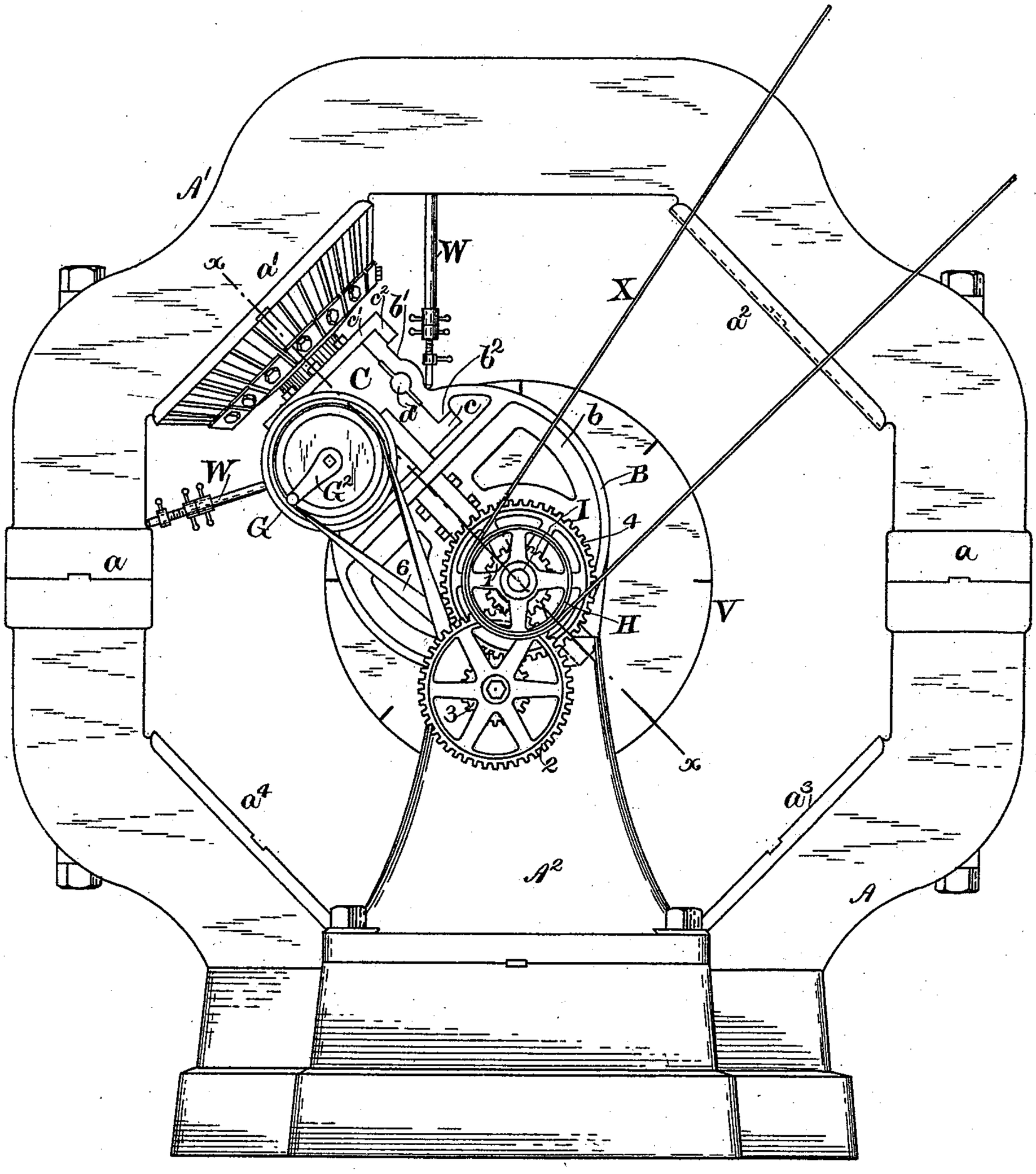
(No Model.) 2 Sheets—Sheet 1.

J. RIDDELL.

MILLING MACHINE.

No. 516,838. Patented Mar. 20, 1894.

FIG. 1.



WITNESSES.

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(No Model.)

2 Sheets—Sheet 2.

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MILLING MACHINE.

