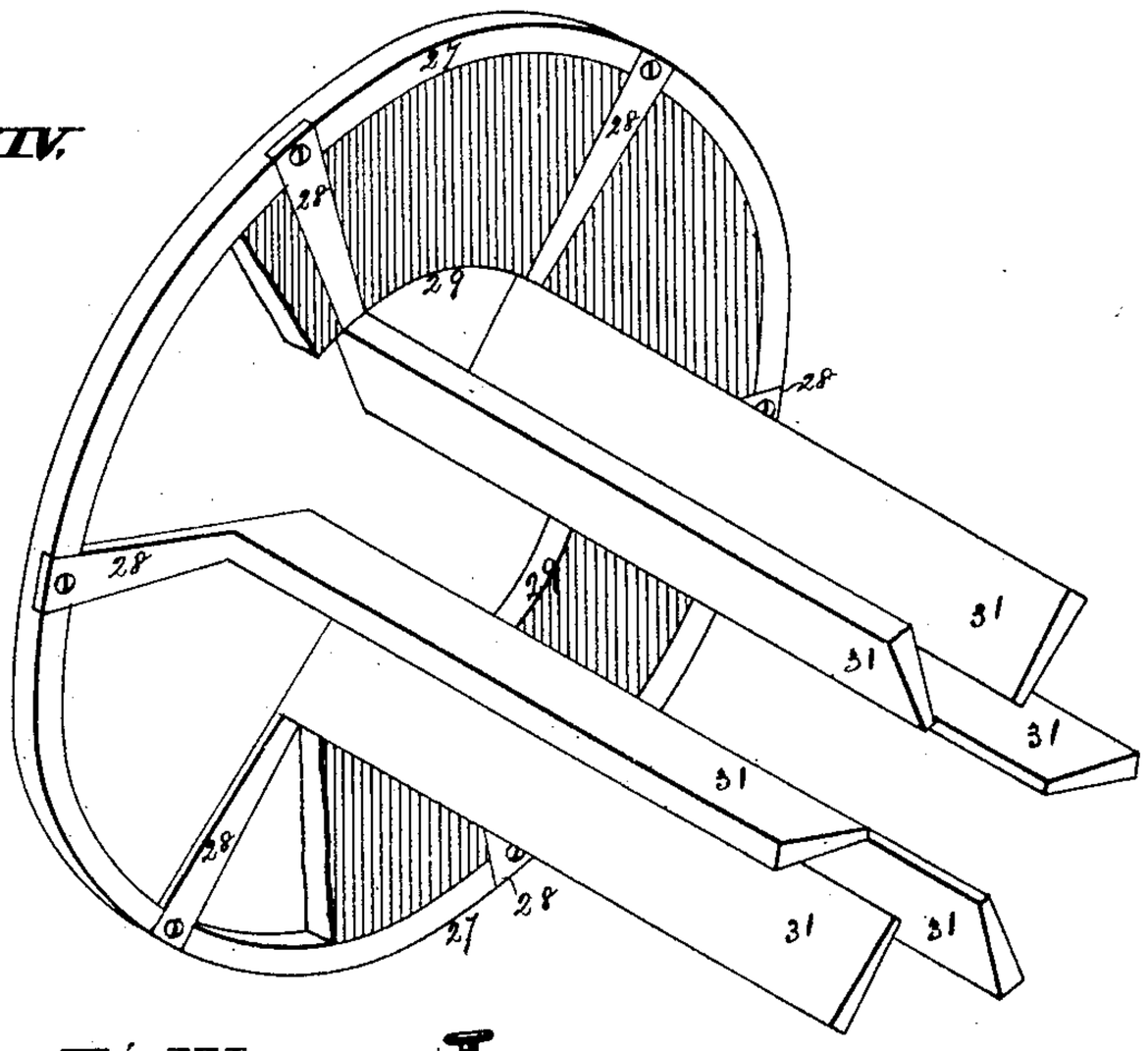
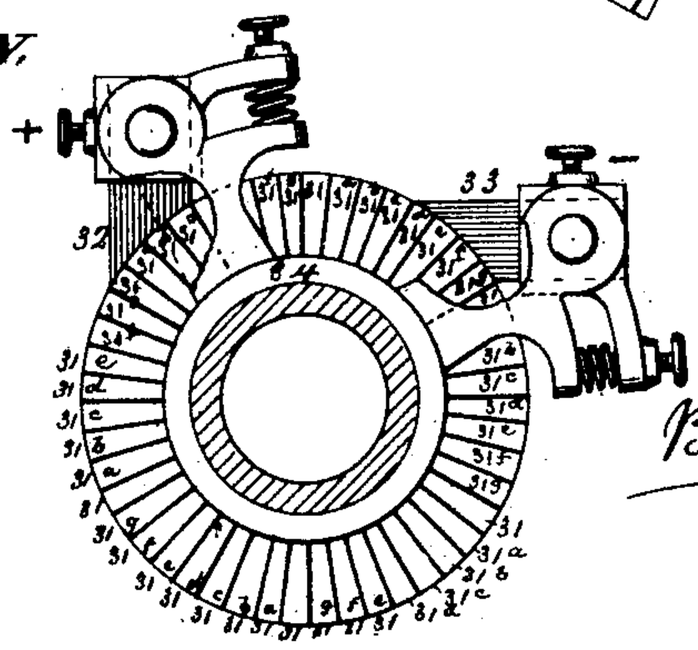


