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PATENT SPECIFICATION

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(54) A COMMUTATOR FOR A SMALL ELECTRODYNAMIC MACHINE

(71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London, E.C.2., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 THIS INVENTION relates to a commutator for a small electrodynamic machine, of the type in which each commutator segment is made of a sheet material comprising a metal substrate and a contact layer which consists of an alloy of one or more noble metals and which has been rolled onto the substrate.

Various embodiments of such commutators are known. For example, commutators in small direct-current motors may have segments each comprising a contact layer consisting of a silver palladium alloy. However, a disadvantage of this alloy is its limited useful life which under favourable conditions may be about 1,000 hours. Furthermore, owing to the rather rapid formation of wear particles, the quality of the commutation is not such as to render these alloys entirely suitable for electronically controlled small direct-current motors used, for example, in battery-fed music reproducing apparatus, since such electronic control requires the contact resistances between the commutator segments and the brushes to be constant within narrow limits. The brushes for motors in such apparatus are always made of metal.

Better commutation quality is obtainable with commutators having segments which are each provided by electrodeposition with a contact layer consisting of a gold alloy. These commutators may have the additional advantage of lifetimes of about 1,500 hours.

However, in many cases a longer useful life is desirable. Moreover, the criteria of useful life and commutation quality may suitably be considered together for an electronically controlled motor, since the product of wear

impair the contact between the brushes and the commutator segments and hence give rise to variation in the effective contact resistances and to short-circuits between the segments, resulting in unreliability of the speed control.

Manufacture of commutator segments each provided by electrodeposition with a contact surface layer of a gold alloy is comparatively complicated and, if satisfactory results are to be achieved, may require about thirty different plating baths. Moreover, the composition of some of these baths is highly critical, making it very difficult to maintain high quality for a prolonged period of time. Installation and operation of so high a number of electrodeposition baths of sizes suitable for mass production are expensive.

Notwithstanding the disadvantages which include those mentioned above, manufacturers of small high-quality electric motors suitable for use in advanced technology apparatus such as portable cassette recorders, Hi-Fi record players, etc., have generally opted for flat commutators having segments each provided with a contact layer of an electrodeposited noble-metal alloy, because the qualities of such commutators have been unsurpassable so far.

An object of the invention is to provide an improved commutator of the type defined at the beginning of this Specification.

According to the invention, in a commutator for a small electrodynamic machine, each commutator segment is made of a sheet material comprising a metal substrate and a contact layer which consists of a gold alloy and which has been rolled onto the substrate.

Suitably, the gold alloy comprises (69—71%) of gold and (19—21%) of silver, the remainder being substantially copper (composition by weight).

Furthermore, the gold alloy may contain (9—11%) of copper.

Preferably, the total percentage in the alloy of metallic impurities, not being gold, silver or copper, is not more than 0.05.

An important criterion with respect to the useful lifetime of a commutator is the mean roughness of the surface of the contact layer. Preferably, this is not more than 2μ .

- 5 Investigations have shown that flat commutators provided with a contact layer satisfying the last two-mentioned criteria may have lifetimes of more than 5,000 hours whilst retaining a hitherto unknown commutation quality. In addition it has been found that the manufacture of such commutators by known mass-production methods is so much simpler than that of the aforementioned commutators having electro-deposited contact layers that ultimately their cost is lower.
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WHAT WE CLAIM IS:—

1. A commutator for a small electro-dynamic machine, in which each commutator segment is made of a sheet material comprising a metal substrate and a contact layer which consists of a gold alloy and which has been rolled onto the substrate.
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2. A commutator as claimed in Claim 1, wherein the gold alloy contains (69—71%) of gold and (19—21%) of silver, the remainder being substantially copper.

3. A commutator as claimed in Claim 2, wherein the gold alloy contains (9—11%) of copper.

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4. A commutator as claimed in Claim 3, wherein the total percentage in the alloy of metallic impurities not being gold, silver or copper, is not more than 0.05.

5. A commutator as claimed in any preceding Claim, wherein the mean roughness of the surface of the contact layer is not more than 2μ .

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6. A commutator as claimed in Claim 1 and substantially as herein described.

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