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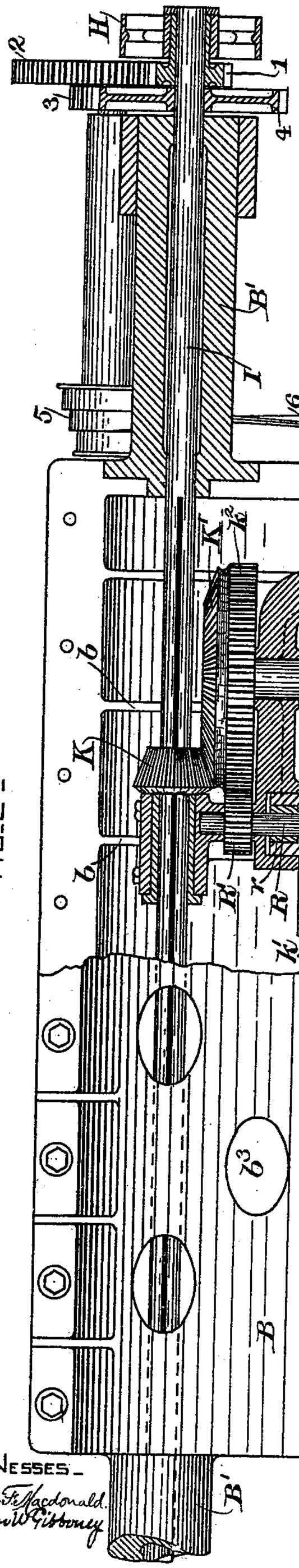

FIG. 2.

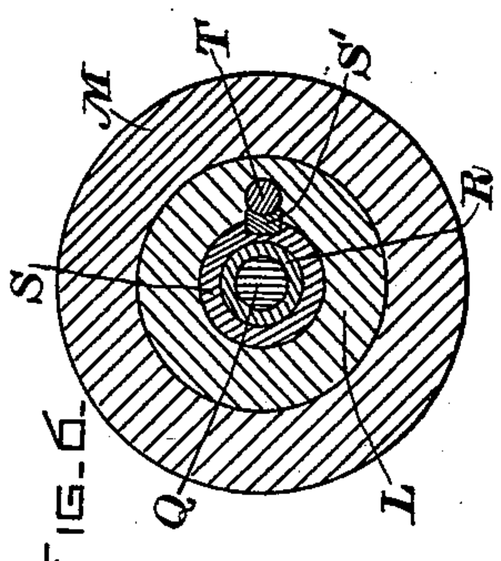

FIG. 6.

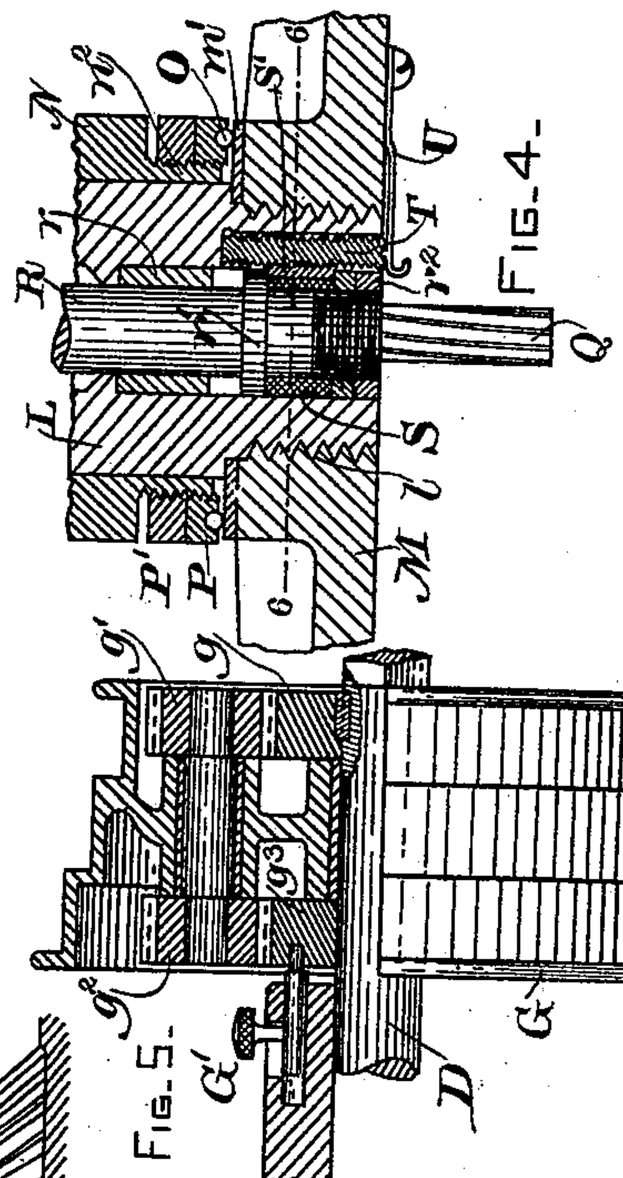

FIG. 4.