Fig. XV.



Attest;
George E. Cuyler.
S. H. Knight

Inventor;
William Koedding.
By Knight Bros
Attys

(No Model.) 4 Sheets—Sheet 4.

W. KOEDDING.

DYNAMO ELECTRIC MACHINE.

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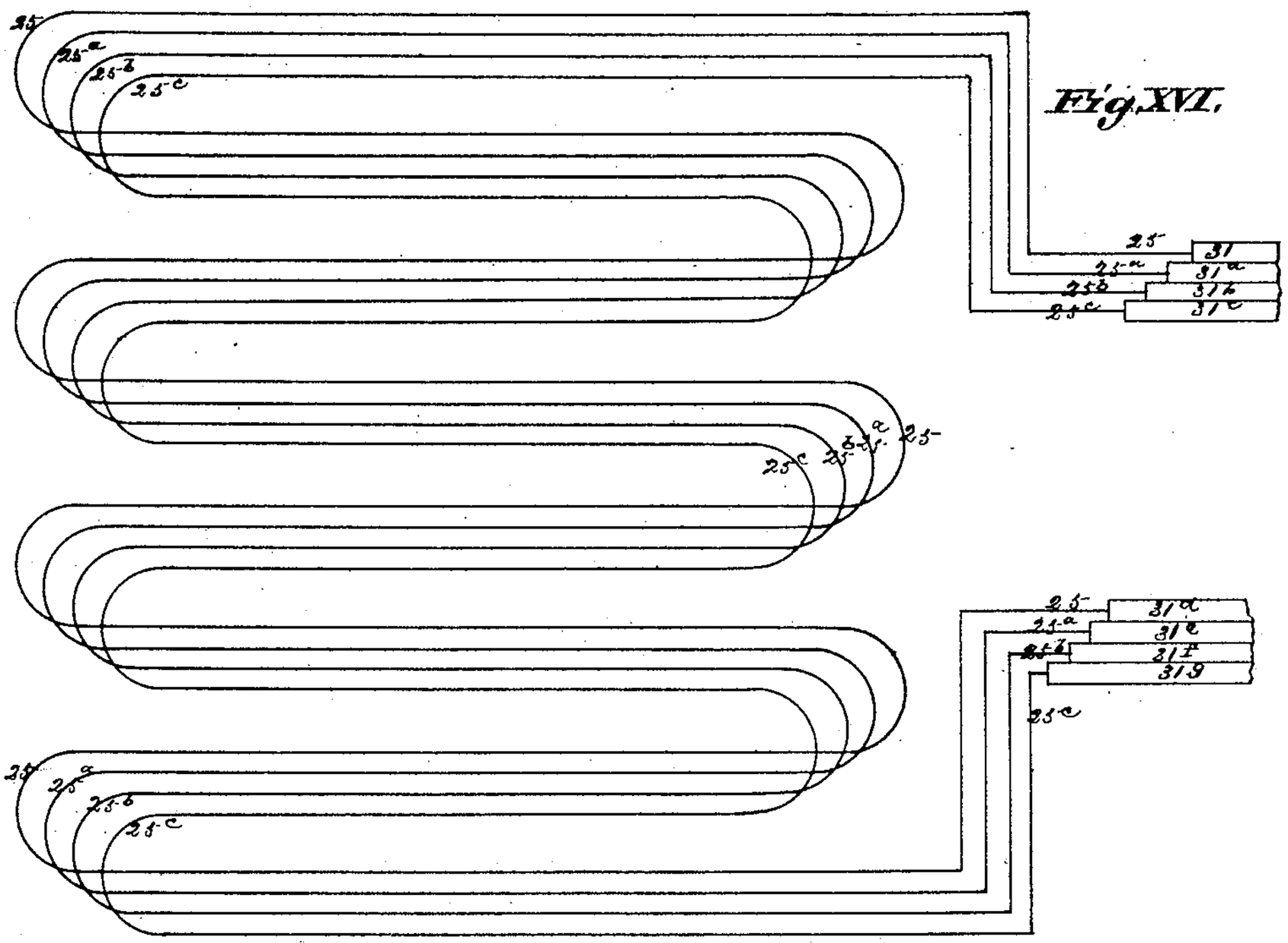

Fig. XVI.

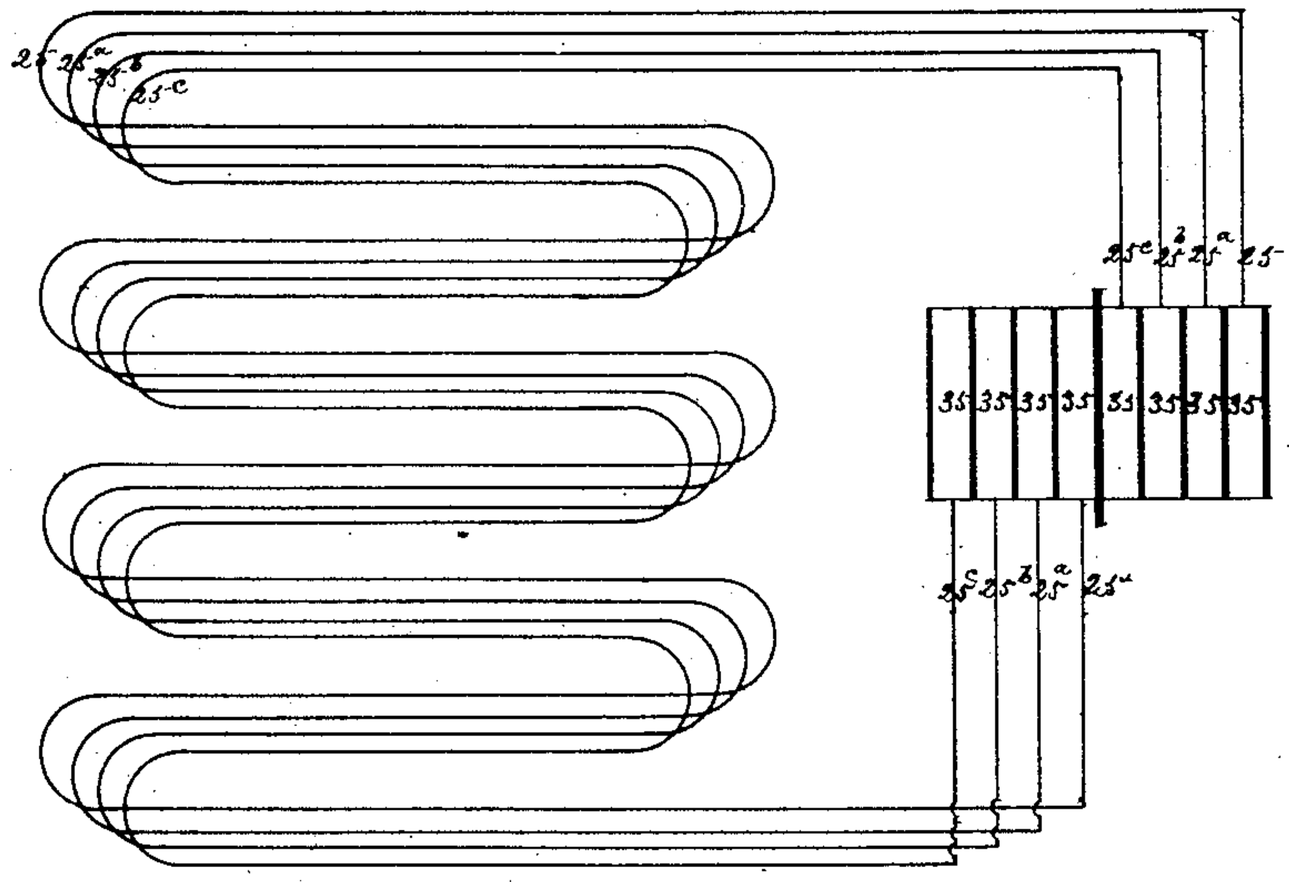

Fig. XVII.

Attest:
George E. Cuyler
S. A. Knight

Inventor.
William Koedding.
By Knight Bros.
Attys.

UNITED STATES PATENT OFFICE.

WILLIAM KOEDDING, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-HALF TO EDMOND VERSTRAETE, OF SAME PLACE.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 476,151, dated May 31, 1892.

Application filed January 31, 1891. Serial No. 379,787. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM KOEDDING, of the city of St. Louis, in the State of Missouri, have invented a certain new and useful Improvement in Dynamo-Electric Machines and Generators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

The principal object sought in this invention is the production of a motor that will run successfully at a low rate of speed and whose initial force will be great in all positions of the armature.

The features of novelty are set forth in the claims.

Figure I is a top view of the machine. Fig. II is a side view of the same. Fig. III is a transverse section of the machine, taken at III III, Fig. V. Fig. IV is a side view of the armature. Fig. V is a longitudinal section of the machine, taken at V V, Fig. III. Fig. VI is a detail transverse section taken at VI VI, Fig. V. Fig. VII is a perspective view of one of the horns over which the armature-wire is lapped. Fig. VIII is a detail perspective view of part of the core of a field-magnet. Fig. IX is a perspective view of one of the shells of the field-magnets. Figs. X and XI are perspective views of modified forms of the horns over which the armature-wires are lapped. Fig. XII is an end view of the commutator. Fig. XIII is a view of the commutator, part in side view and part in longitudinal section. Fig. XIV is a perspective view of one member of the commutator. Fig. XV is an end view of the commutator, showing the brushes in elevation. Fig. XVI is a diagram illustrating the manner of winding the armature-wires and their connection with the commutator. Fig. XVII is a diagram showing the armature-wires and commutator arranged for an alternate-current generator.

The field-magnets are supported upon U-shaped frames 1 and 2, on which the armature-shaft 3 has journal-bearing. These frames have annular portions or rings 5 in planes perpendicular to the shaft. The rings are rigidly connected to each other by the field-magnets and their accessories.

Fig. VIII illustrates the construction of the field-magnet cores 6. They consist of a number of sheet-iron plates 6^a, of horseshoe form, set side to side in a series extending lengthwise of the magnet. These plates are riveted together by rods 7, extending the whole length of the magnet. The magnet-core has a central rib 8 and pole-pieces 9. The wire 10 is not wound directly upon the pole-pieces, but upon a shell 11, in which the pole-pieces are inserted. The aperture 12 of the shell is of such size as to admit two of the pole-pieces 9 of adjoining magnet-cores, which thus are surrounded and polarized by the same coil and have like polarity. Twenty-four of these field-magnets are shown. They may, however, be more or less in number. The shell has an outer flange 13, whose ends rest in an annular rabbet-groove 15, made in the inner side of the rings 5.

14 is a flange projecting outwardly from the inner side of the shell and serving to support the coil at that side, the flange 13 supporting it at the other side. The poles 9 project inwardly from the shells, as seen in Figs. III and V.

16 are bars or strips that are secured to the rings 5 outside the magnets and which when in place form a smooth cylindrical exterior of the field-magnet case. The ends of the bars 16 rest in the rabbet grooves or recesses 15 of the two rings, and their outer sides are flush with the periphery of the rings. The bars are secured to the rings by radial screws 17 and longitudinal screws 18, which latter extend the whole length of the field-magnet cylinder and pass longitudinally through the ribs 8 of the magnet-cores. These ribs 8 fit in recesses made in the inner sides of the bars 16. The radial screws 17 pass through the ends of the bars 16 and through holes 13^a in the ends of flanges 13 of the magnet-shells 11. (See Figs. III, IV, V, VI, and IX.) It will be seen that any one of the magnet-cores may be removed singly by the removal of the strips 16 overlying the core, and each shell 11 may be re-

moved separately without the disturbance of any other of the shells by simply removing the two magnet-cores having their poles inserted in that shell.

The armature has an annular cylinder 19 of soft iron. The ends of the cylinder have inside screw-threads 20. 21 are two similar brass disks screwed fast in the ends of the cylinder and keyed to the shaft 3. These rings have peripheral flanges 22, that extend beyond the cylinder, and the cylinder from end to end is surrounded by numerous rings 23 of soft iron, whose interior diameter is the same as the exterior diameter of the cylinder and whose circumference agrees with that of the flanges 22, so that the circumference of the armature-core has an even cylindrical form from end to end. The rings 23 are placed in position, while one of the disks 21 is removed from the cylinder, and after the rings have been put on the cylinder the disk is screwed into place, thus pressing the rings hard together.

