

SPECIFICATION

Brush mounting for rotary electrical coupling

- 5 This invention relates in general to new and useful improvements in rotary electrical couplings, and more particularly to the mounting of the brushes therein in a manner substantially to eliminate uneven wearing of the brushes.
- 10 This invention most particularly relates to an improvement in the mounting of brushes of existing rotary electrical couplings. Such joints include a hub member which is fixed against rotation and which has rotatably journaled thereon a rotary member. In the existing rotary electrical couplings, the brushes have centrally disposed projections which are seated in notches, permitting the brushes freely to move radially while restraining the brushes against rotation with the rotary member engaged therewith.
- 20 Such an arrangement is found in United States Patent No. 3,596,225 granted to Cary on July 27, 1971.
- In the mounting of the brushes, the frictional force applied by the rotary member on the brush in the area of the leading edge of the brush has a tendency to pivot the brush about the middle thereof so that there was a greater than average pressure of the brush against the rotary member adjacent the leading edge of the brush and a lesser than average pressure of the brush against the rotary member adjacent the trailing edge of the brush. This resulted in the undue wearing of the brush with the result that replacement of brushes became more frequent than expected with the necessary shutdown of the equipment of which the rotary coupling is a part for the replacement of brushes.
- In accordance with this invention, a rotary electrical coupling comprises a rotary member, a fixed hub, and at least one brush carried by the hub and contacting an inner cylindrical surface of the rotary member, the or each brush being provided with a mounting for substantially eliminating uneven wearing thereof, which mounting includes a brush-receiving pocket defined by the hub, resilient means disposed between the hub and the brush and urging the brush outwardly, said brush having a leading edge and a trailing edge in accordance with the intended direction of rotation of the rotary member, and co-operating restraining means on the brush adjacent its leading edge and on the hub for restraining rotary movement of the brush leading edge with the rotary member in response to a drag force applied to said brush by the rotary member when rotating.
- 55 Thus, the or each brush is mounted with the restraint against rotation with the rotary member being adjacent the leading edge of the brush, so that the brush has a tendency to pivot due to forces exerted thereon by the rotary member with the pivoting taking place generally adjacent the leading edge of the brush with the result that the force tending to pivot the brush is primarily absorbed by the resilient means which urges the brush against the rotary member, and therefore an even wearing of the brush is obtained.

- It has also been found that the customary spring urging the brush against the rotary member may be shifted from its normal position to an off-center position toward the trailing edge of the brush. In other forms of the invention, two springs may be utilized with one spring being disposed adjacent the leading edge of the brush and the other being disposed adjacent the trailing edge of the brush. Further, beneficial results may be obtained by making the spring disposed adjacent the leading edge of the brush of a lesser strength than the spring disposed adjacent the trailing edge of the brush.
- With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference by way of example to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

85 *In the Drawings*

- Figure 1* is a perspective view of a hub of a rotary electrical coupling having brushes mounted therein in the customary manner.
- Figure 2* is a fragmentary enlarged transverse sectional view through the hub of *Figure 1*, and most specifically shows the mounting of a brush and the uneven wearing resulting from such mounting.
- Figure 3* is an end view of a portion of the hub of *Figure 1*, showing a brush mounted therein in accordance with this invention.
- Figure 4* is a schematic end view of the brush mounting of *Figure 3*.
- Figure 5* is a schematic end view of a slightly modified form of brush mounting.
- 100 *Figure 6* is a schematic end view of another modified form of brush mounting.
- Referring now to the drawings in detail, it will be seen that there is illustrated in *Figure 1* a hub of a rotary electrical coupling, which hub is generally identified by the numeral 10 and is adapted to be stationarily mounted with a rotary member mounted for rotation thereabout. The hub 10 defines a brush receiving pocket and is provided at the opposite ends thereof with radial flanges 12 which are configured to define a plurality of circumferentially spaced notches 14. Generally aligned with each set of notches 14 is a brush unit, generally identified by the numeral 16. Each brush unit 16 includes a shoe 18 which has bonded to the outer surface thereof a brush 20. The bonding of the brush to its respective shoe is preferably effected by means of a solder having a high electrical conductivity. It is to be understood that when the brushes 20 wear down they may be literally replaced by merely heating the brushes so as to melt the solder and thereafter a like new brush 20 may be soldered to the respective shoe 18. The shoes 18 are preferably formed of copper while the brushes 20 are preferably formed of silver graphite although other metals and alloys may be utilized.
- Each brush unit 16 is restrained against rotation about the hub 10 by its respective shoe 18 having at the opposite ends thereof centrally located projections 22 which extend into the notches 14.
- 130 As is best shown in *Figure 2*, each brush unit 16 is

urged radially outwardly by means of at least one central spring 24 and in order to retain the projections 22 in their respective notches, a suitable retainer 26 is mounted on each end of the hub 10 with each retainer 26 having a portion thereof which overlies each notch 14.

With further reference to Figure 2, it will be seen that mounted for rotation about the hub 10 and frictionally engaging the brushes 20 is a rotary member 30. In order that the necessary electrical energy may be transferred from the brushes 20 to the rotary member 30, it is necessary that the brushes 20 frictionally engage the internal cylindrical surface of the rotary member 30. However, this results in a frictional force being imposed upon each brush unit 16 which tends to tilt the brush unit so that the leading edge of the brush 20 is forced more tightly against the rotary member 20 than the trailing edge of the brush. Most particularly, the projections 22 are forced against the flanges 12 and define a pivot axis for the brush. As is schematically shown in Figure 2, the resultant drag force F_d is generally tangential and this can be resolved into a horizontal drag force F_h and a vertical drag force F_v . The tilting of the brush provides the vertical drag force F_v with a moment arm C and thus a force moment $F_v C$ is generated. On the other hand, the horizontal drag force component F_h is balanced by the reaction of the projection 22 against the flange 12. The net result is that the leading edge of each brush unit 16 tends to move closer to the mating surface of the rotary member 30 which tends to increase the contact pressure on the brush 20 at or near its leading edge. The resultant increase in contact pressure causes increased wear of the brush 20 adjacent the leading edge thereof and thus limits brush life.

