No. 625,826. Patented May 30, 1899.

H. W. BUCK.

DEVICE FOR IMPARTING END PLAY TO SHAFTS.

(Application filed Mar. 12, 1898.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

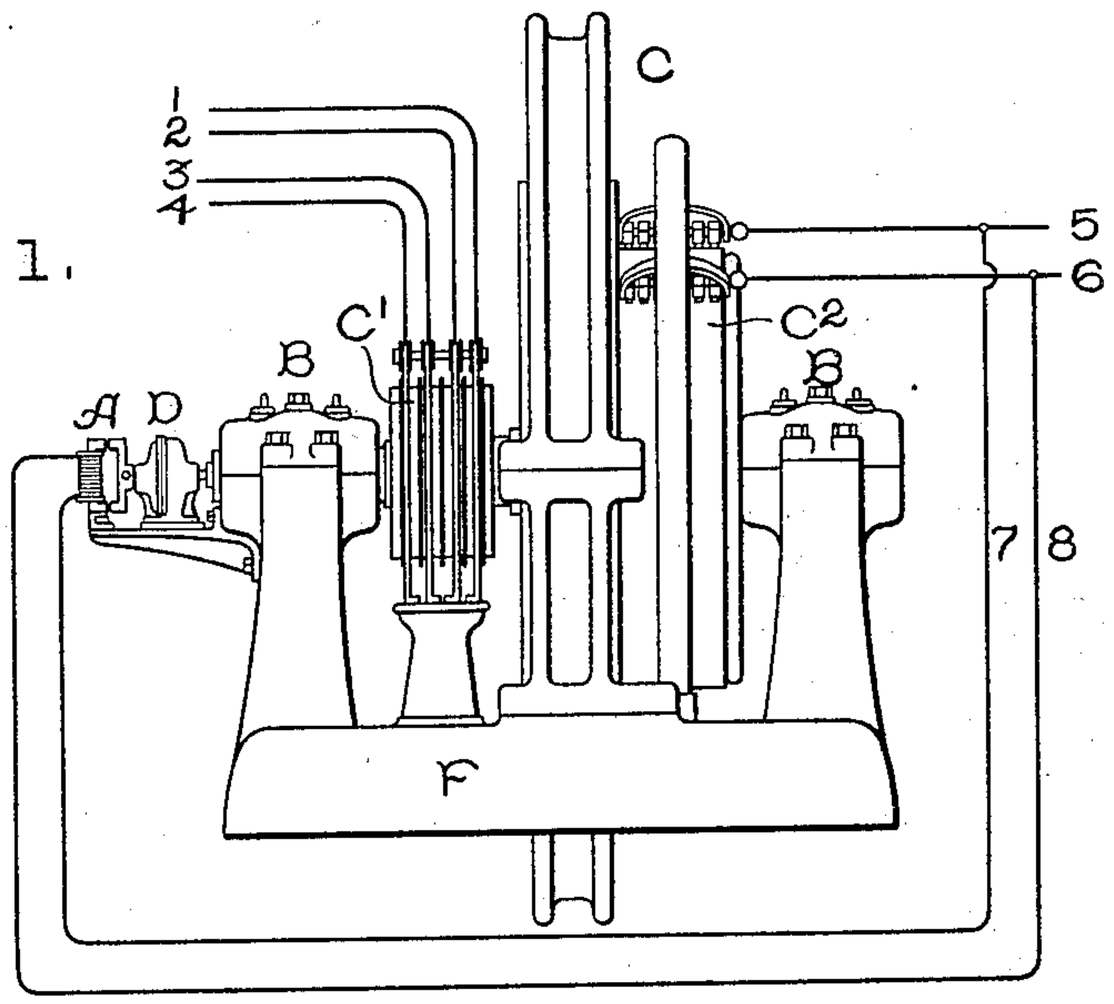


FIG. 2.

