United States Patent

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[54] **CONTOURED BARS FOR BANDED COMMUTATORS**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **310/236**
[51] **Int. Cl.** **H01n 39/04;**
H02k 13/00
[50] **Field of Search** 310/219,
233, 235, 236, 271, 272, 273

[56] **References Cited**

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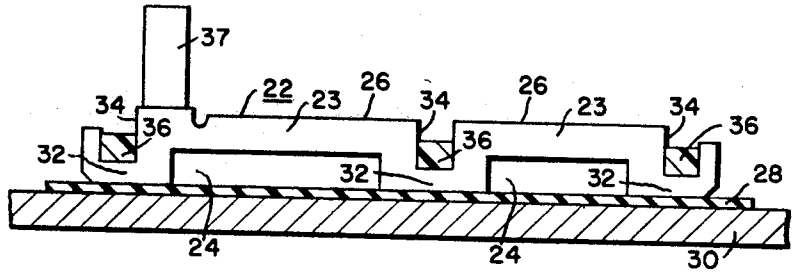
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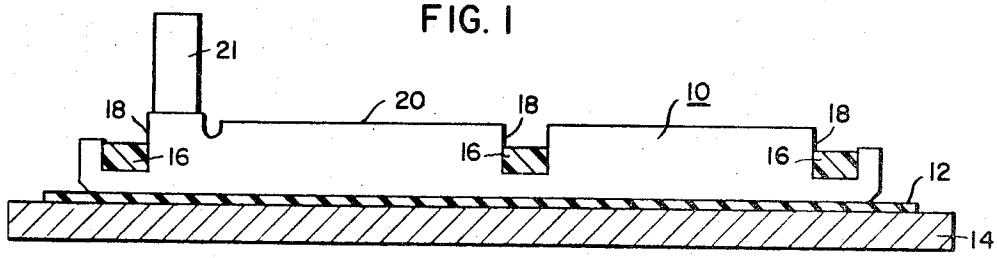
ABSTRACT: A commutator comprising bars or segments secured on a supporting bushing by bands spaced apart along the axis of the bushing, each of the bars or segments having a reduced area or cutout portion between the location of the bands to reduce the total arching pressure between the bars, and to reduce the length and weight of the bars and thus the centrifugal forces when the commutator undergoes high-speed rotation.



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FIG. 1



PRIOR ART

FIG. 2

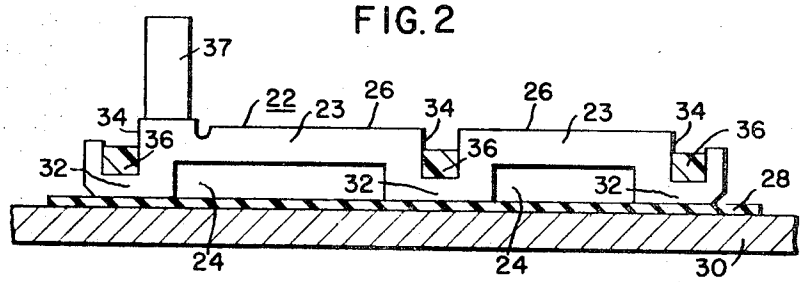
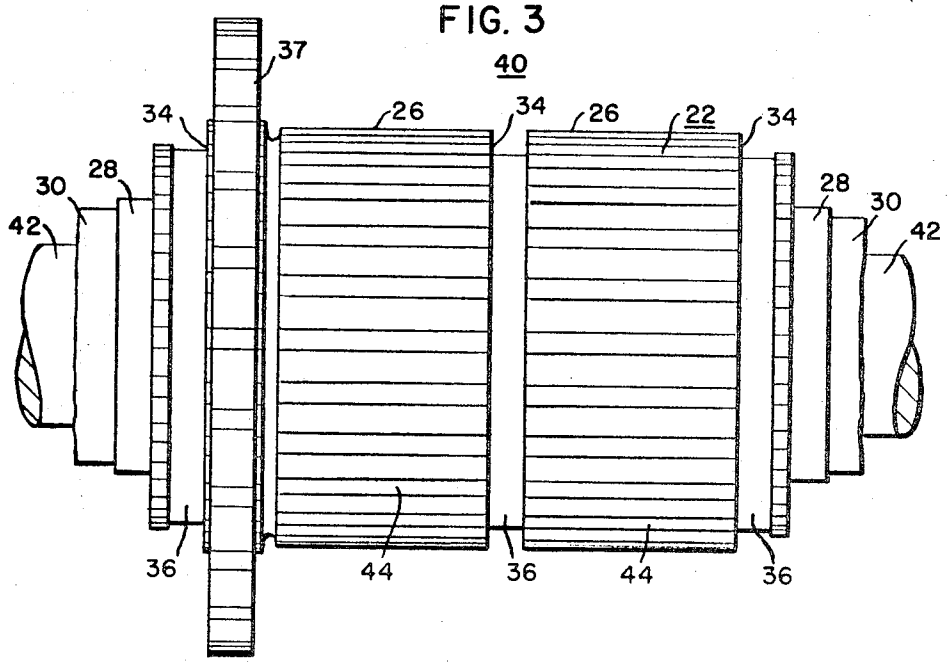