Upon the outer sides of the disks 21 are horns 24, beneath which pass the electric wires 25, 25^a, 25^b, and 25^c, which are in four series, wound zigzag over the surface of the cylinder 19 from end to end and passed beneath the horns. The horns are made in steps and extend obliquely to the side of the ring, as seen in Figs. III, IV, V, and VII, or have an equivalent form—for instance, as illustrated in Figs. X and XI, in both of which the horns are oblique, the first having grooves to keep the wires separate and the last having pins for the same purpose. 24^s is insulating material filling the space between the horns 24.

26 are shields fitting at the periphery the ends of the horns 24 and the insulating material 24^s, filling the space between the horns and fitting at their inner edges, respectively, the shaft 3 upon one side and the commutator upon the other side. If the shields are made of metal, an insulator is placed between the shield and the commutator or space is left between them for purpose of insulation.

The wires 25, &c., extend from end to end of the cylinder in zigzags on different lines, being parallel and spread evenly over the face of the cylinder 19, the wire 25 being carried around the part 24^a of the horns, the wire 25^a around the part 24^b, and so on, each wire passing around a particular part, as may be seen in the diagram Fig. XVI. The position of one of the wires (viz., 25^c) is indicated by broken lines in Fig. IV. The four wires are insulated from each other. In place of each single wire 25 or 25^a, &c., a number of smaller wires may be used or a single smaller wire for each of the larger wires carried continuously in a zigzag two or more times around the cylinder and its ends connected to the commutator in the same way as the ends of the larger single wires or cables of smaller wires, which are passed only once around the cylinder. The commutator has a number of insulated rings 27, 27^a, 27^b, 27^c, 27^d, 27^e, 27^f, and 27^g, each ring having electric connection with one end of one of the wires 25, &c. These rings are connected by metal strips 28 to the bars with which the brushes are in contact. These bars are in six sets of eight, and, although of exactly the same construction, those of each set are numbered 31, 31^a, 31^b, 31^c, 31^d, 31^e, 31^f, and 31^g to render the description clear, these bars with the interposed insulators forming a cylinder smooth at the circumference. Each ring is shown with six of the strips 28 and bars 31, &c., making forty-eight of each. (See Figs. XII, XIII, and XIV.) The commutator-sections are put together as seen in Figs. XII and XIII, the commutator being made by sliding the sections together by an endwise movement. They are separated from each other by insulating material 29. The commutator-bars 31 31^a, &c., are separated from the shaft by insulator 30. The two ends of the wire or bunch of wire 25 are connected, respectively, to the two commutator-rings 27 and 27^d, the wire 25^a to the two rings 27^a and 27^e, and so on, as seen in Fig. XIII. The ring 27 is in electric connection with all of the commutator-bars 31, the ring 27^a with the commutator-bars 31^a, and so on, as seen in Fig. XII.

The brushes 32 33 may have any suitable construction, being fixed to the field-magnet frame by a ring 34 or other means, and are properly insulated. No novelty is claimed in the brushes *per se*. They are each in contact with four of the commutator-bars, being so placed that each wire has electric connection by its opposite ends with the two brushes. It follows that the direction of the electric current is reversed in only one wire at a time, the current being continuous in the other three wires during the reversal of the current in that wire. To illustrate, suppose the brush 32 to be positive and the brush 33 negative. (See Fig. XV.) Then a positive current will be passing through all the armature-wires from brush 32, bars 31, 31^a, 31^b, and 31^c, and the commutator-rings to the negative brush 33. Now as the bar 31 leaves contact with the positive brush and the bar 31^d leaves contact with the negative brush at the same time a bar 31^d takes contact with the positive brush and the bar 31 takes contact with the negative brush and the current in wire 25 is reversed, and so as each pair of bars leaves contact with the brushes the current in the wire connected to those bars is reversed, as the bars 31, &c., with which the wires are in electric connection, are transferred to the other brush.

When the machine is used as an alternate-current generator, the part of the commutator which is in contact with the brushes is composed of insulated rings 35, each of which is an electric connection on end of an armature-wire, the ends of each wire being in electric connection with different brushes, as illustrated by diagram Fig. XVII.

36 are lugs by which the frame is secured to an object to prevent the rotation of the frame.