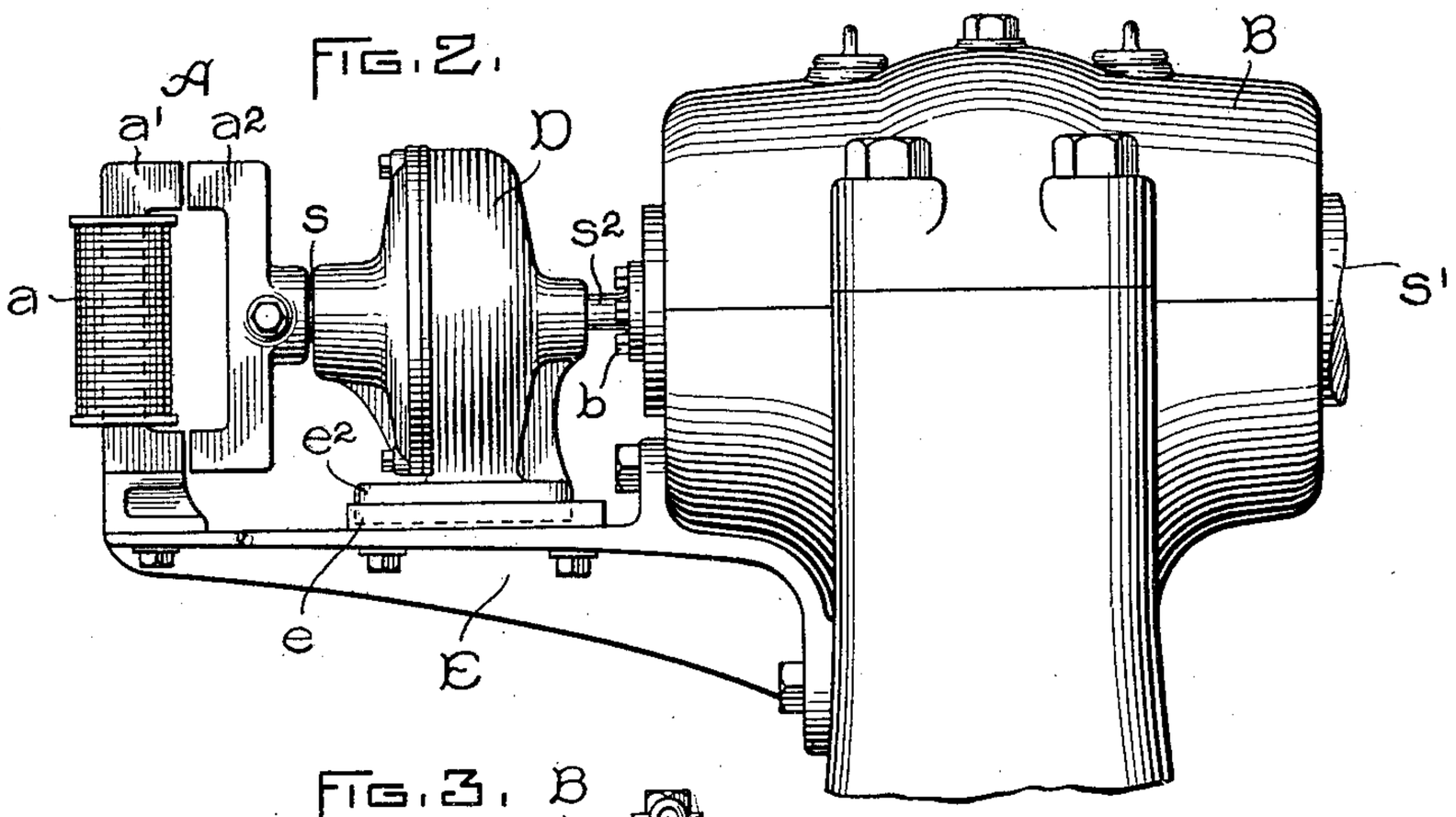
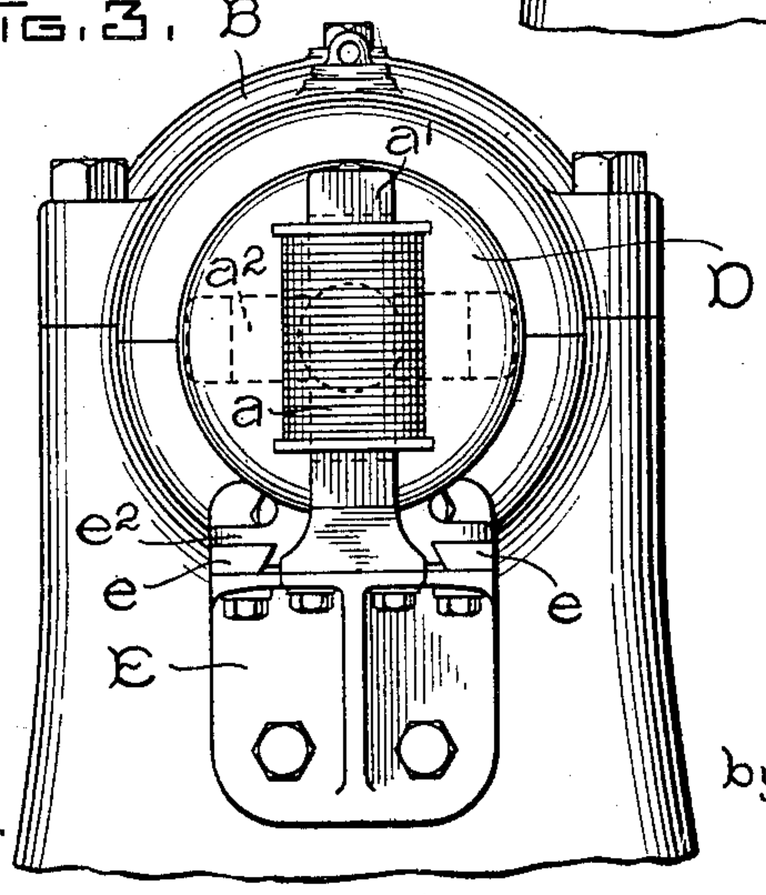


