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Datasheet for the decision of 12 October 2007

Case Number: T 0569/05 - 3.5.02

Application Number: 00126511.5

Publication Number: 1134877

IPC: H02K 15/12

Language of the proceedings: EN

Title of invention:
Stator for an automotive alternator and method of manufacturing the same

Applicant:
MITSUBISHI DENKI KABUSHIKI KAISHA

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - main and auxiliary request - (no)"

Decisions cited:
-

Catchword:
See point 4 of the reasons.

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0569/05 - 3.5.02

D E C I S I O N
of the Technical Board of Appeal 3.5.02
of 12 October 2007

Appellant: MITSUBISHI DENKI KABUSHIKI KAISHA
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 30 November 2004 refusing European application No. 00126511.5 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: M. Ruggiu
Members: J.-M. Cannard
E. Lachacinski

Summary of Facts and Submissions

I. The appellant contests the decision of the examining division to refuse European patent application No. 00 126 511.5. The reasons given for the refusal were that the subject-matter of claim 1 according to the main and auxiliary requests filed with the letter of 26 October 2004 did not involve an inventive step and the subject-matter of claim 2 according to said requests was not new.

II. The document:

D1: EP-A-0 917 278,

considered in the first instance proceedings, remains relevant to the present appeal.

III. Claims according to a main and an auxiliary request were filed with a letter dated 12 September 2007.

Independent claim 2 of the main request reads as follows:

"A stator (8) for an automotive alternator including a rotor (7) having claw-shaped magnetic poles (23, 24) fitted an *[sic]* a rotating shaft (6) and cooling fans (5), wherein said stator (8) is disposed around the outer circumference of said rotor (7), has a coil (16) wound therearound and connected into three-phase alternating-current connections, and is ventilated and cooled by said fans (5),

said stator (8) including a stator core (15) in which a plurality of slots (15a) are formed, and a stator coil

(160) wound around said stator core (15), said stator coil (160) being composed of a plurality of electric conductors jointed to each other,

each of said electric conductors including a plurality of U-shaped conductor segments (31) each inserted into each pair of said slots from a first end of said stator core (15), said conductor segments (31) being bent in a circumferential direction and jointed to each other so that said conductor segments (31) are connected to other conductor segments (31), which are located at different slots (15a), at the open ends thereof, and

curved portions of said conductor segments (31) at the first end of said stator core (15) being disposed in a circumferential direction so as to constitute a counter-joint-side coil end (160a) and joint portions (26) of said conductor segments (31) at a second end of said stator core (15) being disposed in a circumferential direction so as to form a joint-side coil end (160b), wherein:

a varnish is applied to said joint-side coil end (160a) and a varnish is applied to said counter-joint-side coil end (160b), characterized in that

the average amount of application per unit area of the varnish with which one of said coil ends (160a, 160b) is impregnated is larger than the average amount of application per unit area of the varnish with which the other of said coil ends (160a, 160b) is impregnated, and

the varnish, with which said joint-side coil ends (160a) are impregnated, fills the spaces between said electric

conductors inclined in the circumferential direction of said stator (8) without leaving any gaps having no varnish."

Independent claim 2 of the auxiliary request reads as follows:

"A method of manufacturing a stator (8) for an automotive alternator including a rotor (7) having claw-shaped magnetic poles (23, 24) fitted an *[sic]* a rotating shaft (6) and cooling fans (5), wherein said stator (8) is disposed around the outer circumference of said rotor (7), a coil (16) is wound therearound and connected into three-phase alternating-current connections, and is ventilated and cooled by said fans (5),

said stator (8) including a stator core (15) in which a plurality of slots (15a) are formed, and a stator coil (160) wound around said stator core (15), said stator coil (160) being composed of a plurality of electric conductors jointed to each other,

each of said electric conductors including a plurality of U-shaped conductor segments (31) each inserted into each pair of said slots from a first end of said stator core (15), said conductor segments (31) being bent in a circumferential direction and jointed to each other so that said conductor segments (31) are connected to other conductor segments (31), which are located at different slots (15a), at the open ends thereof, and

curved portions of said conductor segments (31) at the first end of said stator core (15) are disposed in a

circumferential direction so as to constitute a counter-joint-side coil end (160a) and joint portions (26) of said conductor segments (31) at a second end of said stator core (15) are disposed in a circumferential direction so as to form a joint-side coil end (160b), wherein:

a varnish is applied to said joint-side coil end (160a) and a varnish is applied to said counter-joint-side coil end (160b) in such a manner that the average amount of application per unit area of the varnish with which one of said coil ends (160a, 160b) is impregnated is larger than the average amount of application per unit area of the varnish with which the other of said coil ends (160a, 160b) is impregnated, and

the varnish, with which said joint-side coil ends (160a) are impregnated, fills the spaces between said electric conductors inclined in the circumferential direction of said stator (8) without leaving any gaps having no varnish."

IV. Oral proceedings were held before the Board on 12 October 2007.

V. The submissions of the appellant that are relevant to the present decision can be summarized as follows:

The cited prior art only disclosed stators in which the same situation existed, in respect of varnish, at the joint-side coil end and the counter-joint-side coil end, or where only one of these coil ends was impregnated with varnish. More specifically, in document D1, it was foreseen to have either both coil ends coated with thin

films of resin, which hardly affected the respective air flows (paragraph [0036]), or both coil ends coated with thick films of resin, with no gaps at the coil ends to provide vibration proof (paragraph [0044]). Paragraph [0030] of D1 indicated that an insulating member, thick only in regions contacting joint portions, might bridge a plurality of joint portions to improve vibration proof and durability. However, this passage of D1 remained silent on the situation at the other coil end. Thus, the teaching of D1 was to apply the same total amount of varnish to both coil ends of the stator.

The expression "average amount of application per unit area of the varnish" in the claims could be understood as the total amount of varnish which was applied to the joint-side coil end or to the counter-joint-side coil end. The present invention recognized that the situations were different at the two coil ends and were differently influenced by the varnish. Thus, different total amounts of varnish were applied to both coil ends.

More specifically, in the stator shown in figure 2 of the present application, the axial height Ma of the inclined portions of the conductor segments at the joint-side coil end was smaller than the axial height Mb of the inclined portions of the conductor segments at the counter-joint-side coil end. In this case, in accordance with the present invention, the gaps on the joint-side coil end were filled with varnish to ensure insulation and improve rigidity. A smaller amount of varnish was applied to the other coil end of the stator of the invention, so as to reduce the costs. Thus, the invention achieved advantageous and unexpected effects by applying different total amounts of varnish to both

coil ends. The claimed solution was not suggested by the cited prior art and involved an inventive step.

VI. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of claims 1 to 8 of the main request filed with the letter dated 12 September 2007, or alternatively on the basis of claims 1 to 8 of the auxiliary request filed with the same letter.

Reasons for the Decision

1. The appeal is admissible.

Independent claim 2 of the main request

2. