A. A. PIFER.

DYNAMO ELECTRIC MACHINE.

APPLICATION FILED APR. 1, 1909.

932,897.

Patented Aug. 31, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

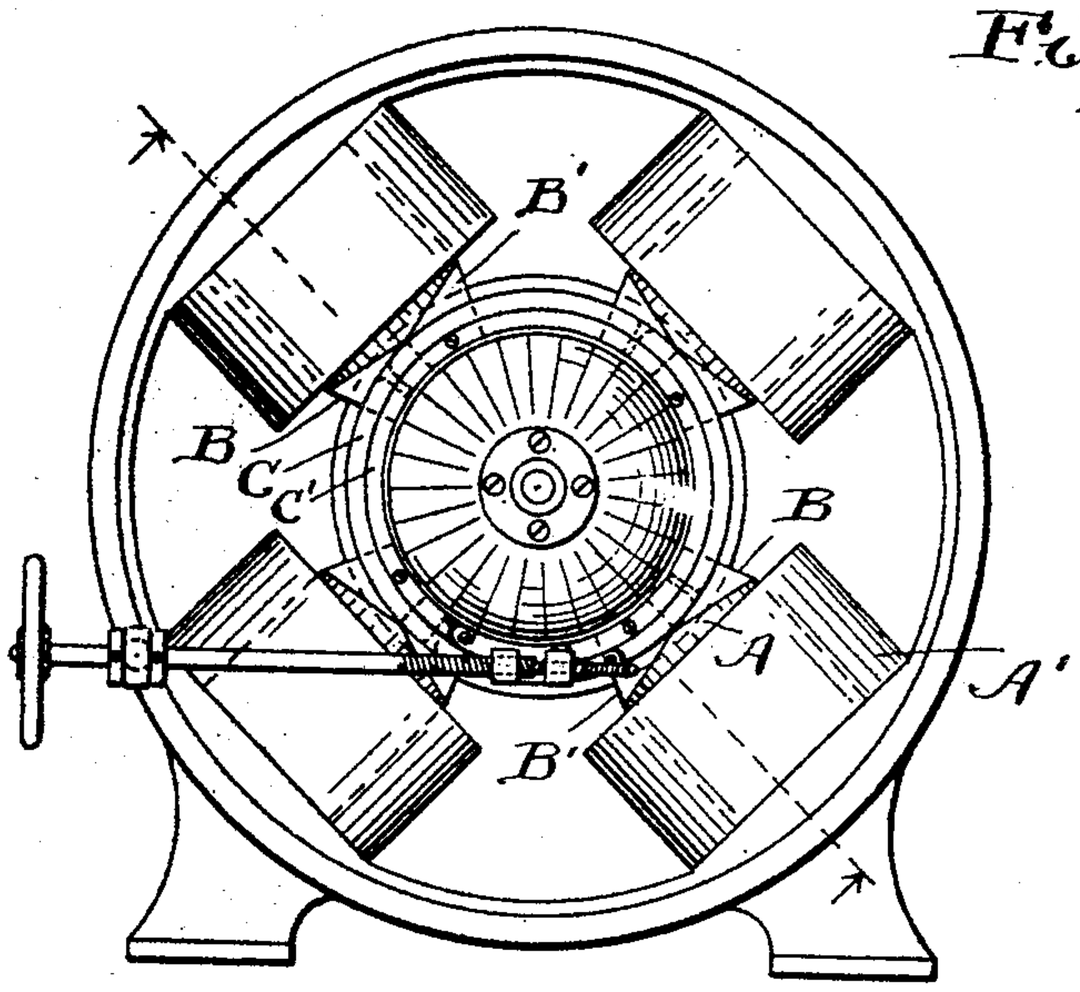
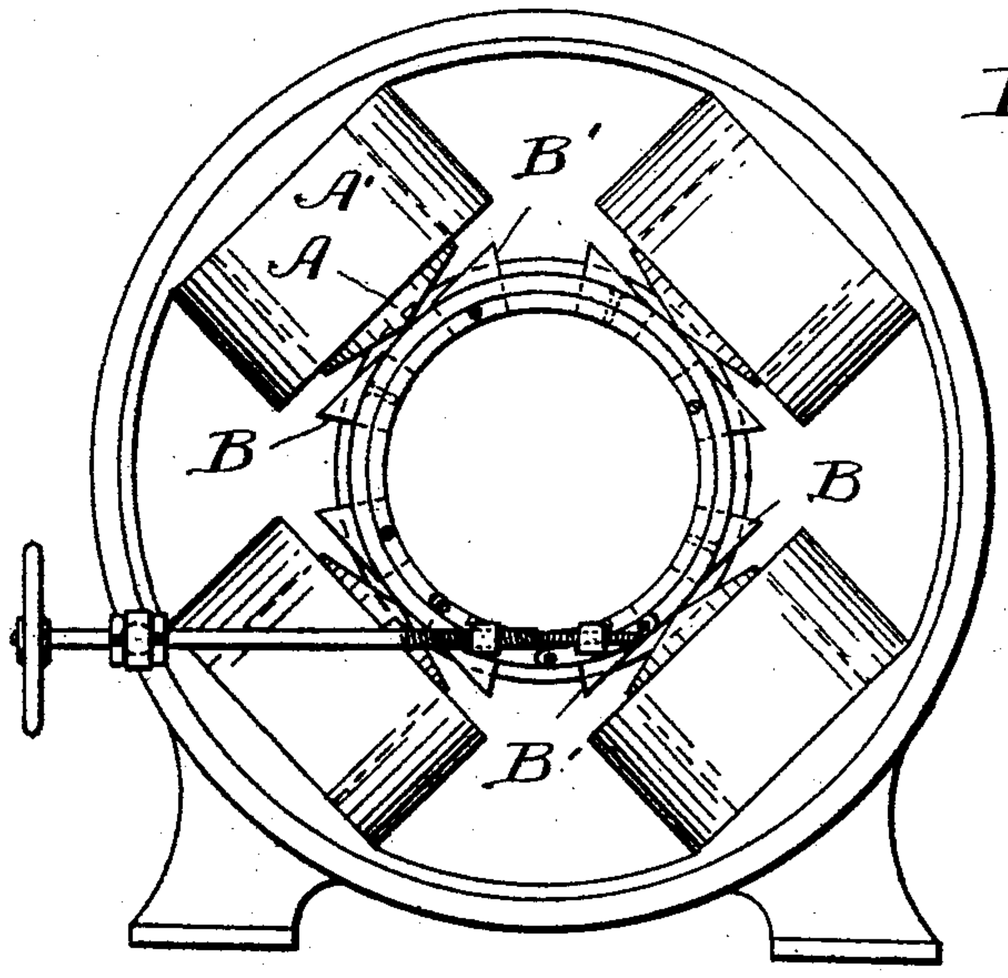