FIG. 3.



WITNESSES:
A. H. Abell.
A. F. Macdonald.

INVENTOR:
Harold W. Buck,
by Albert G. Davis
Atty.

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FIG. 4.

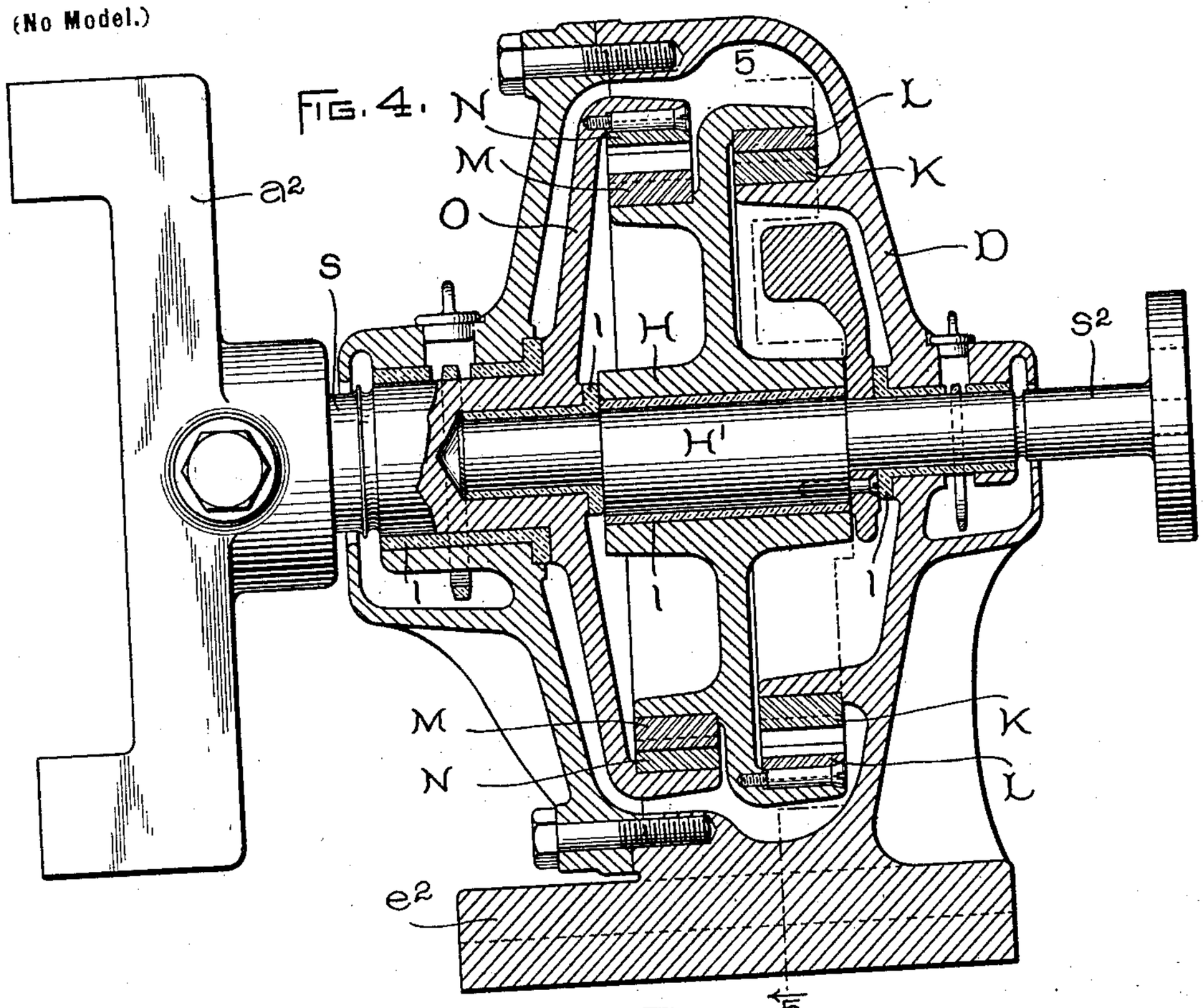
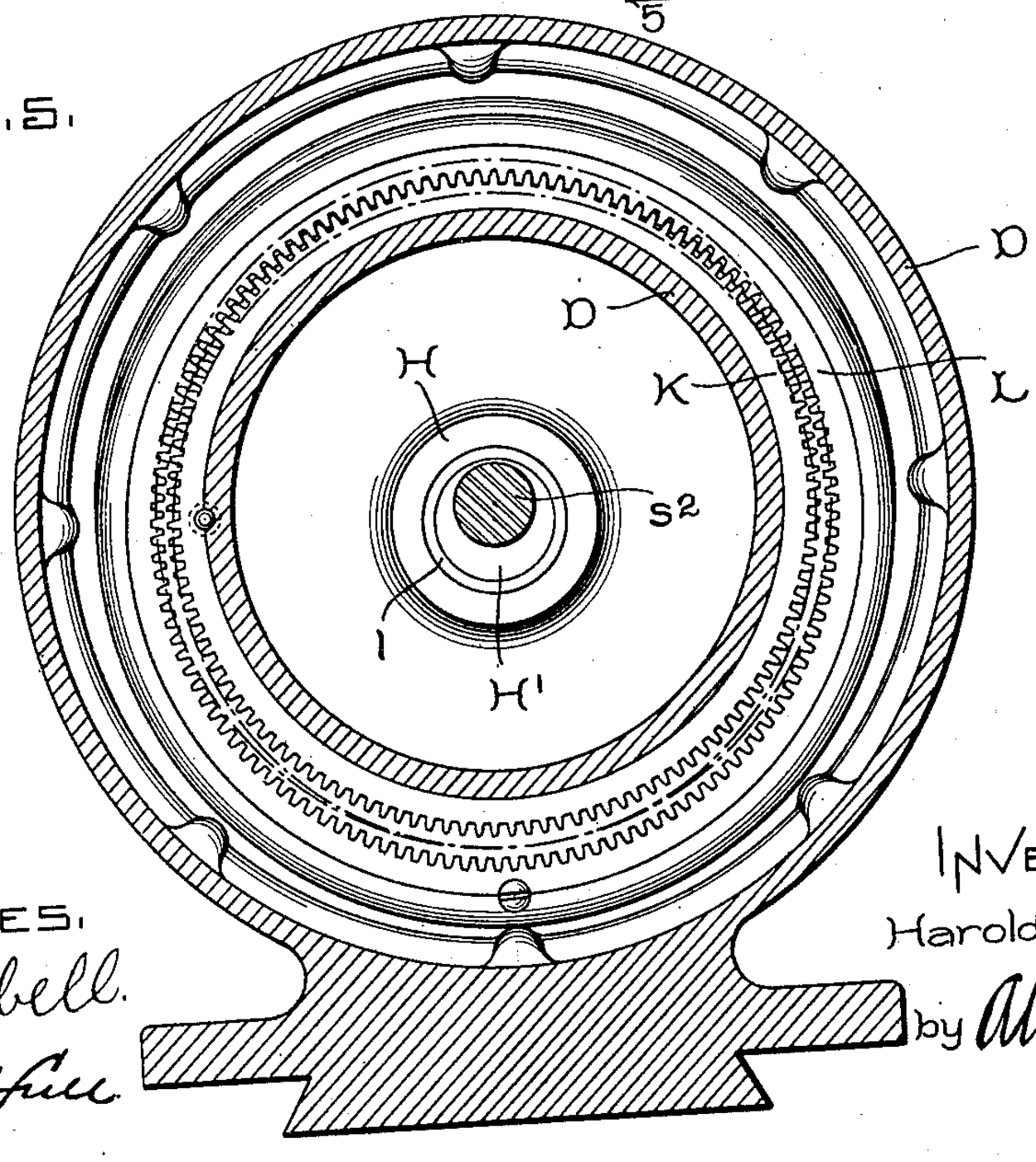


FIG. 5.