Four of the armature-wires 25 25ª, &c., are shown, the horns at the ends of the core-cylinder being adapted for supporting the bends of the wires, so as to distribute the wires evenly over the surface of the armature-cylinder. I do not confine myself, however, to any precise number of these wires, as the number may vary without affecting the novel principles of the invention. The horns may also vary in number from that described.

This machine, as shown in Figs. I to XVI, may be used as a motor either with a constant or alternating current, or may be used as a generator for a constant current, while in the form illustrated in Fig. XVII it is only intended for use as an alternate-current generator.

I claim as my invention—

1. In a dynamo-electric machine, the combination of the cases 11, adapted to receive the wire coils, and the field-magnet cores composed of thin plates 6ª, arranged side by side in metallic contact in a line lengthwise of the magnet and having their poles set in said cases 11, substantially as set forth.

2. In a dynamo-electric machine, the combination of the detachably-supported cases 11, having the wire coiled thereon and arranged to form a cylindrical field, and the detachably-supported magnet-cores of horseshoe form in cross-section, said magnet-cores being arranged with one of their poles in each of the adjacent cases 11, whereby the cores can be removed singly and the cases can be removed singly by first removing the two adjacent magnet-cores, substantially as set forth.

3. In a dynamo-electric machine, the combination of the annular parts or rings 5 of the fixed frame, field-magnets attached to said rings, and a covering-strip 16, attached to each magnet and to the rings, substantially as set forth.

4. In a dynamo-electric machine, the combination of the annular parts or rings 5 of the fixed frame, the cases 11, attached to said rings and having the wire coiled thereon for forming a cylindrical field, magnet-cores inserted in said cases 11, and covering-strips 16, attached to said magnet-cores, substantially as set forth.

5. In a dynamo-electric machine, the combination of the U-formed parts 1 and 2, giving bearing to the armature-shaft, the annular parts or rings 5, supported upon said parts 1 and 2, the cases 11, attached at their opposite ends to the rings 5 and having the wire coiled thereon, the magnet-cores supported in said cases 11, the screw 18, passing through the rings 5 and the magnet-cores, and the covering-strips 16, substantially as set forth.

6. The armature-core having the oblique or inclined horns 24 at its ends, adapted to support the wire at the bends of the same, substantially as set forth.

7. The armature-core having the inclined horns 24 at its ends, said horns being provided with steps or corrugations for supporting the wires out of contact with each other, substantially as set forth.

8. The combination, in an armature, of the body or core of cylindrical form, two or more separate wires 25 25ª, carried in zigzags over the circumference of the core, and inclined horns 24 at each end of the core, adapted to support the wires at the bends and keep them out of contact with each other on the surface of the core, substantially as set forth.

9. The cylindrical armature having inclined horns 24 at its ends and insulating material 24ˢ, occupying the space between said horns, substantially as set forth.

10. The combination, in an armature, of two or more wires running in zigzag over the face of the core and around the same and having their ends in electric connection with different sections of a commutator, and brushes in contact with said commutator of suitable size to extend over a number of said sections, substantially as and for the purpose set forth.

11. The combination, in a dynamo-electric machine, of an armature having two or more separate wires wound in zigzag on the armature, and a commutator having rings parallel with the ends of the armature, each ring in electric connection with only one end of one wire and each ring in connection with two or more sections or bars of the part of the armature in contact with the brushes, substantially as set forth.

12. The combination, in a dynamo-electric machine, of an armature having two or more separate wires wound in zigzag on its surface, a commutator having a series of rings 27 parallel with the ends of the armature, a series of bars or sections 31, connected to said rings by strips 28, and suitable insulating material between said parts, said rings 27 being in electric connection with said wires, substantially as set forth.

13. The combination, in a dynamo-electric machine, of a number of field-magnets of alternate opposite polarity, an armature rotating in the field with two or more separate wires, each end of each wire in electric connection with two or more of the bars or sections of a commutator which revolve in contact with the brushes, and brushes each extending over a number of said sections equal to the number of armature-wires.

14. The combination, in a dynamo-electric machine, of an armature having a plurality of wires carried in a zigzag around it, and a commutator having conducting-rings parallel with the ends of the armature, the rings being double in number to the armature-wires and each end of each wire being in electric connection with a separate ring and each

ring in electric connection with two or more distinct sections or bars, as 31, rotating in contact with the brushes, substantially as and for the purpose set forth.

15. The combination, with the armature of a dynamo-electric machine provided with the horns 24 and the insulating material 24^s between them, of the shields 26, substantially as and for the purpose set forth.

WILLIAM KOEDDING.

In presence of—
THOS. KNIGHT,
SAML. KNIGHT.