

Nov. 28, 1961

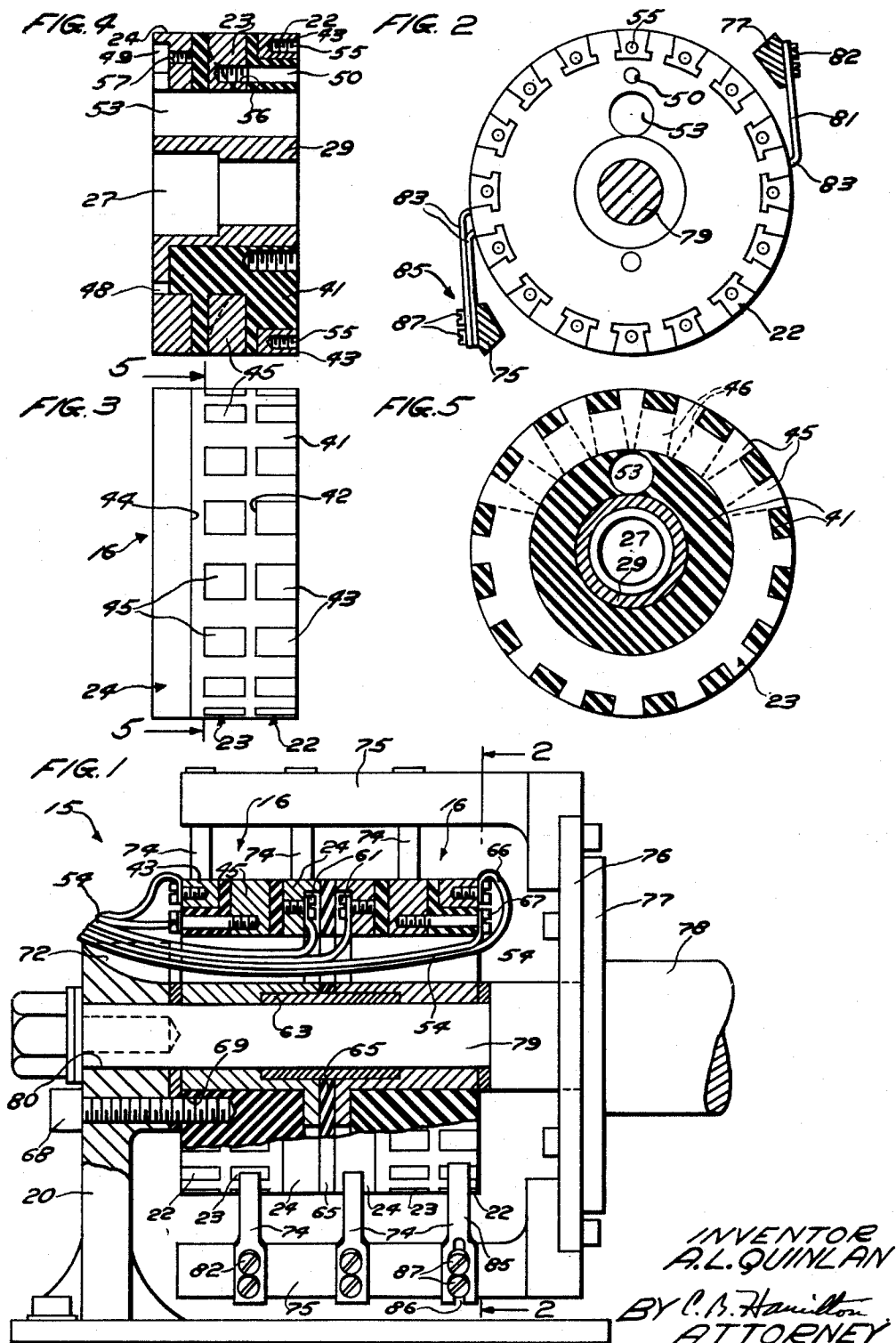
A. L. QUINLAN

3,010,182

METHOD OF MAKING A COMMUTATOR

Filed Jan. 11, 1956

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FIG. 6

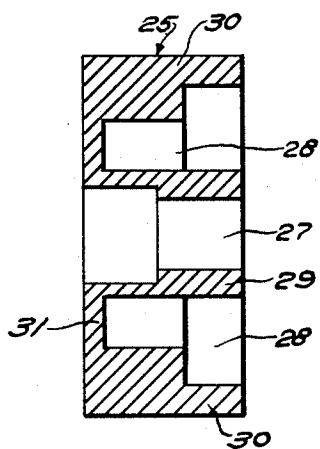


FIG. 7

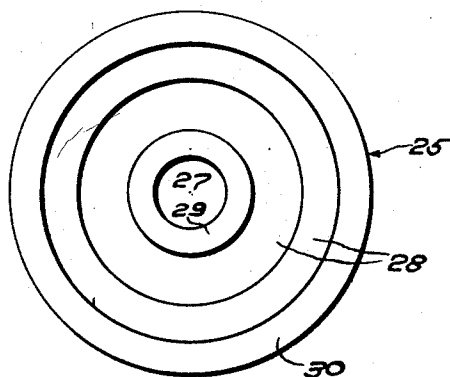
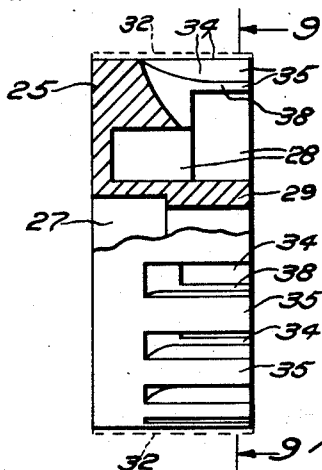


FIG. 8



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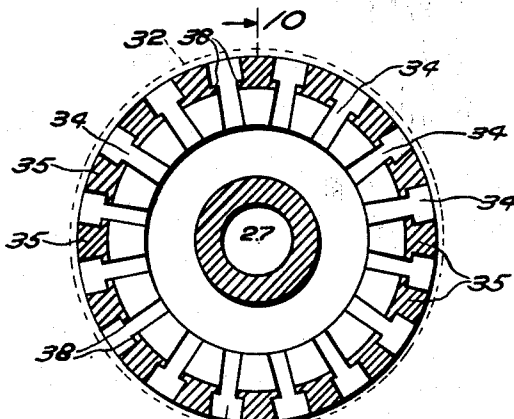


FIG. 10

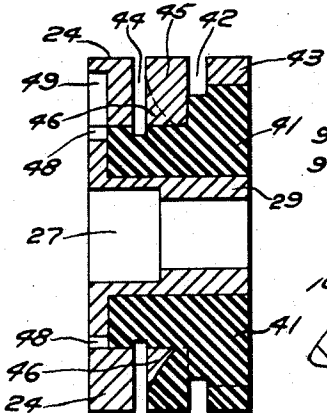


FIG. 11

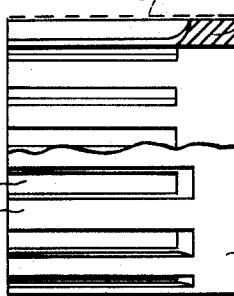


FIG. 12 95

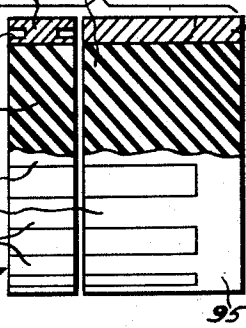
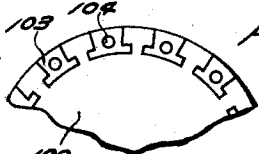


FIG. 13



INVENTOR
A. L. QUINLAN
P. A. Hamilton
ATTORNEY

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METHOD OF MAKING A COMMUTATOR
Amos L. Quinlan, La Grange Park, Ill., assignor to Western Electric Company, Incorporated, New York, N.Y.,
a corporation of New York

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5 Claims. (Cl. 29—155.54)

This invention relates to commutators and methods of making and more particularly to methods of making the commutators from a single piece of metal.