WITNESSES:
A. H. Abell.
B. B. Hill.

INVENTOR:
Harold W. Buck,
by Albert G. Davis.
Atty.

UNITED STATES PATENT OFFICE.

HAROLD W. BUCK, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

DEVICE FOR IMPARTING END PLAY TO SHAFTS.

SPECIFICATION forming part of Letters Patent No. 625,826, dated May 30, 1899.

Application filed March 12, 1898. Serial No. 673,669. (No model.)

To all whom it may concern:

Be it known that I, HAROLD W. BUCK, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Devices for Imparting End Play to Shafts, (Case No. 626,) of which the following is a specification.

My invention has for its object to provide a simple and efficient device for causing end play in shafts in cases in which it may be desirable—such, for instance, as in dynamo-electric machines. In apparatus of this class there is a tendency to a fixed position of the armature in the magnetic field. This tendency is counteracted in belt-driven machines by the variations in tension of the belt and by its shifting from one side to another of the driving-pulley, so that the armature has a corresponding end play sufficient to prevent the brushes wearing grooves in the face of the commutator or collector. In other types of machine, however, such as some forms of direct-connected dynamos, and more particularly in rotary converters or in rotary transformers, there is no such tendency. In the latter cases the rotation of the armature in a fixed plane is particularly marked, as it is electrically driven, and there are, comparatively speaking, no variations in the driving power. I have illustrated this type of machine in the drawings annexed to this description, though nothing herein is to be taken as limiting the invention to any particular machine.

To obviate the difficulty pointed out, it has been proposed to apply a magnet to the end of the shaft and to convey a periodic impulse of current to the coils of the magnet, so that from time to time the shaft will be reciprocated in its bearings. This has not proved as efficient as desired, one of the difficulties to be overcome being hysteresis in the electromagnet. The arrangement which I have devised differs from this in that instead of interrupting the electric circuit it varies the magnetic circuit of a small device attached to the shaft either directly or through interposed gearing. The gearing may be so adjusted as to give the desired impulse during any part of the rotation and is preferably so arranged that this impulse will not come at the same point in the various armature revolutions in which it occurs. I thus avoid another evil of the types of device already referred to, which in some cases have been known to cut a spiral groove or "thread" on the face of the commutator.

My improved device in its simplest form consists of an electromagnet with a correspondingly-shaped rotating armature attached to the end of the shaft. The electromagnet is of an open horseshoe form, and the armature is of substantially the same form. As the shaft rotates the magnetic circuit of the armature and magnet will be varied. As the two are in line a strong pull will be imparted to the shaft, weakening as they are thrown out of line, until at right angles there is no induction. A good form of gear for my purpose is the well-known differential gear, inasmuch as this may be attached directly to the armature-shaft; but any other form might be employed, if desired.

The accompanying drawings show an embodiment of my invention, Figure 1 being a side elevation of a rotary converter with the device applied to it. Fig. 2 is an enlarged side elevation of the device itself. Fig. 3 is an end elevation of the parts shown in Fig. 2. Figs. 4 and 5 are views of the gears.

In Fig. 1, C is the converter, provided with collector-rings C′, by which two-phase currents enter or leave the machine by the leads 1 to 4. C^2 is the commutator, by which continuous current enters or leaves the machine over the mains 5 6. F is the base of the machine, and B B are the bearings. A is the electromagnetic device to which I have referred, and D is the gear. The magnet is preferably supplied with current from the continuous side of the system by the leads 7 8 as long as the machine is in operation.

In Fig. 2, B is one of the bearings of the machine. S′ is the shaft of the converter. *s* is the shaft of the differential gear, to which is attached the armature a^2 of the device for imparting end play. The other shaft s^2 of the differential gear is attached to the shaft of the converter by any convenient means, as by the bolts *b*. A bracket E supports the entire device. At *a* is the coil of the electromagnet,

a' being the core. As shown in Fig. 2, the core and armature form, substantially, a rectangle the magnet-circuit of which is nearly closed, and in this position there is a strong pull on the shaft S′, tending to draw the shaft and the armature toward the electromagnet.

In Fig. 3 the parts are shown in another position. In this case the armature a^2 is shown in dotted lines at a right angle to its position as illustrated in Fig. 2. Thus there is practically no pull upon the shaft, and the armature of the dynamo then tends to return to its central position.

