Oct. 21, 1924. 1,512,221

F. A. HAUGHTON

COMMUTATOR FOR DYNAMO ELECTRIC MACHINES

Filed March 5, 1924

Fig. 1

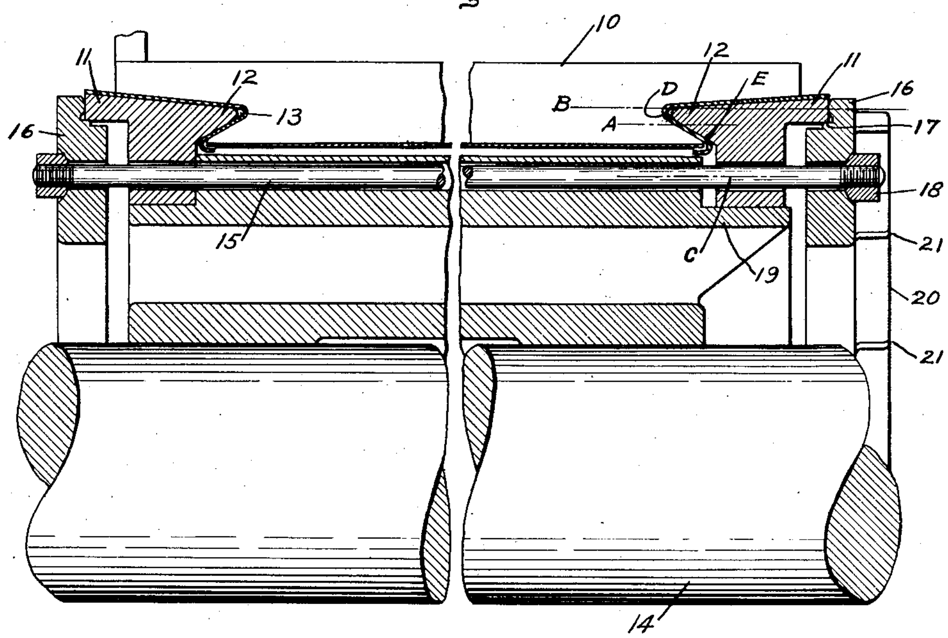
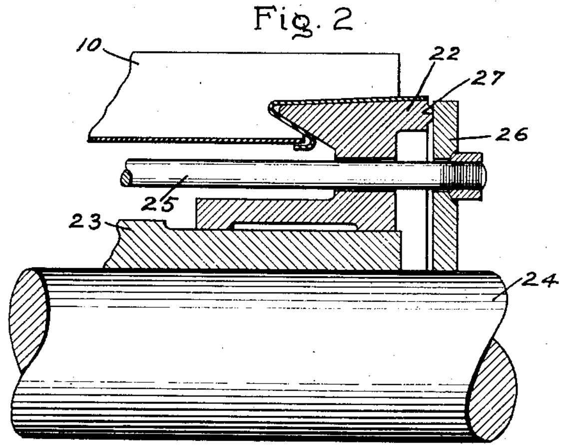


Fig. 2



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UNITED STATES PATENT OFFICE.

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COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES.

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To all whom it may concern:

Be it known that I, FRANK A. HAUGHTON, 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 Commutators for Dynamo-Electric Machines, of which the following is a specification.

My invention relates to commutators for dynamo electric machines.

In the usual form of commutator the segments are held in place by clamping rings having angular projecting flanges which interlock with recesses of corresponding form in the ends of the commutator segments. These clamping rings are firmly drawn together toward the segments by bolts or other suitable means. The clamping pressure thus applied to the segments must be sufficient to hold them truly concentric with the axis of rotation and maintain them permanently in their correct relation to each other under operating conditions.

In practice it is customary to seat the clamping bolts directly on the clamping rings at a point radially removed from the point of its contact with the commutator segments. This type of construction has been extensively used in the past, but is open to the objection that the clamping rings and segments become distorted and the surface of the commutator thereby rendered unsuitable for satisfactory commutating. When such a commutator is in operation the segments become heated to a higher temperature than the other parts of the commutator. This heating causes the segments to expand in a direction parallel to the axis of rotation and collectively in a circumferential direction, both of which increase the pressure against the clamping rings and the strain upon the clamping bolts.

In the manufacture of commutators it is customary to assemble the parts and screw up the clamping bolts firmly so as to resist the centrifugal force of the segments. The cylindrical surface of the commutator is then finished true to the axis of rotation. Commutators built as above have been known to become so heated that the increased strain due to expansion has caused the segments to buckle and often distort the clamping rings, and in some extreme cases the bolts have been known to break. In order to overcome the above objectionable features, I propose to provide means which will permit the free movement of the segments due to expansion, prevent distortion of the clamping rings, and at the same time secure the segments in place.

