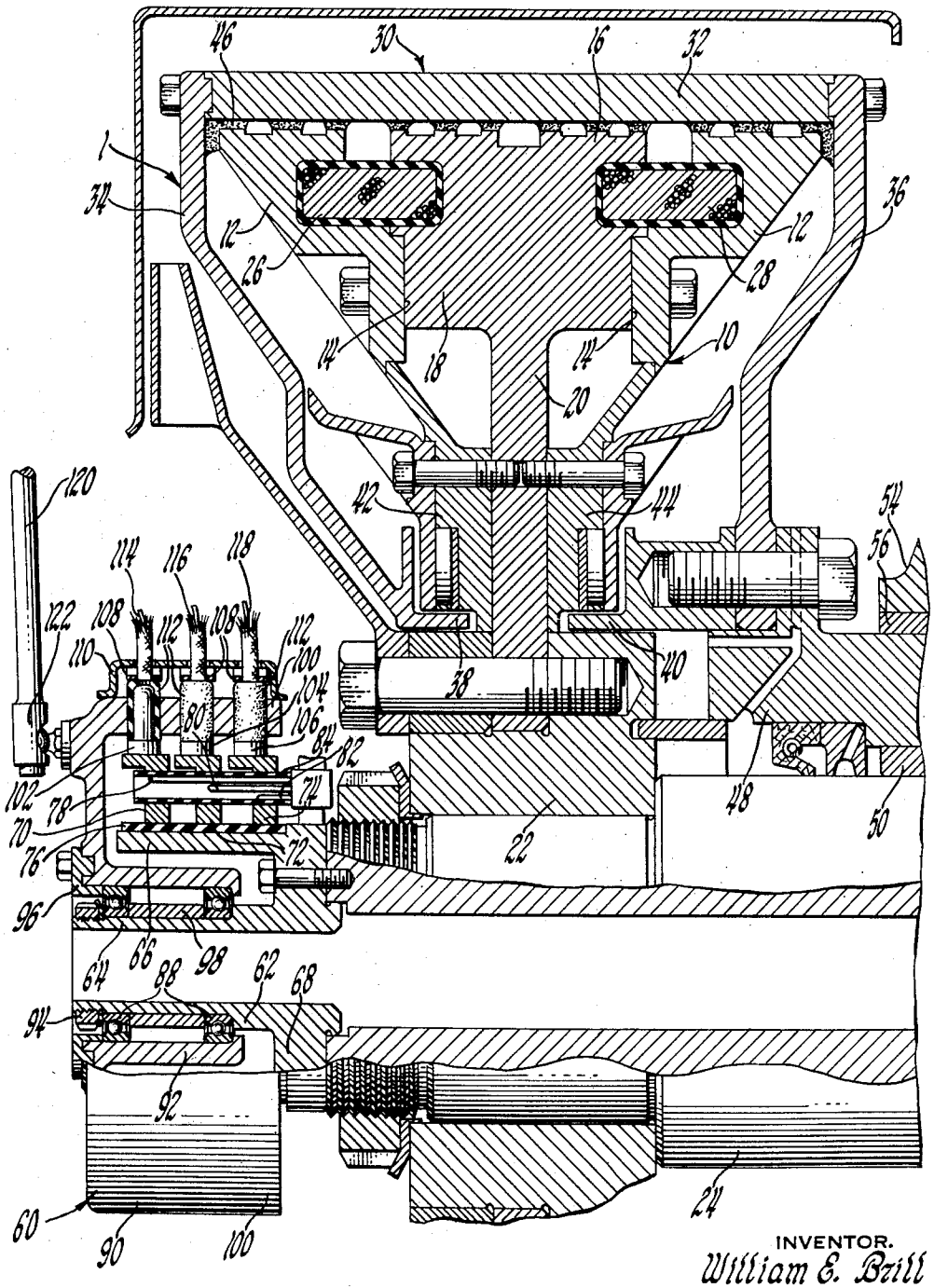
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SLIP RING AND BRUSH HOLDER CONSTRUCTION FOR ELECTRODYNAMIC MACHINERY

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SLIP RING AND BRUSH HOLDER CONSTRUCTION FOR ELECTRODYNAMIC MACHINERY

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This invention relates to an electrodynamic machine and more particularly to a slip and brush holder construction for an electrodynamic machine of the type having a rotatable electromagnetic armature member including a magnetic field inducing coil or winding.

In conventional slip ring and brush carrier constructions for electrodynamic machines of the type described, the slip rings are mounted on the rotatable armature member and the brush carriers are reciprocably or pivotally mounted on a stationary supporting member such as a housing. With such constructions there is no assurance that the brush carriers will be mounted or maintained in concentric relation to the slip rings. This is particularly true in those applications where the slip ring mounting portion of the armature assembly is substantially overhung from the journal bearings of the armature assembly or where the armature assembly is susceptible to dynamic unbalance at certain speeds. This lack of concentricity results in harmonic reciprocation and vibratory movement of the brushes out of contact with the slip rings with resultant arcing therebetween unless brush biasing springs of sufficient rate are utilized. However, the use of such springs results in relatively higher bearing pressures and thus increases the frictional drag and wear between the slip rings and brushes.