FIG. 3



WITNESSES

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CONTOURED BARS FOR BANDED COMMUTATORS

BACKGROUND OF THE INVENTION

The present invention relates generally to banded commutators and particularly to commutator bars or segments having reduced outwardly directed forces at high rotational speeds.

In forming a commutator of the shrink ring or banded type, two general types of binding pressure or force may be employed (or a combination thereof) to hold the segments together, namely, drum binding and arch binding. The drum bound type employs simply a radially inwardly directed force on each segment disposed on an inner, supporting bushing, said force holding the segments together (with insulation between segments to form a commutator cylinder) on the bushing. The arch bound type provides annular, circumferentially directed forces or pressures between each segment, and segment insulation, of a high unit value, the arching pressures holding the segments in such a manner that an inner supporting bushing is not always necessary.

The tension retained in the rings or bands securing the segments together must generate a force in a radially inward direction at least as great as the forces directed radially outward by the total arching pressure between the segments and by the centrifugal force when the commutator is rotated. If the outwardly directed forces become greater than the inward force provided by the bands, the segments lose physical contact with the supporting bushing, if used, and individual segments raise up one above the other to form uneven surfaces. The brushes, riding on the uneven surfaces, bounce which causes sparking and damage to the brushes to the extent that commutation deteriorates and the commutator may become inoperable.

Thus, with high-speed rotation and the total arching pressure, large bands are required to properly clamp the segments, such bands requiring a substantial increase in the length of the segments and commutator. This in turn, increases the cost of the commutator since more copper is required to make each segment.

Brief Summary of the Invention

Broadly, the present invention provides a lighter and shorter commutator by reducing the mass of each segment in the area adjacent a supporting bushing, if used, and between clamping bands axially spaced apart along the length of the commutator. This reduction in segment mass may be accomplished by punching out or otherwise removing part of the inside diameter of the commutator segments so that the segments engage the supporting bushing at the axially spaced apart locations of the clamping bands. In this manner the total arching pressure is substantially reduced without a reduction in unit arching pressure since the area of the segments is reduced without changing the actual pressure in pounds per square inch of bar area or surface. Similarly, the weight of each segment, and of the commutator, is substantially reduced, thereby substantially reducing the outwardly directed, centrifugal forces developed with rotation of the commutator. With the reduction in arching and centrifugal forces, the use of smaller and fewer bands is allowed which permits a reduction in the length of the segments and a considerable saving in copper. Further, the strength of the segments and the outside brush engaging surfaces thereof are unaffected.

THE DRAWINGS

The invention, along with its advantages and objectives, will be better understood from consideration of the following detailed description read in connection with the accompanying drawing in which

FIG. 1 is a side elevation view of a prior art and presently used commutator segment construction;

FIG. 2 is a side elevation view of a commutator segment constructed in accordance with the principles of the present invention; and

FIG. 3 is a side elevation of a commutator employing the segments of FIG. 2.