In accordance with an embodiment of this invention, it has been found that brush life may be extended by simply adding to the shoe 18 at each end thereof adjacent the leading edge of the respective brush unit 16 a further projection 32. This projection 32 has a rounded edge 34 which engages a radial guide surface 36, and is slidable in a radial direction on the guide surface 36. The radial guide surface 36 may be a surface of the associated flange 12 or may be formed as part of a guide added to the flange 12. It is to be understood, however, that the relationship of the projections 32 and the guide surfaces 36 is such that the projections 32 form the sole restraint of the brush units 16 against rotary movement and that the projections 22 do not engage the flanges 12. Thus, the contact between the rounded edges 34 of the projections 32 and the guide surfaces 36 define the pivot axis for the brush unit 16.

It will be readily apparent that by providing this additional restraint on the brush unit adjacent the leading edge of the brush unit and by proper application of the spring force, a more uniform pressure is provided between the brush 20 and the rotary member 30.

It is to be understood that the constraint provided by the projections 32 and the guide surfaces 36 eliminates the prior center of rotation and the above discussed moment $F_v C$ that caused the non-uniform

brush pressure. The spring 24 still generates the outward pressure as before. However, the spring being spaced from the point of brush restraint now uniformly presses the brush 20 against the mating surface of the rotary member 30.

Although it may be desirable to retain the position of the spring 24 in the center of the brush unit as previously provided for, it is to be understood that other beneficial advantages can be obtained by modifying the spring arrangement. Most particularly, with reference to Figure 5, it will be seen that the spring 24 has been shifted circumferentially and it is now offset from the center of the brush unit 16 to a position adjacent the trailing edge thereof. With the constraint on the brush being adjacent the leading edge thereof, it will be seen that this new location of the spring will provide for a slightly more uniform application of the brush against the rotary member.

Reference is now made to Figure 6 wherein there is illustrated a slightly modified form of mounting of the brush assembly 16. It is to be noted that in lieu of the single spring or single line of springs 24, two springs 40, 42 are provided. The springs 40, 42 are offset from the center of the brush unit 16 with the spring 40 being disposed adjacent the leading edge and the spring 42 being disposed adjacent the trailing edge of the brush unit. While the springs 40, 42 may be of the same strength, beneficially the spring 42 should be of greater strength than the spring 40. Thus, any tendency of the leading edge of the brush unit 16 to be forced against the rotary member 30 by the frictional force thereon can be compensated for by the difference in strength of the springs 40, 42.

Although reference is made to single springs 40, 42, it is to be understood that depending upon the axial dimension of the brush unit 16, more than one spring 40 and more than one spring 42 may be utilized.

Although only several preferred embodiments of the brush mounting in accordance with this invention have been specifically disclosed herein, it is to be understood that minor variations may be made in the disclosed brush mountings without departing from the scope of the invention as defined by the appended claims.

CLAIMS

1. A rotary electrical coupling comprising a rotary member, a fixed hub, and at least one brush carried by the hub and contacting an inner cylindrical surface of the rotary member, the or each brush being provided with a mounting for substantially eliminating uneven wearing thereof, which mounting includes a brush-receiving pocket defined by the hub, resilient means disposed between the hub and the brush and urging the brush outwardly, said brush having a leading edge and a trailing edge in accordance with the intended direction of rotation of the rotary member, and co-operating restraining means on the brush adjacent its leading edge and on the hub for restraining rotary movement of the brush leading edge with the rotary member in response to a drag force applied to said brush by the rotary

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member when rotating.

2. A rotary coupling as claimed in Claim 1, wherein the restraining means includes axial projections at opposite ends of the brush and radially extending guide surfaces carried by the hub, said radial guide surfaces being engaged by the axial projections in a circumferential direction.

3. A rotary electrical coupling as claimed in Claim 2, wherein said axial projections are slidable in a radial direction on said guide surfaces.

4. A rotary electrical coupling as claimed in Claim 2 or 3, wherein the axial projections have rounded edge portions which engage said radial guide surfaces.

5. A rotary electrical coupling as claimed in any preceding claim, wherein the or each brush includes a mounting shoe and said restraining means on the brush are carried by the mounting shoe.

6. A rotary electrical coupling as claimed in any preceding claim, wherein said resilient means is a spring positioned substantially centrally between said leading edge and said trailing edge.

7. A rotary electrical coupling as claimed in any one of claims 1 to 5, wherein said resilient means is a spring positioned off-centre of said brush towards the trailing edge of the latter.

8. A rotary electrical coupling as claimed in any one of claims 1 to 5, wherein said resilient means includes two radially directed springs disposed in circumferentially spaced relation, one each disposed adjacent said leading edge and said trailing edge of the brush.

9. A rotary electrical coupling as claimed in Claim 8, wherein the spring disposed adjacent the leading edge of the brush is of a lesser strength than the spring disposed adjacent the trailing edge thereof.

10. A rotary electrical coupling as claimed in Claim 1, wherein there are radial flanges at opposite ends of the hub, and said restraining means on the hub are portions of said flanges.

11. A rotary electrical coupling substantially as hereinbefore described with reference to and as shown in Figure 3 and any one of Figures 4 to 6 of the accompanying drawings.