Among the principal objects of the invention are to provide an improved slip ring and brush holder assembly adapted to insure the concentricity of the several brushes relative to the slip rings; to provide such an assembly which is of a simplified and economical design and adapted for use on existing electrodynamic machinery of the type described; and to provide such an assembly of a construction minimizing the biasing forces necessarily applied to the brushes to maintain them in proper electrical contact with the slip rings.

The foregoing and other objects, advantages and features of the invention will be more clearly understood from the following description having reference to the accompanying drawing showing a sectional view of a portion of a magnetic particle coupling embodying a preferred embodiment of the invention.

In the illustrative embodiment of the invention, a magnetic particle coupling 1 is shown comprising an armature assembly 10 including two annular members 12, 12 of magnetic material which are secured to the opposite end faces 14, 14 of an outer portion 16 of an intermediate or central member 18 of magnetic material. The intermediate member 18 has a web portion 20 which extends radially inwardly from the outer pole portion and is mounted on a hub 22 secured to a rotatable shaft 24. The adjacent faces of the pole pieces are recessed to mount two annular field coil windings 26 and 28 therebetween and to axially separate the peripheral portions of the pole members 12, 12 and 18 to establish annular magnetic poles.

The armature assembly 10 is spacedly embraced by an inductor drum assembly 30 comprising a cylindrical member 32 and two end plates 34 and 26 secured to the opposite ends of the cylindrical member 32. The member 32 and preferably the end plates 34 and 36 are made of magnetic material. The end plates 34 and 36 extend radially inwardly from the cylindrical member and terminate in portions 38 and 40, respectively, which coact with elements of two magnetic seals 42 and 44 and the armature hub 22 to effectively seal a quantity of magnetic particles indicated at 46 within the coupling. The end plate 36 serves as a load carrying member and is secured adjacent its central portion 40 to a second rotatable shaft 48 which is journaled with respect to the shaft 24 by a bearing 50. The shaft 48 is also journaled in a suitable supporting structure, a portion of which is shown at 54, by a bearing 56.

The windings 26 and 28 are oppositely wound and are electrically energizable to establish two substantially toroidal magnetic fields bridging the annular spaces between the cylindrical member 32 and the peripheral surfaces of the pole members 12, 12 and 18 of the inductor drum and armature assemblies, and effecting a load transmitting bond therebetween through the magnetic particles. This bonding action is proportional to the magnetic fields effected by the electrical energization of the field coils 26 and 28 up to a point at which current passing through the coils is sufficient to effectively lock the inductor drum and armature assemblies together by the magnetic bonding action of the magnetic particles. Since the two windings are oppositely wound, these magnetic fields establish the annular pole members 12, 12 as magnetic poles of the same polarity and the intermediate pole member 18 as a magnetic pole of the opposite polarity.

The field coil windings are connected to a controllable source of electrical potential, not shown, through suitable leads and a slip ring and brush carrier assembly 60 constructed in accordance with the invention. The ring and brush carrier assembly 60 includes a turks-head shaped ring carrier 62 having an inner cylindrical portion 64 and an outer cylindrical portion 66 joined by a radially-extending base portion 68 which is secured to the end of the shaft 24. The outer cylindrical portion of the ring carrier 62 mounts three axially-spaced slip rings 70, 72 and 74 insulated therefrom by an insulator pad 76 and connected to the field coils 26 and 28 by suitable leads 78, 80, 82, respectively, mounted in an insulating sheath 84 running axially through the rings.

The inner cylindrical portion 64 of the ring carrier mounts two anti-friction bearings 88, 88 which, in turn, rotatably mounts a turks-head shaped brush carrier 90 which telescopically embraces the outer cylindrical portion 66 of the member 62 and the slip rings 70, 72 and 74. The bearings 88 are retained between the portion 64 and an inner cylindrical portion 92 of the brush carrier 90 by a spanner nut 94 and a retaining collar 96 and are axially separated by spacer sleeve 98. An outer cylindrical portion 100 of the brush carrier 90 reciprocably mounts three brushes 102, 104 and 106, which are biased into bearing contact with the outer surface of the slip rings 70, 72 and 74, respectively, by semi-elliptical leaf springs 108 interposed between a cover plate 110 carried by the brush carrier 90 and insulating caps 112 carrying the individual brushes. The brushes 102, 104 and 106 are connected to the source of electrical potential by leads 114, 116 and 118, respectively.

The brush carrier 90 is retained against rotation by a tie rod 120 which is universally connected thereto by a resilient ball-and-socket connection 122 and is universally connected at its opposite end to a stationary structure, not shown, by a similar swivel connection, also not shown. The resilient ball-and-socket connections 122 intermediate the carrier 90, the tie rod 120, and the stationary structure further serve to damp rotative and

radial vibratory movement of the carrier under dynamic conditions.