Fig. 2.



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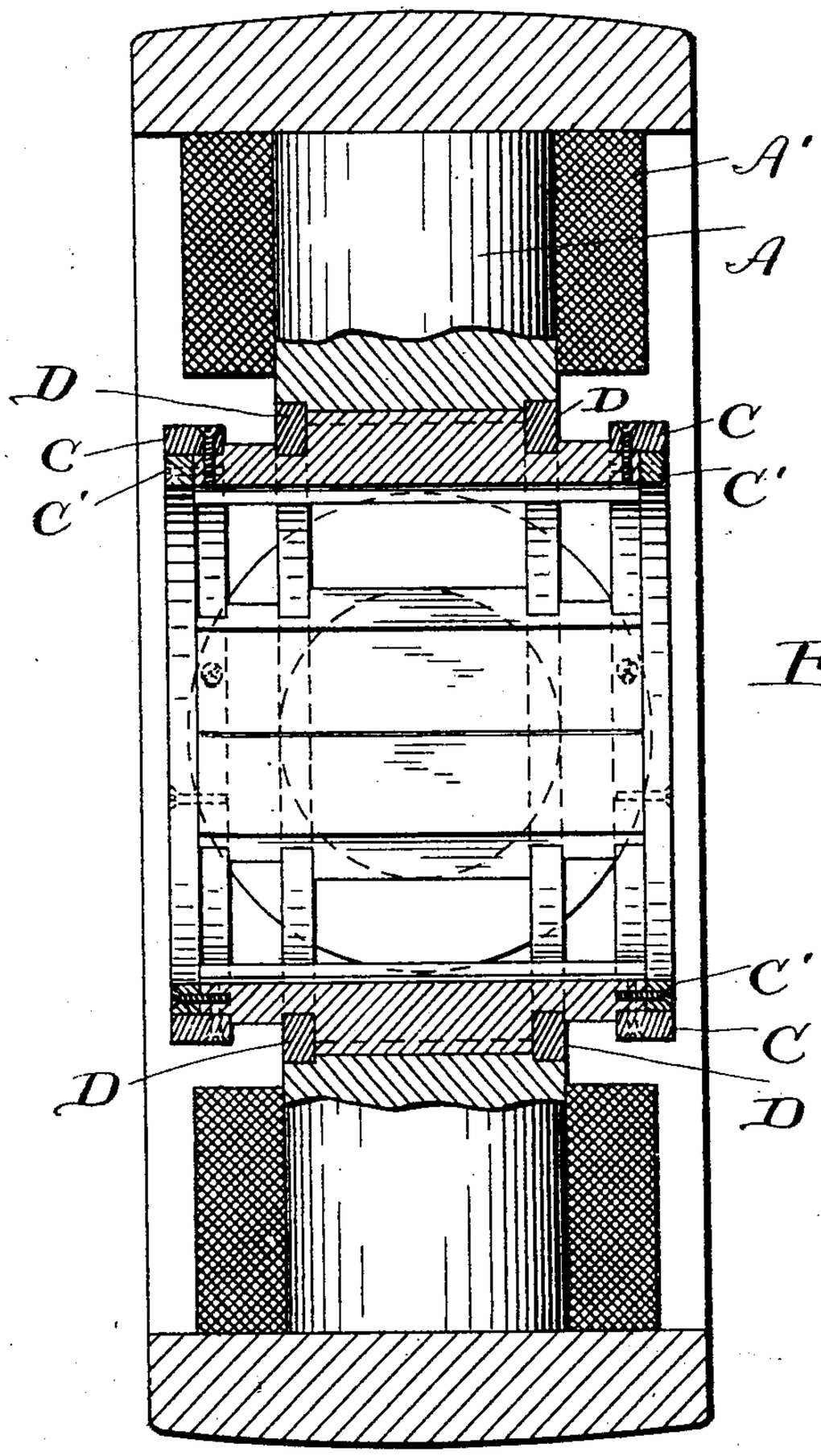
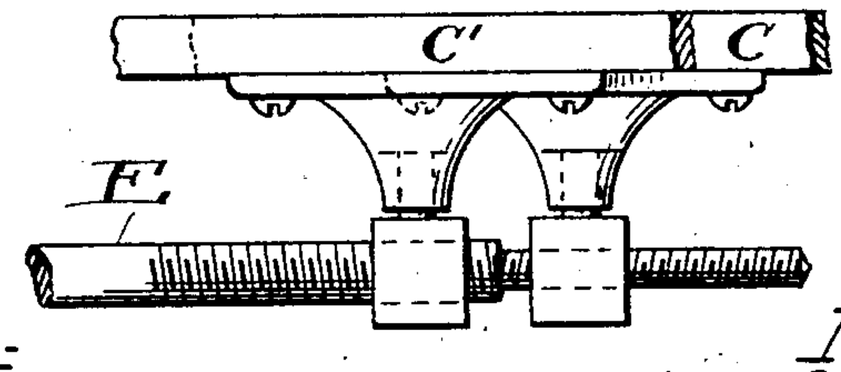


Fig. 3.

Fig. 4.



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UNITED STATES PATENT OFFICE.

ALVIN A. PIFER, OF CLEVELAND, OHIO, ASSIGNOR TO THE CLEVELAND ARMATURE WORKS, OF CLEVELAND, OHIO, A PARTNERSHIP.

DYNAMO-ELECTRIC MACHINE.

932,897. Specification of Letters Patent. Patented Aug. 31, 1909.

Application filed April 1, 1909. Serial No. 487,161.

To all whom it may concern:

Be it known that I, ALVIN A. PIFER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Dynamo-Electric Machines, of which the following is a full, clear, and exact description.

This invention relates to dynamo electric machines and has for its object the provision of means whereby the speed of the machine may be regulated as desired. The regulation of the speed of dynamo electric machines is accomplished in several different ways to which it is not here necessary to refer in detail. I have myself previously devised jointly with C. E. F. Ahlm means whereby such regulation may be had in an efficient manner, the apparatus being the subject of the United States Patent No. 900,420. The present structure involves some other generic principles disclosed in that application but also comprising certain distinctive features, the object of which is to give the machine a greater range of variation so that with motors of the ordinary commercial type a ratio of change in speed may be had such as the daily use of the machines require.

A further object of the characteristic features of the present mechanism is to increase the efficiency of the regulating apparatus, whereby danger of sparking shall be entirely eliminated.

The above objects and other desirable advantages, it will be seen, will be attained in that embodiment of my invention described in the following specification with reference to the accompanying drawings, in which:

Figure 1 is an end elevation of a four pole motor equipped with my novel regulating mechanism. Fig. 2 is a similar elevation with the armature of the motor removed, the regulating mechanism being shown in a position different from that of Fig. 1. Fig. 3 is a transverse section through the motor frame illustrating the relation of the regulating pole shoes to the rest of the apparatus, the armature being removed. Fig. 4 is an enlarged detail plan of the connection between the operating shaft and the rings by which the pole shoe sections are moved.

The mechanism here shown is like that of the patent referred to, designed to maintain the "neutral line" or theoretical diameter of commutation in a fixed position in the magnetic field, this position being substantially midway between adjacent pole pieces. The general principles upon which the mechanism operates were fully discussed in that patent and no further reference need be made to the distinctions between the generic features of the structure and the prior art.

