No. 678,646. Patented July 16, 1901.

E. DANIELSON.

ROTOR FOR ALTERNATING CURRENT GENERATORS.

(Application filed Oct. 12, 1900.)

(No Model.)

Fig. 2.

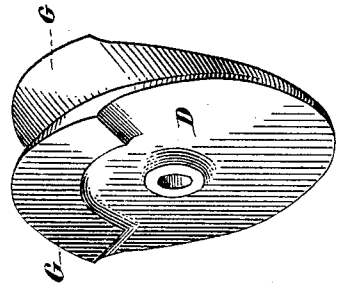
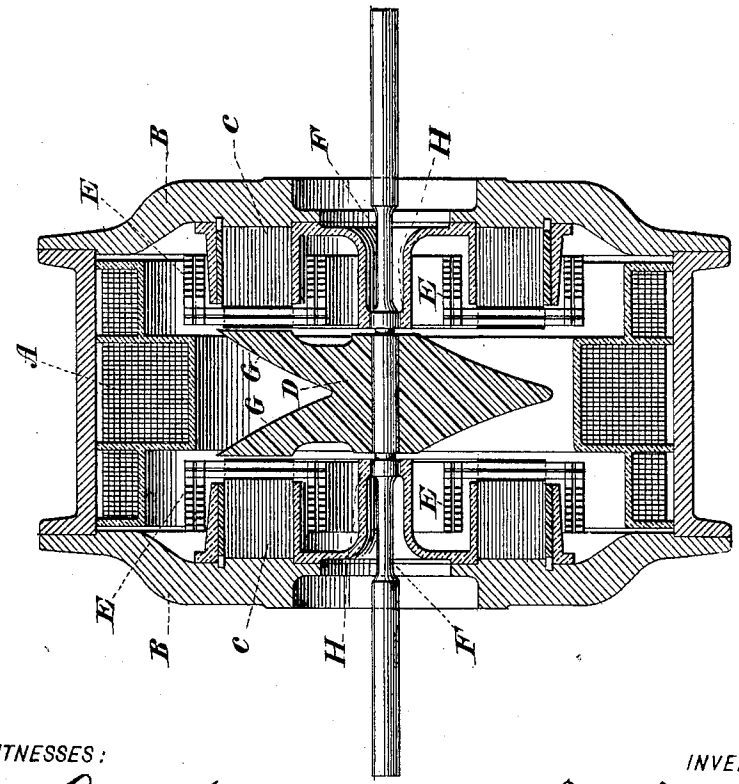


Fig. 1.



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ROTOR FOR ALTERNATING-CURRENT GENERATORS.

SPECIFICATION forming part of Letters Patent No. 678,646, dated July 16, 1901.

Application filed October 12, 1900. Serial No. 32,809. (No model.)

To all whom it may concern:

Be it known that I, ERNST DANIELSON, a subject of the King of Sweden and Norway, residing at Stockholm, Sweden, have invented a new and useful Improvement in Rotors for Alternating-Current Generators, of which the following is a specification.

The object of my invention is to construct a rotor so as to stand higher speeds of revolution than has hitherto been practicable in machines of this class.

My invention consists in a rotor in disk form, wherein the thickness of the metal increases from the periphery of the disk toward the center and reaches its maximum at the portion of the disk immediately surrounding the supporting-shaft, in the novel construction of the disk thus proportioned, so that its polar projections are provided with vertical faces which may be brought into close inductive proximity through the fixed magnetic field of the machine, and also in the combination with such a proportioned disk of a flexible supporting-shaft.

In the accompanying drawings, Figure 1 is a vertical section through a dynamo-electric machine of well-known type containing my improved rotor. Fig. 2 is a perspective view of the rotor itself detached from its shaft.

It is well known that several types of generators for alternating currents have been designed in which there have been no rotating windings whatever. One of the principal reasons why these types have been employed is the greater mechanical strength which can be given to an inductor-wheel altogether of iron as compared with one which is built up of iron cores surrounded with copper windings. Accordingly these types have been mostly advantageous in such cases where it is necessary to work the machines at high speed. Such a case is in a prominent degree steam-turbine apparatus. In regular electrical and mechanical practice it is customary to work with peripheral speeds not much exceeding forty to fifty meters per second, whereas in steam-turbine practice the corresponding speeds may be as high as four hundred meters per second. It is evident that under these circumstances the strain to which the material is exposed is enormous. Only the very strongest steel could be used for the purpose. Moreover, it has been necessary to invent such geometrical forms of disks which can stand the greatest possible peripheral speeds. Calculations show that the thickness of the disk must increase from the periphery to the center in order that the strains may be equal in every part of a rotating disk.