From the foregoing description it will be seen that the several objects of the invention are obtained in the illustrative embodiment; the ring and brush carriers being of a compact and simplified design maintaining the brushes in concentric relation with the slip rings under all operative conditions, thus reducing the slip ring and brush arcing and frictional wear which are inherent in conventional slip ring and brush mounting constructions where the brushes are carried by the supporting structure.

While only one specific structural embodiment of the invention has been shown and described for purposes of illustration, it will be appreciated that various minor modifications may be made without departing from the spirit and scope of the invention, as defined in the following claims.

I claim:

1. A slip ring and brush carrier construction for an electrodynamic machine having a rotatable magnetic armature including a magnetic field inducing coil, said construction comprising, in combination, a shaft mounting said armature member, a first turks-head shaped member having an inner cylindrical portion and an outer cylindrical portion joined by a radially-extending base portion, said base portion being secured to the end of the shaft, at least one slip ring mounted on said outer cylindrical portion and insulated therefrom, said slip ring electrically connected to said field coil, a second turks-head shaped member having an inner cylindrical portion rotatably mounted by said inner cylindrical portion of said first turks-head shaped member, said second turks-head shaped member having an outer cylindrical portion concentrically embracing the outer cylindrical portion of said first turks-head shaped member and said slip ring, said outer cylindrical portion of said second turks-head shaped member reciprocably mounting at least one contact brush for each of said slip rings, spring means carried by said second turks-head shaped member and biasing said contact brushes into bearing contact with the outer surface of said slip rings and a tie rod universally interconnecting said second turks-head shaped member to a stationary supporting structure.

2. A slip ring and brush carrier construction as set forth in claim 1 and including resilient means associated with said tie rod and adapted to damp vibratory movement of said second turks-head shaped member.

3. In a machine having a shaft mounted therein for rotation about an axis and having an electrically energizable device mounted on said shaft for rotation therewith, an electrical contact assembly comprising a first cylindrical member mounted on said shaft and rotatable therewith, at least one annular current collector mounted circumferentially on said first cylindrical member, said current collectors being insulated from each other and electrically connected to said device, a second cylindrical member rotatably mounted with respect to said first cylindrical member and having a cylindrical portion extending longitudinally of and in radially spaced concentric relation therewith, at least one contact brush for each of said annular current collectors mounted for independent movement with respect to said cylindrical portion, spring means carried by said second member for individually biasing each of said contact brushes to maintain electrical contact with the outer surface of said annular current collectors, and means for connecting said second member to the supporting structure to retain said second member against rotation with said cylindrical member, said last-mentioned means including means for resiliently damping rotational vibratory movement of said second member.

4. In a machine having a shaft mounted therein for rotation about an axis and having an electrically energizable device mounted on said shaft for rotation therewith, an electrical contact assembly comprising a cylindrical member mounted on said shaft and rotatable therewith, an annular current collector mounted circumferentially on said cylindrical member and electrically connected to said device, a second member supported by and rotatable with respect to said cylindrical member, said second member having a portion thereof extending longitudinally of and in radially spaced concentric relation with said cylindrical member, said portion mounting a contact brush engageable with said annular current collector, means carried by said second member for resiliently biasing said contact brush to maintain electrical contact with the outer surface of said annular current collector, and means for retaining said second member against rotation with said cylindrical member, said last-mentioned means including means for resiliently damping rotational vibratory movement of said second member.

5. An electrical contact construction for an electrical machine having a rotatably mounted electrical element, said construction comprising, in combination, said rotatably mounted electrical element, a first member having an inner cylindrical portion and an outer cylindrical portion joined by a radially extending base portion, said base portion being secured to the electrical element in coaxial relation thereto, a plurality of contact elements mounted circumferentially of the outer cylindrical portion, said contact elements being in spaced electrically insulated relation to each other and connected electrically to said electrical element, a second member having an inner cylindrical portion rotatably mounted by the inner cylindrical portion of the first member and an outer portion extending longitudinally of the outer cylindrical portion of the first member and of the contact elements mounted thereon and in radially spaced relation thereto, at least one contact brush reciprocably mounted by the outer portion of the second member for engagement with the contact elements, spring means interposed between the second member and each of said brushes for independently biasing said contact brushes into electrical contact with the contact elements, and a tie rod universally interconnecting the second member to a stationary portion of the machine.

6. An electrical contact construction for a rotatably mounted electrical element comprising a first member having two radially spaced cylindrical portions joined by an intermediate radially extending portion, said first member being carried by said electrical element in coaxial relation thereto, a plurality of contact elements mounted circumferentially of one of said cylindrical portions in electrically insulated relation to each other and connected electrically to said electrical element, a second member rotatably mounted by the other of the cylindrical portions of the first member and having a portion thereof extending longitudinally of said one cylindrical portion of the first member in radially spaced relation to the contact elements mounted thereon, at least one contact brush mounted by said portion of the second member for movement into engagement with the contact elements, spring means interposed between the second member and each of said brushes for independently biasing said contact brushes into electrical contact with the contact elements, and means for universally connecting the second member to a stationary portion of the machine.

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