FIG. 5.

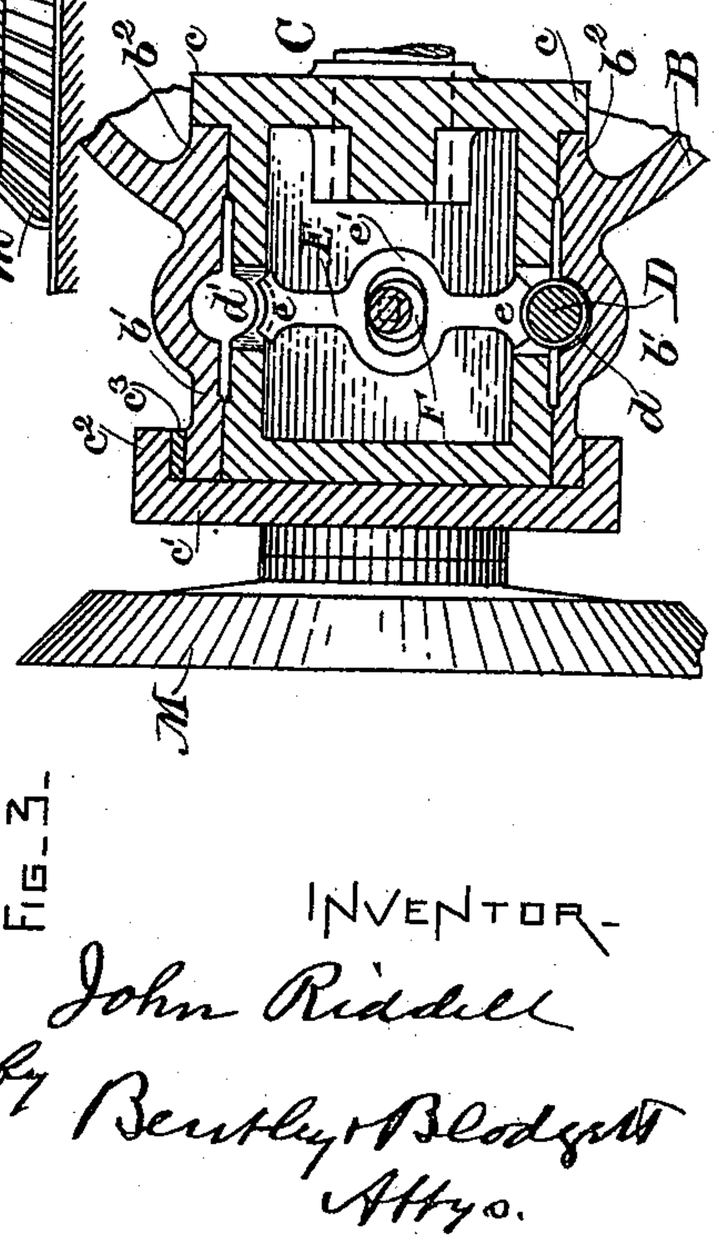

FIG. 3.

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UNITED STATES PATENT OFFICE.

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MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 516,838, dated March 20, 1894.

Application filed August 26, 1892. Serial No. 444,203. (No model.)

To all whom it may concern:

Be it known that I, JOHN RIDDELL, a citizen of the United States, residing at Saugus, county of Essex, State of Massachusetts, have invented a certain new and useful Improvement in Milling-Machines, of which the following is a specification.

My invention relates to milling machines, and it is designed for milling off the faces or seats for the pole pieces in large multipolar dynamo electric machines. It is necessary that all the pole pieces shall stand exactly radial to the axis of the armature. The fields of these machines are commonly made in two pieces. The usual method of finishing the faces is to mount one of the field castings on a planer bed, plane off and face up the inside of the joints, then set the tool at the proper angle to plane off one of the faces for the pole pieces, then put in a special key-seating tool to cut the key-way, repeat these facing and key-seating operations for the other face (in the case of a four-poled machine); then remove this piece of the field from the planer, and mount the other piece, on which the same process is gone through with. This mode of procedure occupies a great deal of time in adjusting the castings on the planers and in setting the tools at the required angles, since a slight inaccuracy throws the pole pieces out of line.