An object of the invention is to provide an improved commutator with segments thereof in accurately spaced insulated relation to each other and a method of making.

Another object of the invention is to provide an improved commutator and a method of making it from a single piece of metal.

Another object of the invention is to provide a commutator with brushes having adjustable wiping surfaces.

A method illustrating certain features of the invention may include the steps of longitudinally slotting a metal tube to form a plurality of commutator segments supported in fixed relation to each other by the unslotted end of the tube, supporting the tube on end and wrapping a sheet of material therearound to close the slots, filling the tube and the slots with plastic dielectric molding material, curing the dielectric molding material to form a dielectric core for supporting the fingers in fixed relation to each other, and cutting through the fingers and the dielectric core to form a commutator section having the segments thereof embedded in and supported by the dielectric core and insulated in accurately spaced relation to each other.

Another embodiment of the invention of making a commutator unit includes the steps of drilling an axial aperture in a cylindrical block of metal, cutting an annular axially directed cavity in the block to form a hub, an outer cylindrical wall, and an end wall, longitudinally slotting the outer cylindrical wall to provide a plurality of commutator segments supported by the unslotted portion of the outer wall in accurately spaced relation to each other, wrapping a sheet of material around the block to close the slots therein, supporting the block on end and filling the annular cavity and the slots with plastic dielectric molding material, curing the molding material to form a dielectric core bonded to the block, cutting an axial directed slot in the end wall of the metal block to separate the outer cylindrical wall from the hub, cutting an axially directed slot in the end wall of the metal block to separate the outer cylindrical wall from the hub, cutting a circumferential groove through the outer wall to separate the commutator segments from the unslotted portion of the outer wall to form a slip ring and a commutator supported by the dielectric core, filling in the circumferential groove with dielectric material, and machining the outer cylindrical face to form a smooth cylindrical surface on the commutator unit. Holes are drilled and tapped in the slip ring and segments of the commutator for the connection of wires thereto and a plurality of these commutator units are mounted on a sleeve and stationarily supported on the bracket and cooperate with a plurality of brushes mounted for rotation around the commutator units.

One embodiment of the brushes comprises a pair of flat members, one superposed on the other and adjustably secured at one end to a carrier. The members have wiping surfaces on the end portions thereof engageable with the commutators and the members are adjustable relative to each other to vary the distance between the end portions and thus vary the effective length of the wiping surface of the brush.

Other objects and advantages of the invention will be-

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come apparent by reference to the following detailed description and the accompanying drawings illustrating two embodiments thereof, in which—

FIG. 1 is a side elevational view of one embodiment of a commutator structure with portions thereof shown in section and showing the brush supporting arms in one position;

FIG. 2 is a vertical sectional view of the commutator structure taken on line 2—2 of FIG. 1 showing the brush supporting arms in a different position;

FIG. 3 is a side elevational view of one of the commutator units shown in FIG. 1;

FIG. 4 is an axial sectional view through the commutator unit shown in FIG. 3;

FIG. 5 is a sectional view through the commutator unit taken on line 5—5 of FIG. 3;

FIG. 6 is a sectional view of the commutator unit showing the first stage in the formation thereof;

FIG. 7 is an end view of the commutator unit shown in FIG. 6;

FIG. 8 is a side elevational view of the commutator unit at a later stage with portions thereof shown in section;

FIG. 9 is a cross-sectional of the commutator component taken on line 9—9 of FIG. 8;

FIG. 10 is a sectional view of the commutator component taken on line 10—10 of FIG. 9 and showing the last stage in the manufacture thereof.

FIG. 11 is a side elevational view of another embodiment of a commutator structure in one stage of manufacture and with portions thereof shown in section;

FIG. 12 is a side elevational view of the commutator structure shown in FIG. 11 in a later stage of manufacture and with portions thereof shown in section; and

FIG. 13 is a fragmentary end view of a portion of the commutator shown in FIG. 12.

