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END BELL OR END BRACKET FOR MOTORS

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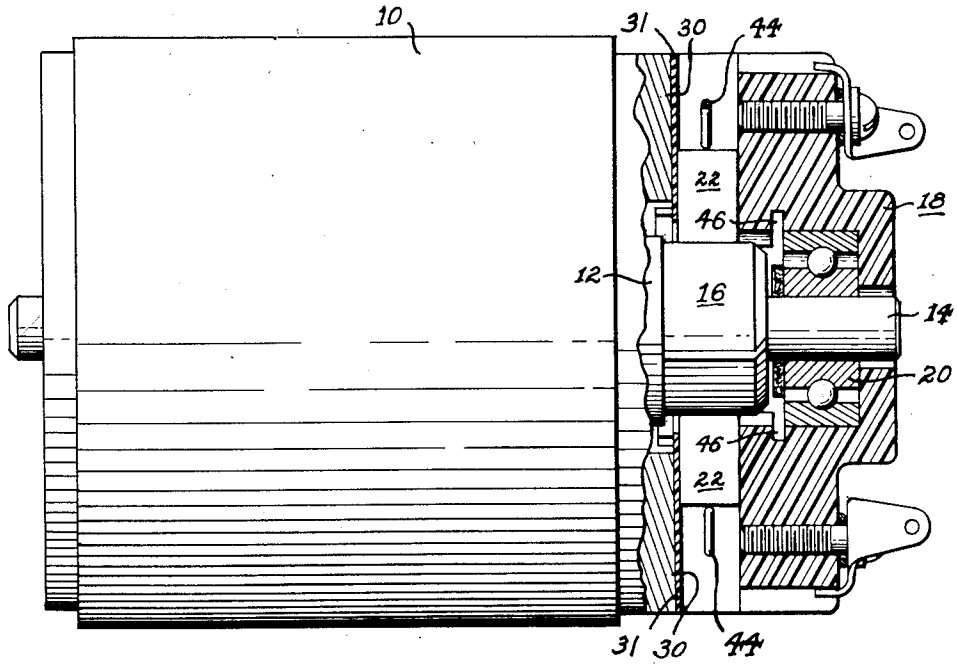



FIG. 1

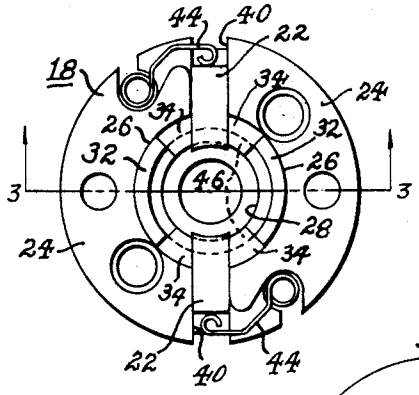



FIG. 2

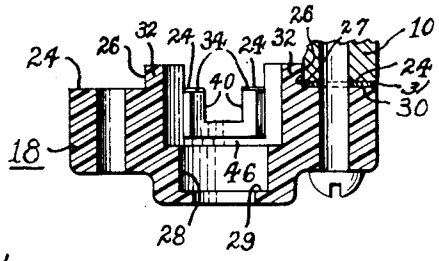



FIG. 3

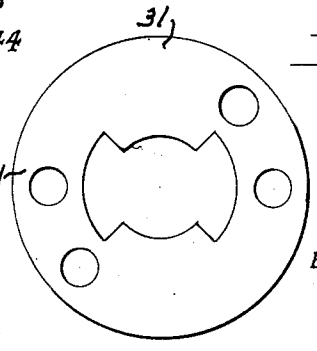



FIG. 4

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## END BELL OR END BRACKET FOR MOTORS

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7 Claims. (Cl. 310—238)

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This invention relates to aeronautical apparatus and more particularly to an electric motor for use in aircraft.

In constructing motors for use on aircraft, it is important to make the parts as small as possible and to arrange the parts as compactly as possible consistent with good electrical design. Consequently, it is important to make the end bells of the motors as small as possible, but the one end bell which serves to support both the bearing for the armature shaft and also the brushes must provide adequate space between the brushes and the bearing to provide sufficient dielectric strength. The danger of short-circuits is aggravated by the fact that the friction between the brushes and the commutator causes minute particles of conducting material to collect on the surfaces adjacent the brushes and unless the end bell is properly designed, these particles eventually build up a coating of conducting material on the inner surface of the end bell extending between the brushes and the motor bearing.