In the form of machine illustrated the frame of the motor supports the four pole pieces A, each having its coil A′ of the usual construction. At the inner extremity of each pole piece connected to the armature are provided two pole shoe sections B B′ which are secured to rotatable diamagnetic rings C C′, there being two rings at each side of the machine. It will be noted that there are, additionally, two locking rings D D, one on each side of the pole pieces, fitted into shouldered bearings in the pole pieces, the pole shoe sections being grooved on their exterior surfaces so that the grooves C^2 may embrace the locking rings, and the pole shoe sections extend up between said rings into contact with the lower face of the pole. By this construction it will be seen that, when the parts are assembled and the pole shoe sections secured at each end to their respective operating rings, accidental dislodgment of the parts is not possible. Each alternate shoe section is secured to the same ring, and each ring on one side of the machine is connected by a swivel nut with an operating shaft having a pair of oppositely directed screw threads thereon. By this arrangement it will be seen that the operating rings may be moved in opposite directions through the medium of the single shaft E, thus causing the two sections of each pole shoe to move away from the pole piece simultaneously and to the same angular extent, but in opposite directions. As this movement on the part of the pole shoes takes place, the magnetic flux will be shunted so as to decrease the number of lines of force passing through the armature, and an air gap will be formed at the center between the two shoe sections, which will have the effect of shunting the lines of force somewhat and increasing the magnetic reluctance and thus cause a weakening of the magnetic field. It will be observed, however, that I construct the lower ends of the pole pieces so that the line of contact between each section and its pole piece shall not follow a curve concen-

tric with the armature, as in the case of the former patent, but shall, starting near the inner end of the zone of contact, extend outward or farther away from the center of the armature. Preferably, I construct the pole piece as shown in the drawing in which this contacting surface of the pole piece is in a plane making an acute angle with the tangent of the circle of movement of the outer rear corner of the pole shoe section. By this construction I am enabled to effect a very rapid increase in the air gap between the shoe sections and the pole piece, which, in addition to the air gap between the pole pieces themselves, is sufficient to make a very rapid change in the magnetic field, and consequently in the speed of the dynamo. This is a very important factor in the practical operation of the regulator, since it is desirable that most motors, such as are commonly used in machine shops, shall have a variation of from 1 to $3\frac{1}{2}$ or 4 in the matter of speed. Heretofore this has been a difficult ratio to achieve with efficiency. I have found, however, that with the contacting surfaces between the shoe sections and the pole piece inclined from the middle of the pole piece outwardly away from the center of the armature that the desired increase in speed may be easily attained within the limits of movement imposed upon the shoe sections by ordinary dynamo electric construction. In fact, I have found that it is possible by this means to cause a variation in speed of from 1 to 5, though the higher speeds are achieved with less efficiency than the lower speeds.

As a further improvement in the matter of permitting pole shoe sections to have a greater amount of movement away from each other, I have tapered the forward surface B^3 of the shoes inwardly, substantially along the lines of the radii drawn from the center of the armature and extended to the outer forward corner of each shoe. By this construction it will be seen that there are no forward projections which may come in contact with similar projections on the adjacent pole shoe, and thus interfere with the more extended movement of the shoe sections which occur at the higher speeds.

The apparatus above described, it will be seen, has attained the objects of invention sought, whereby the strength of the magnetic field may be regulated with any desired fineness and without loss of energy, while, at the same time, permitting the speed to be varied at an increased ratio within those limits of angular movement imposed upon the pole shoe sections by the ordinary construction.

Having thus described my invention, I claim:

1. A dynamo electric machine comprising a plurality of poles each having two separate pole shoe sections adapted to be moved toward and from each other circumferentially about the armature, each pole shoe section having a surface contact with the pole piece when at its rearward limit of movement, the forward edge of the contacting surface lying outside the circle concentric with the armature and cutting the rear edge of said surface.

2. A dynamo electric machine comprising a plurality of poles each having two separate pole shoe sections adapted to be moved toward and from each other circumferentially about the armature, each of said sections contacting with the end of the pole piece when at the rear end of their path of movement, the contacting surface of the pole shoe making an acute exterior angle with a radius extended from the center of the armature through the rear edge of said surface.

3. A dynamo electric machine comprising a plurality of poles each having two separate pole shoe sections adapted to be moved toward and from each other circumferentially about the armature, the forward surface of each shoe section being tapered inward so as to coincide substantially with an extension of a radius drawn from the center of the armature.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

ALVIN A. PIFER.

Witnesses:
H. R. SULLIVAN,
J. M. WOODWARD.