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ROTARY ELECTRIC MOTOR

This invention relates to rotary electric motors.

So-called "miniature" electric motors of the permanent magnet field type are widely employed in various pieces of electrical equipment as drive motors, for example in
5 gramophones, tape recorders and players, optical equipment, office equipment, and also for computer-related equipment.

More recently, the possibility of employing these miniature electric motors has been considered for compact disc drive units.

10 In order to achieve volume production at a sufficiently low price to be competitive in the world's markets, it is the general practice for miniature electric motors of the permanent magnet field type for them to have a generally cup-shaped motor case manufactured by drawing and stamping
15 metal sheets. Compact disc equipment require close tolerances in the mounting of any drive motor. This has made it necessary for the Applicant company, as a major manufacturer of mass-produced electric motors of this kind, to subject an entire production run to inspection, with a
20 consequent sacrifice in overall efficiency, whereby to select those motors from any production run which would meet the aforementioned dimensional requirements. In an attempt to improve efficiency, the present Applicants have proposed to provide a conventional miniature electric motor with a
25 spacer machined to a high accuracy, thereby enabling the strict dimensional requirements to be achieved. Both because of the need to manufacture spacers at all, and also because their manufacturing process involves considerably close tolerances, this proposal has resulted in increased
30 production costs.

In the production and sale of miniature electric motors, it is the cost element which is paramount. The present invention has arisen from our work seeking to provide satisfactory solutions to the
 5 problem of providing mass-produced, and thus inexpensive, miniature electric motors for driving compact disc units and the like. The present invention has arisen from this work.

In accordance with the present invention,
 10 there is provided a rotary electric motor having a generally cup-shaped motor case comprising a generally cylindrical side wall and an end face; a bearing supported by said end face; a rotor shaft mounting a rotor and supported via said bearing for rotation within
 15 said motor case; a plurality of holes adapted for mounting the motor to an external structure being formed in said end face; and, circumjacent each such motor mounting hole and on the outer side of said end face, the respective surfaces being machined to a substantially
 20 common plane essentially perpendicular to the axis of said shaft and thereby providing a motor mounting surface adapted for facial contact with a surface of a said external structure.

The invention is hereinafter more particularly
 25 described by way of example only with reference to the accompanying drawings, in which:-

Fig. 1 is a side elevational view, partly in section, of an embodiment of miniature electric motor constructed in accordance with the present invention;

30 Figs. 2A, 2B and 2C are partial perspective views of embodiments of electric motor constructed in accordance with the present invention; and

Fig. 3 is a view generally similar to Fig. 1 of a conventional prior proposed miniature electric
 35 motor.

The motor of Fig. 3 is essentially conventional. It has a generally cup-shaped motor case 1 which has a generally cylindrical side wall and an end face 3, a central portion of which in effect forms a
 40 housing 12 for a bearing 11 for the rotor shaft 2. A second bearing 11 is mounted in

an end closure 9 for the otherwise open end of the motor case 1. The end closure 9 also mounts brush gear for the motor, which brush gear comprises terminals 5 which extend externally of the end closure for connection in an external electric circuit and brushes 8 positioned to make contact with a commutator 10 mounted on the rotor shaft together with rotor 7. One or more permanent magnets 6 forming the stator are mounted on the interior surface of the cylindrical side wall of the motor case 1.

10 It will be seen that the embodiment of motor illustrated in Fig. 1 and which is in accordance with the present invention is thus far identical with the motor of Fig. 3.

In order to mount the motor of Fig. 3 to an external structure, it is provided with a plurality of threaded through holes 4. The outer side of the end face 3 serves as a motor mounting surface intended to make facial contact with the surface of a said external structure and the holes 4 serve as motor mounting holes. In conventional mass-produced miniature electric motors of the kind illustrated in Fig. 3, the motor case 1 is formed by drawing a metal sheet. As a consequence, the closed end face 3 will not remain accurately and reliably square to the axis of the rotor shaft 2 throughout a production run.

25 In the embodiment of motor in accordance with the present invention illustrated in Fig. 1, the motor mounting surface 3 is provided by respective surface portions circumjacent each motor mounting hole and on the outer side of the end face of the motor case, which portions are relatively raised outwardly of the end face. This relatively raised motor mounting surface is formed integrally with the motor case as part of the mass production process. The so-produced motor case 1 is machined on the relatively raised portions. Such machining may be by way of cutting, or grinding and
35 polishing. The alternative of hand finishing by similar

processes is labour intensive and therefore not to be preferred. By this means, the motor mounting surface 3 is made essentially perpendicular to the axis of the shaft 2. Where particularly close tolerances are required and the motor mounting surfaces are required to intersect the axis of the shaft virtually exactly at 90° , such high precision can be achieved by mounting the shaft 2 of the fully assembled motor to a jig and then rotating the motor as a whole to grind and polish the motor mounting surfaces 3.

It will be appreciated that the raised portions which provide the motor mounting surface in the embodiment of Fig. 1 cover a minor proportion only of the whole surface of the bottom or closed end face of the motor case 1 so that the region over which irregularities and deformations need to be redressed in the machining step is significantly less than would be necessary if the whole of the outer bottom surface of the motor case were to be similarly machined, as would be necessary in the arrangement of Fig. 3 to achieve a similar effect; so that it will be seen that the embodiment of motor in accordance with the present invention can be produced with a relatively high working efficiency.

Figs. 2A, 2B and 2C schematically illustrate different configurations for the motor mounting surface 3. In Fig. 2A the motor mounting surface is provided as separate islands raised above the general surface of the closed end face of the motor case 1, the islands in each case surrounding a respective motor mounting hole 4. In the arrangements of Figs. 2B and 2C, the motor mounting surface is formed as a continuous ring about the axis of the shaft 2. In Fig. 2B this relatively raised portion is provided at the outer circumference of the motor while in Fig. 2C the surface is inset from the edge of the motor case.

Practical embodiments constructed as shown in Fig. 1 and Figs. 2A, 2B and 2C can readily be produced at

relatively low cost merely by processing and machining the motor case in a mass production process to produce miniature electric motors which can readily be installed with the precision required on pieces of external equipment such as compact disc players.

CLAIMS

1. A rotary electric motor having a generally cup-shaped motor case comprising a generally cylindrical side wall and an end face; a bearing supported by said end face; a rotor shaft mounting a rotor and supported via
5 said bearing for rotation within said motor case; a plurality of holes adapted for mounting the motor to an external structure being formed in said end face; and, circumjacent each such motor mounting hole and on the
10 outer side of said end face, a surface portion relatively raised outwardly of said end face, the respective surfaces being machined to a substantially common plane essentially perpendicular to the axis of said shaft and thereby providing a motor mounting surface adapted for facial
15 contact with a surface of a said external structure.
2. A motor according to Claim 1, wherein the motor mounting surface is machined by rotating the motor with the motor shaft fixed to a jig.
3. A motor according to Claim 1 or Claim 2, wherein said motor mounting surface is formed as a
20 plurality of separate islands respectively surrounding respective motor mounting holes.
4. A motor according to Claim 1 or Claim 2, wherein the motor mounting surface is formed as a continuous ring about the axis of the motor shaft.
- 25 5. A rotary electric motor substantially as hereinbefore described with reference to and as shown in Figures 1 to 2C of the accompanying drawings.