It is an object of this invention to provide an improved end bell construction which not only lends itself to mass production but also serves to prevent dielectric breakdowns or short-circuits.

Thus, it is an object of this invention to provide a very compact end bell wherein the brushes are supported close to the motor bearing and wherein the effective length of the surface between each brush and the bearing has been increased and so designed as to reduce the danger of a dielectric breakdown between the brushes and the bearing.

In high speed motors of the type commonly used on aircraft, it is important to provide a uniform air gap between the armature and the stator and consequently it is important to provide accurately machined reference surfaces on the end bells for engaging complementary reference surfaces on the main motor frame.

It is an object of this invention to provide an improved end bell construction wherein certain of the more accessible portions of the one face of a molded or cast end bell are machined to provide a reference plane and wherein other less accessible portions of the same face are not machined but do not extend beyond the machined portions.

Other objects and advantages reside in the construction of parts, the combination thereof and the mode of operation, as will become more apparent from the following description.

In the drawing:

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Figure 1 is an elevational view, with parts broken away, showing the relationship between the plastic end bell and certain of the other motor parts;

Figure 2 is an elevational view showing the one side of the end bell which faces the motor stator;

Figure 3 is a sectional view of the end bell taken substantially on line 3—3 of Figure 2 and showing a fragmentary portion of the motor stator frame; and

Figure 4 is a side view of the insulator which is mounted between the end bell and the motor frame.

Referring now to the drawing wherein I have shown a preferred embodiment of my invention, reference numeral 10 designates the main frame or stator of a small direct current motor having an armature or rotor 12 supported for rotation within the stator 10. The rotor 12 comprises a main shaft 14 which supports a conventional commutator 16 in accordance with well established practice. A plastic end bell 18 serves to support the bearing assembly 20 and the motor brushes 22, as best shown in Figure 1.

The plastic end bell 18 may be made from a cast or molded piece of plastic material, such as a phenol formaldehyde resin, or any other suitable type of insulating material. It has been found that it is impossible to form the molds accurately enough so as to eliminate the need for machining the reference surfaces on the end bell. The principal reference surfaces which must be machined are the surfaces designated by the reference characters 24, 26, 28 and 29. The reference surfaces 24 are provided on the one face of the end bell and serve to engage a flat insulating disc 31 which fits directly against a complementary reference surface 30 provided on the end of the motor stator 10. The surfaces 24 must be perpendicular to the surfaces 26 and 28 and serve the purpose of properly positioning the bearing assembly 20 and the end bell in proper alignment with the armature shaft 14. As shown in Figure 4, the insulating disc 31 is provided with a central cut out portion which permits the lugs 32 of the end bell 18 to project into the motor stator 10. The reference surfaces 26 are provided on the outer periphery of the arcuate lugs 32 and cooperate with complementary reference surfaces 27 provided on the main motor stator 10 (see Figure 3), so as to maintain the rotor in concentric relationship to the stator.

Since the end bell 18 is placed in the lathe while the surfaces 24, 26, 28 and 29 are being machined, it is obvious that the projecting lugs

32 interfere with machining the surfaces 34 which lie between the projecting lugs 32. It is desirable to form these relatively inaccessible surfaces 34 so as to be in substantially the same plane as the finished surfaces 24, and in order to achieve this end without need for resorting to any complicated machining operation and without making it necessary to have the surfaces 34 extend beyond the machine surfaces 24, the mold in which the end bell is made is so designed as to form the surfaces 34 slightly lower than the surfaces 24 so that after the surfaces 24 are machined the surfaces 34 will be in substantial alignment with the surfaces 24.

In molding the end bell 18, suitable brush guides 40 are provided as shown. These guides slidably support conventional brushes 22 which are biased into engagement with the commutator by any suitable means, such as spring fingers 44. Since the construction of the brushes and the means for holding the brushes against the commutator may be varied considerably without departing from the spirit of my invention, these means will not be described in greater detail.