The embodiment of the commutator structure 15 shown in FIGS. 1 to 10 of the drawings comprises a pair of commutator units 16 disposed in coaxial relation and stationarily supported on a bracket 20. Each of the commutator units 16 comprises a pair of commutators 22 and 23 and a slip ring 24, the commutator 22 having its segments mounted in insulated relation to each other and the commutator 23 having its segments electrically connected with each other. Each of the commutator units 16 is formed from a cylindrical block of metal 25 (FIG. 6), such as copper, having flat parallel end faces. An axially disposed counterbored aperture 27 is bored therein and an annular axially directed cavity 28 is cut therein to provide a hub 29, an outer cylindrical wall 30, and an end wall 31. A plurality of axially directed T-shaped slots 34 are cut in the outer wall 30 of the block in a predetermined circumferentially spaced relation to each other to form a plurality of parallel fingers 35 supported by the unslotted portion of the outer wall 30 in accurately spaced relation to each other. The slots 34 are T-shaped in cross section to form laterally extending beads or flanges 38 on the fingers 35 and these slots are formed by first milling narrow slots through the wall 31 and then milling wider slots in the outer portions of the wall 31.

The block 25 is then supported on a flat surface on its end wall 31 and a strip of material 32 indicated in dotted lines in FIGS. 8 and 9 is wrapped around the block to close the slots 34 and form a continuation of the outer cylindrical surface of the block. A plastic dielectric molding material, such as epoxy casting resin, is poured in the cavity 28 to fill in the cavity and the slots 34. The dielectric molding material is then cured to harden it and form a core or body 41 of dielectric material for supporting the fingers in a predetermined spaced relation to each other. A circumferential groove 42 (FIG. 10) is then cut

through the fingers 35 and a portion of the dielectric core 41 to form a plurality of segments 43 of the commutator 22. A second circumferential groove 44 is cut through the outer cylindrical wall 30 and intersects the sloping portion of the slots 34 to form a plurality of commutator segments 45 of the commutator 23, which segments are interconnected by portions 46 of the outer wall to electrically interconnect them. An annular axially directed slot 48 (FIG. 10) is cut through the end wall 31 to electrically separate the hub 29 from the slip ring 24. The separated segments 43 of the commutator 22, the interconnected segments 45 of the commutator 23, the slip ring 24, and the hub 29 are secured in fixed and insulated relation by the dielectric core 41. The flanges 38 on the commutator segments 43 form an interlock with the core 41 and the cavity 28 may be rough cut to provide rough or grooved surfaces to further aid in interlocking the metal members and the core 41.

A radially disposed recess 49 (FIGS. 4 and 10) is cut in the end of the slip ring 24 and a recess 50 (FIG. 4) is bored in the dielectric core 40 to form a passageway from the end of the commutator unit to the commutator 23. The grooves 42 and 44 are then filled with the plastic dielectric molding material and cured to provide dielectric separators between the commutators 22, 23, and slip ring 24. The outer surface of the commutator unit is then machined to provide a smooth peripheral surface for the brushes to engage. An axially directed aperture 53 is bored through the core 41 and the commutator end wall 31 to provide a passageway through the commutator unit for wires 54. Holes 55 are then drilled and tapped in each of the segments 43 of the commutator 22, holes 56 are drilled and tapped in the commutator 23 in alignment with the recess 50, and a hole 57 is drilled and tapped in the slip ring 24 in communication with the recess 49.

The wires 54 are then connected to the slip rings 24 of a pair of the commutator units 16 by screws 61 threaded in the holes 57 and the pair of commutator units 16 are then pressed onto a sleeve 63 which fits in the counter-bored portion of the apertures 27 of the hubs 29 of the commutator units to secure the commutator units in coaxial alignment and in fixed relation to each other. An annular disc 65 of dielectric material is inserted between the ends of the commutator units to electrically insulate the adjacent slip rings 24 from each other and the disc 65 has a hole therethrough aligned with the aperture 53 of the commutator units for the wires 54. Other wires 54 are connected to the segments 33 of the commutator 22 by screws 66 and wires 54 are connected to the commutator 23 by screws 67 passing through the recesses 50 and engaging the threaded holes 56.