PREFERRED EMBODIMENT

Specifically, FIG. 1 shows a presently employed elongated solid commutator segment or bar **10**, shown in elevation, disposed on an insulating sleeve **12** and a supporting metal bushing **14** shown in section. The bar is tightly secured to the bushing, with other bars (not shown) to form a commutator, by wide rings or bands **16** which are disposed about the bars under a suitable amount of tension. As shown in the FIGS. the bands are accommodated in wide, spaced apart slots **18** provided in the outside surface or face **20** of the bar along the length thereof. The surface **20** is the contacting surface for associated dynamoelectric machine brushes not shown. The bar **10** is further provided with a radially extending riser **21** for connecting with an armature winding (not shown) of the machine.

As explained above, the bands **16** must provide an inwardly directed force having a magnitude at least equal to that of the outwardly directed forces developed with rotation of the commutator. With high speeds of operation, the centrifugal forces and total arching pressures of the bars **10** require large, high strength bands **16** in order to maintain the bars in contact with the insulating sleeve **12** and bushing **14**. This requires increases in the length of the bars in order to provide sufficient clamping area for the bands as well as working space for the brushes between the bands.

In accordance with the invention, FIG. 2 shows a commutator segment or bar **22** having a reduced bar area **23** formed by open areas or cutout portions **24** beneath brush engaging surfaces **26** of the bar. The open areas extend along an insulating sleeve **28** and a support bushing **30**, the open areas **24** leaving integral, inwardly extending portions **32** of the bar to engage the insulating sleeve. The sleeve engaging portions of the bar are provided with inwardly extending portions **32** of the bar to engage the insulating sleeve. The sleeve engaging portions of the bar are provided with inwardly extending slots or recesses **34** for receiving rings or bands **36** designed to clamp a plurality of the bars **22** tightly together on the bushing **30** for forming a commutator cylinder **40**, such as shown in the side elevation view of FIG. 3. Like the bar of FIG. 1, the bar **22** is provided with a riser **37**.

The open areas **24** may be provided by removing the copper in any suitable manner, for example by a punching process, or by originally forming the bar **22** to have a configuration like that shown in FIG. 2 or any other similar configuration, the number of open areas depending upon design considerations.

The bands **36** are preferably made from a resin impregnated glass tape or laminate, and cured to form a high strength insulating material.

Because of the large open areas **24** providing the reduction in copper mass and the reduced bar area **23**, the total arching pressure of the bars **22** of FIG. 2 is reduced, and each bar weighs considerably less than the prior bar construction **10** of FIG. 1. The unit arching pressure, however, remains the same to hold the bars together as explained above. Because of the reduced weight and total arching pressure of the bars **22**, smaller bands **36** can be used to clamp the bars on the bushing **30** to form the commutator **40** (FIG. 3) which then permits a shorter bar and commutator structure. In a typical commutator, the bar weight and area can be reduced up to 30 percent, resulting in a reduction of centrifugal forces and total arching pressures of approximately the same amount.

The shorter bar **22** and the reduced bar area **23** further provides a substantial saving in copper which reduces considerably the cost of the bar and commutator.

In FIG. 3, the commutator cylinder **40** is shown disposed on a shaft **42** of an associated machine not shown. The cylinder comprises the bars **22** each of which is separated from an adjacent bar by a thin strip of insulating material **44** fixed between the bars.

It should now be apparent from the foregoing description that a new, useful and unobvious commutator bar structure has been disclosed, the novel bar structure providing shorter, lighter and economical commutators for rotating machines.

Through the invention has been described with a certain degree of particularity, it should be noted that changes may be made therein without departing from the spirit and scope thereof.

I claim:

1. A commutator comprising a plurality of commutator bars disposed in a cylinder and insulated from each other, said bars having radially outer edges forming a cylindrical surface, said commutator cylinder having a predetermined radial depth, a plurality of axially spaced bands extending circumferentially around the cylinder, said bands clamping the bars in assembled relation with substantial arch binding forces between adjacent bars, and the bars having portions between said bands of smaller area than the area defined by said predetermined radial depth.

2. A commutator as defined in claim 1 in which said portions of the bars between the bands have radially inner edges spaced from the outer edges a distance less than said predetermined radial depth.

3. A commutator as defined in claim 1 in which said portions of the bars between the bands have open areas forming annular recesses in the inner surface of the commutator cylinder.

4. A commutator as defined in claim 3 in which said bands are disposed in recesses in the outer surface of the commutator cylinder.