I will now describe the form of disk which is shown in cross-section in Fig. 1 and in perspective in Fig. 2 of the accompanying drawings. With this shape of rotor I have found it possible to run with safety up to peripheral speeds of four hundred meters per second. A indicates the magnetizing-spools of the generator. B is the frame. At C are shown laminations. D is the rotor, E the armature-winding, and F the shaft on which the rotor is mounted, said shaft being supported in bearings H, which may be formed, as shown, on the frame of the machine. Considering the lower portion of the cross-section of the rotor shown in Fig. 1 it will be seen that this is in substantially the form of a triangle, the thickness of the metal decreasing from center to periphery. On the opposite side of the shaft it will be seen that the cross-section has materially changed and that there appear to be two arms, as G G, the vertical faces of which are brought into close proximity to the field-poles. These arms G G are of course the polar projections. It will be observed, however, that in Fig. 1 the cross-section of the space between the arms G G is tapering from periphery toward the center of the disk. The result of this construction, so far as the actual thickness of the metal is concerned, is substantially the same as if this portion of the disk were solid and of triangular cross-section, as shown, below the shaft in Fig. 1. This can better be realized by imagining the arms G G as closed together, so that the sides of the V between them come into contact. The result is that although the vertical faces of the polar projections are in proper position to have the nearest inductive proximity to the magnets, nevertheless the weight of metal acting at the periphery of the disk is not that which it would be if the space between the arms G G were completely filled up and solid, but a quantity which is precisely the same as that which acts at the periphery

of the opposite side of the disk. Therefore, because in this construction the net thickness of the metal thus increases from periphery to center, the disk can be given a great peripheral speed, which may be directly imparted to it by coupling the shaft F to a rapidly-running steam-turbine. The space between the vertical faces of the arms G and the field-poles serves as an air-gap, and the opposite projections G have the further advantage of neutralizing the magnetic pull on the rotor.

In operation the lines of force due to the magnetic flow set up by the magnetizing-spool A passes through the frame B, through the laminations C, and thence into the rotor at projections G, which pass close to the laminations. When the rotor revolves, the lines of force accompany it, thus making a revolving field which induces alternating current in the usual manner in the windings of the machine.

The shaft F is preferably to be made flexible, substantially as set forth in United States Patent No. 431,750, to C. G. P. De Laval, dated July 8, 1890, the object being to render the rotor self-adjusting and self-balancing, and thus to permit it to be run at the very high rotative speeds before mentioned without excessive wear or undue expenditure of power.

I do not intend herein to claim, broadly, the combination of a rotor with a flexible shaft; but I do claim that a rotor shaped in the manner hereinbefore described—that is to say, with arms, such as G G, separated substantially as set forth, whereby despite the variations in form the weight of the metal around the rim of the rotor is less than at the center—is new in combination with such a flexible shaft. A rotor not proportioned in the manner described may of course be provided with a flexible shaft such as described in the De Laval patent; but although the shaft will be adapted to permit the rotor to run at high speed this will be of practically little avail unless the rotor itself is suitably shaped to that end. It will be seen, therefore, that the essence of my invention in this respect resides in the combination, with a flexible shaft such as is fully described in the De Laval patent aforesaid, of a rotor shaped as hereinbefore set forth, and therefore adapted to coact with such a speed-permitting shaft.

I claim—

1. A rotor for dynamo-electric machines in disk form and of increasing thickness from periphery toward the center, substantially as described.

2. A rotor for dynamo-electric machines in disk form, and of increasing thickness of material from periphery toward the center, and partially split or divided in a plane at right angles to the axis of rotation, substantially as described.

3. A rotor for dynamo-electric machines in disk form and of increasing thickness of material from periphery toward the center and partially split or divided in a plane at right angles to the axis of rotation; the said split or divided portions being separated by a space V-shaped in cross-section, substantially as described.

4. In combination with a dynamo-electric machine a rotor in disk form and of increasing thickness of material from periphery toward the center and partially split or divided in a plane at right angles to the axis of rotation; the said split or divided portions having vertical faces respectively disposed so as to be moved during rotation of said disk in inductive proximity to the field-magnets of said dynamo, substantially as described.

5. The combination with a dynamo-rotor in disk form and of increasing thickness from periphery to center, of fixed bearings and a flexible or yielding shaft supported in said bearings and supporting said rotor, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ERNST DANIELSON.

Witnesses:
WALDEMAR BOMAN,
H. RIDDERSTOLPE.