It has been found that it is possible to reduce the axial distance between the brushes 22 and the bearing assembly 20 without reducing the distance which must be traversed by any short-circuiting current by providing circumferentially extending grooves 46 (see Figure 1) in the end bell surface between the brushes 22 and the bearing assembly 20. The side walls of the groove 46 are parallel and lie in planes substantially perpendicular to the axis of rotation of the rotor. The groove 46 not only serves to increase the effective length of the surface between each brush and the bearing assembly 20, so as to elongate the path of any short-circuiting current, but also serves to establish a pocket between each brush and the bearing assembly into which particles emanating from the brushes do not readily pass. Thus, the provision of the grooves 46 very materially increases the length of time that a motor of this type can be operated without the formation of a coating of short-circuiting material between the bearing assembly 20 and one or more of the brushes 22.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. In a small high speed motor for use in aircraft and the like, a stator, a rotor, said rotor having a shaft, a commutator supported on said shaft, an insulating end bell carried by said stator, said end bell having brush guides formed therein, a shaft bearing carried by said end bell, brushes slidably supported within said brush guides, and circumferentially extending groove means provided in the inner surface of said end bell between said brushes and said shaft bearing, the side walls of the groove means lying in planes substantially perpendicular to the axis of rotation of the rotor and offset from the end of the commutator.

2. In a small high speed motor for use in aircraft and the like, a stator having reference



surfaces formed thereon for engagement by an end bell, a rotor, said rotor having a shaft, a commutator supported on said shaft, an end bell carried by said stator and having reference surfaces complementary to said first named surfaces, certain of said reference surfaces being arranged at right angles to other of said reference surfaces, said end bell comprising a molded insulating member having machined reference surfaces and having brush guides molded therein, a shaft bearing carried by said end bell, and brushes slidably supported within said brush guides, said end bell having circumferentially extending groove means provided in the surface between said brushes and said shaft bearing, the side walls of the groove means lying in planes substantially perpendicular to the axis of rotation of the rotor, said planes being offset from the end of the commutator.

3. An end bell for a brush type of motor having a commutator, said end bell comprising a one-piece molded insulating member, brush guides formed in the one face of said member, said member having a substantially centrally located aperture therein, a first portion of said aperture being adapted to support a shaft bearing, said member having a circumferentially extending groove formed in the walls of said central aperture between said brush guides and said first portion, said groove being offset from the end of the commutator and having a pair of parallel side walls lying in planes substantially perpendicular to the axis of rotation of the motor whereby the effective length of the surface between said first portion and the brushes operating in said brush guides is increased.

4. An end bell for a brush type of motor having a commutator, said end bell comprising a one-piece molded insulating member, brush guides formed in the one face of said member, said member having a substantially centrally located aperture therein, a first portion of said aperture being adapted to support a shaft bearing, said member having a circumferentially extending groove formed in the walls of said central aperture between said brush guides and said first portion, said groove being offset from the end of the commutator and having a pair of parallel side walls lying in planes substantially perpendicular to the axis of rotation of the motor whereby the effective length of the surface between said first portion and the brushes operating in said brush guides is increased, and positioning lugs formed integrally with said end bell and projecting from said one face for engagement with a motor frame.

5. An end bell for a brush type of motor comprising a one-piece molded insulating member, brush guides formed in the one face of said member, a substantially centrally located aperture in said member, a first portion of said aperture being adapted to support a shaft bearing, a circumferentially extending groove formed in the walls of said central aperture between said brush guides and said shaft bearing supporting portion whereby the effective length of the surface between the bearing and the brushes operating in said brush guides is increased, the sides of the groove being parallel and lying in a plane substantially normal to the axis of rotation of the armature so that the groove forms a pocket into which particles emanating from the brushes do not readily pass, said one face of said member having a machined reference surface formed thereon, said machined

reference surface projecting slightly beyond the face of said member adjacent said central aperture, and projecting reference lugs extending beyond said machined surface and having machined surfaces formed thereon at right angles to said first named machined surfaces.

6. An end bell for a brush type of motor comprising a one-piece molded insulating member, brush guides formed in the one face of said member, a substantially centrally located aperture in said member, a first portion of said aperture being adapted to support a shaft bearing, said one face of said member having a machined reference surface formed thereon, said machined reference surface projecting slightly beyond the face of said member adjacent said central aperture, and projecting reference lugs extending beyond said machined surface and having machined surfaces formed thereon at right angles to said first named machined surfaces.

7. A method of manufacturing an end bell for a brush type of motor having brush guides formed in one face thereof, said method including the steps of molding the end bell from insulating material, forming brush guides therein and a centrally located aperture, said aperture having shoulders provided therein, the larger portion of the aperture having inwardly directed projections, these projections terminating in spaced relation from the annular surface, machining the annular surface which projects beyond the projections, said machined surface forming a reference surface, said end bell having projecting reference lugs projecting beyond said machined surface, and machining the reference lugs in a direction normal to the first machined surface.



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