It has heretofore been proposed to provide resilient means for clamping the segments together. These means however are impractical for large commutators and have therefore not come into extensive use.

In accordance with my invention, I provide a novel, practical and effective means which will permit the commutator segments to expand and contract in response to temperature changes, maintain the commutating surface of the segments concentric with the axis of rotation and in a smooth condition. I accomplish this by providing relatively movable clamping rings, at least one of which is movably mounted on the commutator shell and applying a clamping pressure to said clamping rings through an elastic means such as an annular resilient member, the clamping pressure being applied on the clamping ring at a point substantially in line with the reactive force caused by the expansion of the segment.

For a better understanding of my invention reference may be had to the following description taken in connection with the accompanying drawing in which Fig. 1 is a sectional view of a commutator embodying my invention, and Fig. 2 is a fragmentary view similar to Fig. 1 showing a modification of my invention.

In the drawing I show a commutator built in accordance with my invention having segments 10 which are held in place by clamping rings 11. The clamping rings 11 are provided with a V shaped projection 12 which interlock with similar shaped grooves 13 formed in the ends of the segments 10 and interposed between the V-shaped projection and the segments 10 is the usual insulation such as is commonly used in commutators of this type. These clamping rings 11 are mounted upon a shell 19, which forms a support for the commutator and maintains the parts in concentric relation with the shaft on which the commutator is to be mounted. Bolts 15 which act through resilient annular member 16 exert a clamping pressure upon the rings 11 and hold them in engagement with the commutator segments. The resilient annular members 16 engage the clamping rings 11 at a point approximately along the center line of the segments 10, or in other words, in line with the reactive force caused by the expansion of the segments 10. The bolts 15 apply a clamping pressure to the resilient annular members 16 at a point between their inner circumference and where they abut the clamping rings, and thus cause a yielding pressure to be applied on the clamping rings 11. From the above it will be seen that the commutator segments 10 due to the clamping rings being mounted on the shell 19 will always remain concentric with the axis of rotation. It will also be seen, due to the clamping pressure of the resilient members 16 being applied at a point, in line with the reactive force caused by the expansion of the segments 10, that the clamping rings 11 will not be subjected to distortion while at the same time the segments 10 will be permitted to expand and contract as their temperature changes, the expansion and contraction being compensated for by the resilient annular members 16.

Referring to Fig. 1 of the drawing, in commutators of the type shown, the mean center line of bearing surface where the clamping pressure is exerted on the segments 10 by the clamping rings 11, is on the line A, and the approximate center line of the segments 10 is along the line B. As these lines are not coincident, any excessive increase in the clamping pressure which would be caused by the bolts 15 if seated directly on the clamping rings 11 at the point C would cause the segments 10 to buckle. As the point C, or center line of the clamping bolts 15, in this case is offset from the mean bearing line A, a moment will be set up, tending to dish the clamping ring 11 due to the clamping pressure of the bolts 15. This dishing of the clamping rings 11 will take place when the commutator is assembled and further increased by the expansion of the segments 10 when operating and will result in changing the angle of bearing of the clamping rings 11 with the segments 10, and tend to decrease the pressure exerted by the clamping rings 11, at the point D and increase the pressure at the point E. By adding the resilient annular member 16 to the arrangement described above and applying the clamping pressure of the bolts 15 to the clamping rings 11 through the member 16, I transfer the distortion which formerly occurred in the clamping rings 11 to this resilient annular member 16. And by applying the pressure exerted by the bolts 15 through the resilient annular members 16 to the clamping ring 11 along the center line of the segments, or line B, which as stated, is the center line of the reactive force caused by expansion of the segments, I prevent buckling of the segments 10 and cause the clamping rings 11 to maintain the same bearing contact with the segments irrespective of the normal clamping pressure of the bolts 15 or of the expansion or contraction which takes place. These resilient annular members 16 are held concentric with the clamping rings 11 by a shoulder 17. This shoulder 17 is made narrow and its mean center is located in the plane of the neutral axis of the section of the resilient member, so that when the resilient member 16 is dished due to the normal clamping pressure or to expansion, no appreciable distorting effect will be caused thereby on the clamping rings 11. By the expression, neutral axis, I mean the axis about which other points of the section of the resilient member 16 rotate as it is dished. If desired, this shoulder may be slightly curved in cross section so that when the resilient member 16 dishes the shoulder 17 will not tend to expand the clamping ring 11 in the slightest degree. The point of contact on the resilient member 16, which engages the clamping ring 11 is rounded to permit a slight rolling movement of the resilient member 16 on the clamping ring 11 as dishing of the resilient member occurs and thereby prevents any interlocking engagement between the annular member 16 and the clamping rings 11, and the nuts 18 on the bolts 15 are seated in concave spherical seats which maintain the nuts 18 in alignment with the bolts 15, as the resilient member 16 is distorted. The resilient annular member 16 is also provided with a projecting flange 20 such as is usually provided to shroud the nuts 18 on the outer end of the commutator and prevents them from coming in contact with or catching into anything as the commutator rotates. This is merely a protective measure and results in a commutator having no projecting parts such as have been found to be dangerous. As this flange is of small cross section it contributes only a small amount of the resistance of the member 16 to dishing, but as its extreme fibers are remote from the neutral axis of the section, it is slit at intervals as shown at 21, to prevent it from becoming overstrained and taking a permanent set. In this figure of the drawing the commutator is provided with a shell 19. This arrangement together with the resilient annular member 16, as shown, provides a commutator having a free circulation of air therethrough which is a desirable feature when the commutator is large or subject to heating.