The two commutators 16 mounted together on the sleeve 63 are secured to the bracket 20 by a plurality of screws 68 (FIG. 1) which pass through apertures in the bracket and engage threaded holes 69 in the core 41 of one of the commutator units 16. As shown in FIG. 1 the electrical connections to the slip rings 24, the commutator 23, and the segments 43 of the commutator 22 on the right-hand commutator unit 16 are made by wires 54 disposed in the passageway 53 and electrical connections to the commutator 23 and the segments of the commutator 22 of the left-hand commutator unit 16 are made by wires 54 connected directly thereto. A portion of the bracket 20 is cut away at 72 to provide clearance for the wires 54.

Electric current applied to the slip rings 24 is transferred to the commutators 22 and 23 of the two commutator units 16 by two groups of three brushes 74 (FIGS. 1 and 2) mounted on and electrically connected to a pair of metal arms 75 which are secured to the annular disc 76 of dielectric material, which in turn is supported on a flange 77 of a shaft 78. The shaft 78 has a reduced end 79, a portion of which is journaled in a bearing aperture 80 in the bracket 20. The brushes 74 comprise flexible resilient arms 81 made from flat strips of suitable metal,

such as phosphorus bronze, which are secured at one end by screws 82 to the brush supporting arms 75 and have transversely bent end portions 83, the end faces of which form narrow wiping surfaces engageable with the commutator. The brushes are mounted to provide a slight tension therein for maintaining them in engagement with the commutator.

A brush 85 of the group of brushes is provided with an adjustable wiping surface and comprises two arms 81 which have slots 86 in one end thereof and are adjustably secured to the supporting arm 77 by screws 87. The arms 81 of the brush 85 may be adjusted relative to each other to vary the spacing of the end portions 83 and obtain the desired effective length of wiping surface for the brush.

In the embodiment of the invention disclosed in FIGS. 11, 12, and 13 a metal tube 95 is longitudinally slotted at 96 to provide a plurality of fingers 97 supported by the unslotted portion of the tube in fixed and accurately spaced relation to each other. The tube 95 is then placed on its end on a horizontal supporting surface and a sheet of material 98 is wrapped therearound to close the slots 96, after which plastic dielectric molding material is poured into the tube to fill up the central cavity and the slots 96 and form a supporting body or core 100 of dielectric material for supporting the fingers in fixed relation to each other. After the dielectric material has been cured, the tube 95 and the dielectric core 100 may be cut along a plane 101 perpendicular to the axis of the tube to form a commutator 102 which has a dielectric core 100 with commutator segments 103 supported thereby in insulated and accurately spaced relation to each other. Holes 104 may be drilled in the commutator segments 103 for the attachment of conductors thereto and the core 100 of dielectric material may be provided with suitable apertures or recesses by means of which it may be mounted on or secured to other components of a commutator structure.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A method of making commutators which comprises cutting narrow longitudinal slots in a metal tube to form a plurality of segments supported in fixed relation to each other by an unslotted portion of the tube, cutting longitudinal grooves of greater width and lesser depth than the slots in the tube along the paths of the slots to form flanges on opposite sides of the segments extending longitudinally along the segments and toward the flanges of the adjacent segments in radially spaced and coaxial relation to the periphery of the slotted tube, filling the interior of the tube and the slots with plastic dielectric molding material to form a dielectric core for supporting the segments in a predetermined spaced relation to each other, curing the molding material, and cutting a peripheral slot along a plane perpendicular to the axis of the tube through the segments and the dielectric core to form a commutator with commutator segments embedded in a dielectric core and supported thereby in fixed and insulated relation to each other.

2. A method of making commutators which comprises cutting longitudinal slots of T-shaped cross section in a metal tube with the stem of the T-shaped opening on the center of the tube to form a plurality of segments supported in fixed relation to each other by an unslotted portion of the tube and to form flanges on opposite sides of the segments extending longitudinally along the segments and toward the flanges of the adjacent segments in radially spaced and coaxial relation to the periphery of the slotted tube, filling the interior of the tube and the slots with plastic dielectric molding material to form a dielectric core for supporting the segments in a

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predetermined spaced relation to each other, curing the molding material, and cutting a peripheral slot along a plane perpendicular to the axis of the tube through the segments and the dielectric core to form a commutator with commutator segments embedded in a dielectric core and supported thereby in fixed and insulated relation to each other.

