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Datasheet for the decision of 27 July 2010

Case Number: T 0797/07 - 3.5.02

Application Number: 00106533.3

Publication Number: 1091473

IPC: H02K 23/38

Language of the proceedings: EN

Title of invention:
Commutator of an electric motor

Applicant:
ASMO CO., LTD.

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Relevant legal provisions (EPC 1973):
-

Keyword:
"Inventive step - yes (after amendment)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0797/07 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 27 July 2010

Appellant: ASMO CO., LTD.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 11 December 2006 refusing European application No. 00106533.3 pursuant to Article 97(1) EPC 1973.**

Composition of the Board:

Chairman: M. Ruggiu
Members: G. Flyng
P. Mühlens

Summary of Facts and Submissions

I. The applicant appealed against the decision of the examining division refusing the European patent application no. 00 106 533.3.

II. The following prior art document references are used in this decision:

D1: US 1 464 123
D2: US 3 484 634
D3: US 4 876 472 (corresponding to JP 2 535 181)

III. The examining division refused the application on the grounds that claim 1 filed during the oral proceedings of 7 November 2006 lacked an inventive step, Article 56 EPC, over document D1.

The examining division held inter alia that there was no technical effect caused by dividing the winding into upper and lower layer windings and connecting them to the commutator segments as defined in the characterising portion of claim 1 on file at the time (see sections 10.2.7 and 10.3 of the reasons).

IV. With the written statement setting out the grounds of appeal (letter of 20 April 2007) the appellant filed new claims according to a main and an auxiliary request and argued *inter alia* that the subject-matter of claim 1 was new and inventive over documents D1, D2 and D3.

V. The board summoned the appellant to attend oral proceedings. In an annex to the summons the board raised questions concerning the admissibility of certain amendments, and concerning clarity and support in the description, Articles 123(2) and 84 EPC. Furthermore, the board made observations on the prior art documents D1, D2 and D3.

VI. With a letter dated 27 May 2010 the appellant filed new claims 1 to 5 and description pages 1 to 4 according to a new main request, replacing the main request and auxiliary request of 20 April 2007. The appellant addressed the points raised in the annex to the summons.

VII. In a telephone conversation with the appellant's representative on 22 June 2010 the rapporteur discussed possible amendments to claim 1.

VIII. With a letter dated 24 June 2010 the appellant filed new claims 1 to 5 replacing those filed hitherto.

Independent claim 1 reads as follows (feature references (F) added by the board):

F1 *"An electric motor having power supply brushes comprising:*

F2 *a slotted core (12);*

F3 *a commutator (14, 24) having a plurality of segments (15, 26) disposed in a commutator ring (14a);*

F4 *plural sets of power supply brushes (17a - 17d) held in sliding contact with the plurality of segments (15, 26); and*

F5 *a plurality of shorting members (16, 27) for electrically connecting same-phase segments (15, 26) of the plurality of segments (15, 26), the same-phase segments being segments of the commutator which are in the same phase to each other, which are positioned at opposite sides of the commutator with an 180° interval, and which are contacted by different brushes of the same polarity,*

F6 *wherein each of the power supply brushes (17a - 17d) has a segment contact surface width (W), the width (W) being defined to bridge three segments (15), so that in any instances during rotation of the electric motor, each power supply brush (17a - 17d)contacts at least two adjacent segments (15, 26) at the same time,*

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F7 *a plurality of lower layer windings (19, 20) wound around and all over the slotted core (12) as a lower layer and a plurality of upper layer windings (21, 22) wound around and all over the slotted core (12) as an upper layer,*

F8 *wherein the number of turns of the windings (19 - 22) is the same among the winding layers,*

F9 *wherein each lower layer winding (19, 20) of the plurality of lower layer windings is wound such that a wire is connected to a first segment (S1, S12), extended near a rotary shaft (13) of the motor while bypassing the same, wound at a position of the slotted core (12) which opposes the first segment (S1, S12) with a 180° angular interval, extended near the rotary shaft (13) and connected to another segment (S2, S13) adjacent to the first segment (S1, S12),*