In the modification shown in Fig. 2 of the drawing, no ventilating passages are provided under the commutator segments. The clamping rings 22 are mounted on a shell 23 which is secured to a shaft 24. The clamping rings 22 are movable axially along shell 23 and are thus held concentric with the axis of rotation. Clamping pressure is applied to the rings 22 by means of bolts 25, acting through a resilient annular member 26, which engages a rounded projection 27 on the clamping rings 22. This type of contact between the clamping rings 22 and the resilient member 26 will permit a relative movement between the parts and thus avoids any possibility of the distortion of the annular member 26 being imparted to the clamping rings 22. The resilient annular members 26 are movably mounted upon the shaft 24 and are thus maintained concentric with the clamping rings 22.

While I have shown and described a commutator having clamping rings and resilient annular members at each end, I wish to have it understood that if desired only one of each of the above members need be used and that one of the clamping rings can be cast integral with the spider or other support.

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

1. A commutator comprising a plurality of segments, a commutator shell, relatively movable clamping rings on said shell for securing said segments, resilient annular members in contact with said clamping rings on the center line of reactive force caused by the expansion of said segments, and bolts passing through said annular members for applying a clamping pressure thereto.

2. In a commutator, the combination of a commutator shell, commutator segments, clamping members interlocking with said segments mounted on said shell and adapted to move axially along said shell in response to forces caused by the expansion of said segments, resilient annular members abutting said clamping members at a point in line with the center of forces set up by the expansion of said segments, and means extending through said shell and resilient annular members for applying a clamping pressure on said clamping members.

3. In a commutator, the combination of commutator segments, relatively movable clamping members interlocking with said segments for retaining them in position, resilient annular members abutting said clamping members near their outer circumferences, and bolts passing through said resilient annular members at a point between their inner circumferences and where they abut the clamping members adapted to transmit a clamping pressure through said clamping members and said resilient annular members to said segments for securing the segments in position.

4. In a commutator, the combination of a shell, commutator segments, relatively movable annular clamping members on said shell interlocking with said segments for retaining them in position on said shell, resilient annular members abutting said annular clamping members near their outer circumferences, and bolts passing through said shell, annular clamping members and resilient annular members for securing the parts together, said parts being arranged to permit a free circulation of air through said shell.

5. In a commutator, the combination of commutator segments, a shell, a clamping ring on said shell interlocking with said segments and adapted to move axially in response to forces caused by expansion of said segments, a resilient annular member abutting said clamping ring for applying a clamping pressure thereto, and a shoulder on said resilient annular member interlocking with said clamping ring to maintain said resilient annular member concentric with said commutator, said shoulder being slightly rounded to prevent distortion of said clamping ring.

6. In a commutator, the combination of commutator segments, a shell, a clamping ring on said shell interlocking with said segments and adapted to move axially in response to forces caused by expansion of said segments, a resilient annular member abutting said clamping ring for applying a clamping pressure thereto, bolts passing through said resilient annular member for clamping the parts together, and a projecting flange on said resilient annular member for protecting the ends of said bolts, said flange being slit in a plurality of places to decrease its stiffening effect on said resilient annular member.

7. In a commutator, the combination of commutator segments, a shell, a clamping ring on said shell interlocking with said segments and adapted to move axially in response to forces caused by expansion of said segments, a resilient annular member abutting said clamping ring for applying a clamping pressure thereto, bolts passing through said resilient annular member for clamping the parts together, nuts on the end of said bolts having a spherical face, and a concave spherical recess in said resilient annular member cooperating with said nuts for permitting said bolts and nuts to always maintain true alignment.

In witness whereof, I have hereunto set my hand this 4th day of March, 1924.

FRANK A. HAUGHTON.