3. A method of making commutators which comprises cutting longitudinal slots of T-shaped cross section in a metal tube with the stem of the T-shaped opening on the center of the tube to form a plurality of segments supported in fixed relation to each other by an unslotted portion of the tube and to form flanges on opposite sides of the segments extending longitudinally along the segments and toward the flanges of the adjacent segments in radially spaced and coaxial relation to the periphery of the slotted tube, filling the interior of the tube and the slots with plastic dielectric molding material to form a dielectric core for supporting the segments in a predetermined spaced relation to each other, curing the molding material, and cutting a peripheral slot along a plane perpendicular to the axis of the tube through the segments and partly into the dielectric core to form a slip ring and a commutator with the slip ring and the commutator segments supported on a dielectric core in fixed and insulated relation to each other.

4. A method of making commutators which comprises forming an annular axially directed concentric cavity in a cylindrical block of metal to provide a hub, an outer cylindrical wall, and an end wall, cutting a concentric bore through the hub, cutting longitudinal slots of T-shaped cross section in the outer cylindrical wall from one end thereof toward the end wall and with the stem of the T-shaped opening on the center of the outer cylindrical wall to form a plurality of segments supported by an unslotted portion of the outer wall and to form flanges on opposite sides of the segments extending longitudinally along the segments and toward flanges of the adjacent segments in radially spaced and coaxial relation to the periphery of the outer cylindrical wall and to form surfaces at the closed end of the slots sloping toward the outer periphery and the end wall of the block, filling the annular cavity and the spaces between the segments with a plastic dielectric molding material to form a dielectric core bonded to the block and having outer cylindrical surfaces concentric and flush with the peripheral surfaces of the segments, cutting a first circumferential slot partly into the core and through the slotted outer wall in a region intermediate the ends of the longitudinal slots to form a circumferential row of commutator segments supported on and embedded in the dielectric core at one end thereof in spaced and insulated relation to each other, and cutting a second circumferential slot through the outer cylindrical wall and partly into the dielectric core at the ends of the longitudinal slots to form

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a slip ring supported on the dielectric core at the other end thereof and to form a second ring supported on the dielectric core intermediate the ends thereof and having a plurality of slots and a plurality of peripheral cylindrical surfaces in circumferentially spaced relation to one another.

5. A method of making commutators which comprises forming an annular axially directed concentric cavity in a cylindrical block of metal to provide a hub, an outer cylindrical wall, and an end wall, cutting a concentric bore through the hub, cutting narrow radially directed slots longitudinally in the outer wall from one end thereof toward the end wall to form a plurality of segments supported by an unslotted portion of the outer wall and to form surfaces at the closed end of the slots sloping toward the outer periphery and the end wall of the block, cutting longitudinal grooves of greater width and lesser depth than the slots in the slotted outer wall along the paths of the slots to form flanges on opposite sides of the segments extending longitudinally along the segments and toward the flanges of the adjacent segments in coaxial and radially spaced relation to the outer periphery of the outer wall, filling the annular cavity and the spaces between the segments with a plastic dielectric molding material to form a dielectric core bonded to the block and having outer cylindrical surfaces concentric and flush with the peripheral surfaces of the segments, cutting a first circumferential slot partly into the core and through the slotted outer wall in a region intermediate the ends of the longitudinal slots to form a circumferential row of commutator segments supported on and embedded in the dielectric core at one end thereof in spaced and insulated relation to each other, and cutting a second circumferential slot through the outer cylindrical wall and partly into the dielectric core at the ends of the longitudinal slots to form a slip ring supported on the dielectric core at the other end thereof and to form a second ring supported on the dielectric core intermediate the ends thereof and having a plurality of slots and a plurality of peripheral cylindrical surfaces in circumferentially spaced relation to one another.

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