Figs. 4 and 5 show in enlarged detail differential gears suitable for the purposes of my invention. Fig. 5 is a section on the line 5 5 of Fig. 4, looking to the left. The construction is best shown in Fig. 4. In this the shaft s^2 has an eccentric portion H′. Over this is the hub H of a spider carrying an internal gear L and an external gear M. The internal gear L meshes with a fixed gear K, which is carried by the case D and is concentric with the shaft s^2. A spider O, fixed to the shaft s, carries another internal gear, the shafts s and s^2 being concentric and the spider which carries the internal gear N being also concentric with the shaft. Suitable bushings or linings l are provided wherever the parts slide upon one another. The whole case D slides in ways e upon the bracket E, the base e^2 being shaped to adjust it to the ways. It will be seen in Fig. 5 that the gears have different numbers of teeth, and the action of the parts as thus described is as follows: As the shaft s^2 rotates its eccentric portion moves the internal gear L, which is upon the eccentric, and as this meshes with the gear K the effect of this is, as will be perceived, to advance the gear K by a distance equal to the difference between the numbers of teeth in the two gears. At the same time the gear M is rotated, it being formed integral with the gear L, and the number of teeth in this differs from the number in the internal gear N, so that the spider O will be rotated by a distance equal to the sum of the differences of the two sets of gears L K and M N. Thus the armature a^2 is rotated at considerably less speed than the shaft s^7. The particular type of differential gear here illustrated is not of my invention, being shown and described in the patent to Regan, No. 546,249, dated September 10, 1895, for a power-transmitter, and it being immaterial what particular form of gear is used or what relation of speed is effected by the form selected.

As already stated, I prefer an asynchronous relation of the gearing between the armature and shaft or such relation that the various end thrusts or pulls will occur at different points in the revolution. For example, in a machine rotating five times per second, or once every .2 of a second, I may cause the end thrust to occur every .201 seconds, which may easily be attained by a suitable selection of gears.

The electromagnet might, as will be manifest, be attached to the shaft and the armature be made stationary without affecting my invention; but as this would necessitate sliding connections it is not the preferred construction, the one illustrated being better. A permanent magnet might be substituted; but an electromagnet is in general less bulky and less expensive. Other arrangements are obvious in which a variation in a magnetic circuit causes the end play, and I consider all such within the scope of my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A device for imparting end play to the shafts of dynamo-electric machinery, consisting of a magnet and its armature, one being stationary and the other attached to the shaft, so that the rotation of the latter changes the magnetic circuit of the device from time to time, thus imparting a periodical impulse to the shaft.

2. A device for imparting end play to the shaft of a dynamo-electric machine, consisting of a source of magnetomotive force, means for varying its magnetic circuit as the shaft rotates, and means whereby such variation longitudinally shifts the shaft.

3. A device for imparting end play to shafts, consisting of an electromagnet and its armature, the two forming substantially a closed magnetic circuit in one position, and being substantially out of inductive influence in another position, means for rotating one of the parts so that the magnetic circuit is varied, and means for attaching one of the parts to the shaft.

4. A device of the kind described, consisting of a constantly-energized electromagnet and its armature, the core and armature forming substantially a closed circuit, with means for attaching one of the parts to a shaft so that the rotation of the latter alternately opens and closes the magnetic circuit.

5. A device of the kind described, consisting of a magnet and its armature, with means for connecting one of the parts to a shaft, and gearing between the connected part and the shaft, the relation being such that the shaft will open and close the magnetic circuit of the device asynchronously with its own rotation.

6. The combination of a rotating shaft, a differential gear, an armature rotated by the shaft through the differential gear, and a constantly-energized electromagnet coöperating with the armature.

7. The combination of a rotary converter receiving or delivering alternating currents on the one side and continuous currents on the other, with a device for imparting end play to the shaft of the converter, consisting of an electromagnet constantly energized from the continuous-current mains, and an armature for the electromagnet, so connected to the shaft that the rotation of the latter acts to alternately open and close the magnetic

circuit of the device, and thus impart periodic impulses to the shaft of the converter.

8. A device for imparting end play to a shaft, consisting of two magnetically-attracted bodies relatively movable with respect to each other and one of which is rotated responsively to rotation of the shaft, and means for periodically varying the attraction between said bodies without altering the magnetomotive force which causes the attraction.

In witness whereof I have hereunto set my hand this 2d day of March, 1898.

HAROLD W. BUCK.

Witnesses:
B. B. HULL,
C. L. HAYNES.