F10 *wherein each upper layer winding (21, 22) of the plurality of upper layer windings is wound such that a wire is connected to a first segment (S1, S12), wound at a position of the slotted core corresponding to the first segment (S1, S12) and connected to another segment (S2, S13) adjacent to the first segment,*

F11 *wherein each upper layer winding (21, 22) is wound at the same position of the slotted core (12) as a lower layer winding (20, 19) and is connected to segments of the commutator ring that are same-phase segments of the segments to which the lower layer winding (20, 19) wound at the same position of the slotted core (12) is connected."*

Claims 2 to 5 are dependent on claim 1

IX. The appellant (applicant) requested that the decision under appeal be set aside and the patent be granted in the following version:

Description:

– Pages 1 to 4 filed with the letter dated 27 May 2010;
– Pages 5 to 13 as originally filed;

Claims:

– Nos. 1 to 5 filed with the letter dated 24 June 2010;

Drawings:

– Sheets 1/4 to 4/4 as originally filed.

X. With a communication dated 25 June 2010 the Board advised that the oral proceedings set for 30 June 2010 were cancelled.

XI. The appellant argued essentially that the claims as amended did not introduce fresh subject-matter and were novel and inventive over the cited prior art. In particular, document D1 did not suggest the specific way of providing the windings as set out in claim 1 and documents D2 and D3 did not disclose any details of the armature windings structure or with respect to multiple same-polarity brushes. Thus, even an arbitrary combination of documents D1 to D3 could not have inspired the skilled person such that the subject-matter of claim 1 became obvious.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments, Article 123(2) EPC*

2.1 Features F1, F3 and F4 are unchanged from claim 1 as originally filed.

2.2 Feature F2 is directly and unambiguously derivable from claim 7 and paragraph [0013] of the application as originally filed (see publication EP 1 091 473 A2).

2.3 Feature F5 is adapted from a feature of claim 1 as filed. Concerning the amendments: the fact that there is a plurality of shorting members (16, 27) and the definition of "same-phase segments" are both directly and unambiguously derivable from figures 3A, 3B, 5 and 7 as well as paragraphs [0014], [0017] and [0034] of the application as originally filed.

2.4 Feature F6 is also adapted from a feature of claim 1 as filed, the amendment being directly and unambiguously derivable from paragraph [0026], column 5, lines 20 to 25 of the application as originally filed.

2.5 Features F7 to F10 are directly and unambiguously derivable from figure 4 and the description of the windings in paragraphs [0019] to [0025] of the application as originally filed. In particular, feature F7 is derivable from paragraphs [0022] and [0025], feature F8 from paragraph [0022], feature F9 from paragraph [0020] and feature F10 from paragraph [0023].

2.6 Feature F11 is adapted from a feature of claim 7 as originally filed, that "windings (19 - 22) of a same phase are wound around a same slotted core (12) in a plurality of winding layers and connected to same phase segments". Given that the description and figures mention only one slotted core 12, the reference in original claim 7 to "a same slotted core" has to be understood as meaning the same slotted core. The arrangement of the windings of the invention is shown in figure 4. It is evident from figure 4 that upper layer winding 21 is connected to the segments S1, S2 of the commutator that are same-phase segments of the segments S12, S13 to which lower layer winding 20 is connected and it is furthermore evident that upper layer winding 21 and lower layer winding 20 are wound at the same position of the slotted core 12. The same is evident for the upper layer winding 22 and lower layer winding 19. Thus, feature F11 is directly and unambiguously derivable from original claim 7 in conjunction with figure 4.

2.7 For the above reasons, the amendments to the claims do not offend Article 123(2) EPC.

3. *Novelty and inventive step, Articles 54 and 56 EPC*

3.1 Novelty was not contested in the first instance proceedings and the Board has found no document that discloses all the features of claim 1 in combination.