My invention aims to effect the facing of the seats for the pole pieces and the cutting of the key-ways after the castings composing the field have been fitted together. I have devised a special milling machine, adapted to be mounted in the bearings for the armature shaft. An index plate enables it to be adjusted to the proper angle. The milling cutter rotates on an axis radial to the axis of the shaft bearing, thus insuring the radial alignment of the pole pieces. The cutter travels laterally across the pole face on a line parallel with the axis of the shaft, thus insuring the parallelism of the pole pieces. The cutter is arranged to face off the seat and cut the key-way at the same operation.

In the drawings, Figure 1 is an end view of a multipolar machine showing the milling machine at work on one of the pole faces. Fig. 2 is an enlarged side view of the milling machine, partly in section, on the line x—x, Fig. 1. Fig. 3 is a sectional elevation on the line 3—3 Fig. 2, of the double segmental nut for engaging the feed screw. Fig. 4 is a sectional view showing the means for holding and adjusting the key-way cutter. Fig. 5 is a side view, partly in section, of the cone pulley which operates the feed screw, and Fig. 6 is a cross-section on line 6—6, Fig. 4.

The field of the multipolar machine consists of two castings, A, A′, suitably jointed together at a, and fastened by bolts. The field shown is for a four-poled machine, the faces for the pole pieces being at a', a^2, a^3, a^4. At each end of the machine is a standard A^2 in which are the bearings for the armature shaft.

The milling machine comprises a strong tubular frame B, which is stiffened by suitable ribs b, and is preferably cylindrical in shape. From each end, near one side of the cylinder, projects a strong trunnion or gudgeon B′, adapted to fit and turn in the shaft bearings in the standards A^2. The opposite side of the frame is open, the opening being bordered by parallel flanges b', which preferably extend a little way into the cylinder at b^2 to form guides for the carriage C, which has shoulders c to rest on said guides. The base c' of the carriage has flanges c^2 which overlap the outer edges of the body flanges b'. A gib or liner c^3 may be used to take up the wear. The carriage is traversed along the guides by a feed screw D, which rotates in one or the other of suitable channels d, d', between the flanges b' and the carriage. On the carriage is a movable bar E, having at each end a segmental nut e, adapted to engage with the feed screw. By means of an eccentric F operating on a yoke e' in the bar, the bar can be shifted endwise, to bring the nut into engagement with the screw, whereby motion is imparted to the carriage. The necessity for having two screw channels and a double nut, arises from the fact that when the face a^4 is being operated upon, the cone pulley G, on the end of the screw, would strike the standard A^2, if the screw were allowed to remain in the channel in which it is shown in Fig. 1. By having a channel on each side of the carriage, the cone pulley and screw can

be withdrawn and the latter inserted in the uppermost channel when the faces a^3, a^4 are to be dressed off, thus avoiding all interference with the standards.

Power is imparted to the machine by a belt X, running over a pulley H secured to the hollow hub of a pinion 1 sleeved on a main shaft I concentric with the hollow trunnions B′ in which it rotates. The pinion 1 meshes into a spur gear 2, on the hub of which is a pinion 3 meshing into a spur gear 4 keyed on the shaft I, the gears forming a well known speed reducing train. On the shaft of the spur gear 2 is a cone pulley 5, from which a belt 6 runs to the cone pulley G on the feed screw. The cone pulley G is hollow, and contains a train of differential gearing g, g', g^2, g^3 to reduce the speed of the feed screw, while gear g^3 is loose thereon. A sliding bolt G′ locks the gear g^3 when the screw is feeding. By withdrawing the bolt, the screw is left free to be turned directly and quickly by means of a handle G^2. The shaft I extends through the entire length of the frame B, and imparts motion to the cutters, preferably in the manner hereinafter described. On the carriage C is a tubular bearing encircling the shaft, and having sleeved within it the hub of a bevel pinion K, splined on the shaft I, so as to be revolved thereby, but free to move with the carriage. By means of the bevel gear K′, pinion k and spur gear k', motion is imparted to the hollow shaft L, to the end of which is fastened, as by the screw threads l, the head M carrying the cutters m. The cutters are arranged in a circle inclining outwardly, as shown. One or two are set to work a little behind or out of line with the others to give a finishing cut. The shaft has a collar l' which rests upon the inner end of a sleeve N axially movable, as by the screw bolt n, in a bearing in the carriage. The screw is rotatably held in a bearing in the lug c^4, a collar n' preventing it from backing out. Its threaded portion enters a tapped hole in an ear on the sleeve N, said ear projecting through a slot in the bearing. This screw n adjusts the depth of cut of the cutter m. A bolt c^5 enables the side of said slot to be drawn together, thereby clamping the sleeve N in its bearing when adjusted. On the head M is a collar m' of hardened steel, to form a bearing for the balls O, confined in a groove in the nut P, which turns on a threaded neck n^2 on the sleeve N. By running down the nut, the collar l' is given a firm bearing on the upper end of the sleeve, and all play is taken up. A lock nut P′, secures the nut P when adjusted.