3.2 Document D1 discloses various arrangements for the positioning and interconnection of commutator segments and brushes in an electrical machine. Figure 3 shows an embodiment in which "the commutator is fully equalized,

that is, where each segment is connected to the corresponding segments at the other poles of the same sign" (see page 1, lines 79 to 84).

In Figure 3 of D1 there are three groups of axially aligned brushes 21, 22, 23, the groups being spaced apart around the commutator by one commutator segment less than two pole pitches (see page 1, lines 84 to 90). It seems that, as in the embodiment of figure 2, each brush embraces somewhat more than three commutator segments (see page 1, lines 77 and 78).

The armature in D1 has three windings 6, 7, 8. Winding 6 is connected to commutator segments 15, winding 7 to commutator segments 16 and winding 8 to commutator segments 17. The commutator segments 15, 16 and 17 are arranged in a repeating sequence around the commutator. In figure 3, the windings 6, 7 and 8 are shown only schematically, and there is no disclosure of the manner in which they are wound on the armature.

In view of the disclosure of an equalised commutator in combination with multiple brushes that are spaced around the commutator and are able to span three commutator segments, document D1 represents the prior art closest to the present invention.

The subject-matter of claim 1 differs from the disclosure of document D1 by the features set out in the characterising portion (features F7 to F11). These features define the arrangement of the winding, with upper and lower layer windings connected to the commutator in a specifically defined manner. The

defined winding arrangement corresponds to that shown in figure 4 of the application.

3.3 In the contested decision (see paragraph 10.2.4), the examining division noted that the short circuiting connections between segments S1 and S12 (although the decision refers at this point to S2, it is apparent that S12 was intended) and also between segments S2 and S13 lead to an electrical circuit in which all said layer windings 19 to 22 are connected in parallel. The examining division held that in view of this parallel connection, the upper and lower layer windings behaved magnetically as if they were one single winding and therefore there was no technical effect caused by dividing the winding into upper and lower windings (see sections 10.2.4 to 10.2.7 of the decision). The Board does not share this view for the following reasons.

Given that in document D1 the armature windings are disclosed only schematically, with no details of the layout of the winding being given, it does not seem possible to predict what technical effects the winding of D1 might achieve. Present claim 1 on the other hand does define a particular winding layout that comprises a specific arrangement of upper and lower layer windings. According to the description, with the arrangement of upper and lower layer windings imbalance of power supply that may be caused by variation in the sliding-contact of the brushes 17a to 17d with the commutator segments can be reduced. Furthermore, fluctuation in rotation, vibration and unusual noise of the motor can be reduced (see paragraphs [0027] and [0028]). In the Board's view these claimed benefits are at least plausible with the winding as claimed, as it

provides for an arrangement in which same-phase commutator segments are connected to an upper winding and a lower winding on both opposing sides of the armature, an arrangement that would be well balanced both mechanically and magnetically.

3.4 None of the prior art documents mentioned during the procedure before the department of first instance discloses the claimed winding layout. Document D2 refers to lap-wound armatures (see column 1, lines 35 to 40) but does not disclose any details of the armature winding layout. Document D3 does disclose specific winding layouts but none which have upper and lower winding layers and more particularly windings that are connected to the commutator in the manner as claimed. Thus, the cited prior art could not lead the skilled person to adapt the disclosure of document D1 in such a way that the subject-matter of claim 1 is reached.

3.5 For these reasons the Board concludes that the subject-matter of claim 1 is new and not obvious to the person skilled in the art. The same applies to the remaining claims 2 to 5 at least in view of their dependency on claim 1.

4. In view of the above the board accedes to the appellant's request for grant.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent in the following version:

Description:

– Pages 1 to 4 filed with the letter dated 27 May 2010;
– Pages 5 to 13 as originally filed;

Claims:

– Nos. 1 to 5 filed with the letter dated 24 June 2010;

Drawings:

– Sheets 1/4 to 4/4 as originally filed.

The Registrar: The Chairman:

P. Cremona M. Ruggiu