The key-seat cutter Q is carried on the end of a spindle R, which rotates in brass bushings r in the hollow shaft L. The inner end of the spindle carries a pinion R′ which is driven by a series of spur gear teeth k^2 cut on the periphery of the bevel gear K′. The relative diameters of the gears k'', R′ are such that the spindle rotates about twice as fast as the cutter head, whereby the small cutter Q is enabled to keep up with the large circle of cutters m.

The mechanism for adjusting the cut of the key-way cutter is shown in Figs. 4 and 6. It consists of a bushing S, sleeved upon the spindle R and held between a collar r' and the nuts r^2 on said spindle. In one side of the bushing is formed a vertical groove, to receive a block S′, the outer edge of which is a half nut, to mesh with an adjusting or feed screw T, fitted into a groove adjacent to the block S. A spring bolt U engages with notches in the head of the screw to prevent it from turning accidentally. The pinion R′ is splined on the spindle, so that the axial movement thereof by the feed screw T does not throw the pinion out of mesh with the gear k^2.

The operation of the machine is as follows: The field castings are fitted and bolted together, and the standards bolted in place. The milling machine is then mounted by its trunnions in the shaft bearings in the standards. An index plate V is fastened on one of the trunnions, and a fixed point on the castings is established from which to set the plate. Having found the proper position for the milling machine, it is firmly braced by suitable means, such as the extensible struts W, and the revolving cutter head is fed over one of the pole faces, the key-way being simultaneously cut by the cutter Q. When one face has been finished the milling machine is turned through the proper angle as shown by the index plate, and another pole face is operated upon. When dressing off the lower pole faces a^3, a^4, the feed screw is placed in the channel d or d' farthest from the standard A^2. In Fig. 1, the machine is at work on face a', having finished a^3 and a^4; a^2 being yet in the rough.

The machine can be readily inspected, whether at work or not, through suitable openings b^3 in the side of the frame.

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

1. A machine for milling the pole faces of dynamo electric machines, consisting of a frame having trunnions adapted to be mounted in the shaft bearings of the dynamo electric machine, a cutter head having main and key-way, cutters carried by said frame, and means adapted to rotate and feed said cutters in a plane parallel to the axis of the shaft-bearings, substantially as described.

2. The combination with a suitable frame, of a main shaft journaled therein and adapted to be mounted in the standards of a dynamo electric machine, a carriage sliding in the frame, a spindle mounted in the carriage and carrying a key-way cutter, a hollow shaft concentric with the spindle and carrying a cutter head, and connections whereby the spindle and hollow shaft are driven by the main shaft, substantially as set forth.

3. In a milling machine, a tool carriage hav-

ing a slotted bearing, a sleeve held in said bearing and having an arm projecting through said slot, a screw engaging said arm for moving said sleeve axially, a shaft rotating in said sleeve and having a bearing against the ends thereof, and a cutter head secured to said shaft, substantially as described.

4. In a milling machine, the combination with a hollow shaft carrying a cutter head, of a spindle rotatable in said shaft, and carrying a key-way cutter, means for adjusting the spindle axially in the hollow shaft, and means for rotating the spindle and shaft independently, substantially as set forth.

5. In a milling machine, the combination with a hollow shaft carrying a cutter head, of a spindle rotatable in said shaft and carrying a key-way cutter, a bushing sleeved on the spindle and carrying a half nut, and a screw mounted in the hollow shaft and engaging with said half nut, whereby the spindle can be axially adjusted in the hollow shaft, substantially as described.

In witness whereof I have hereto set my hand this 23d day of August, 1892.

JOHN RIDDELL.

Witnesses:
JOHN W. GIBBONEY,
BENJAMIN B. HULL.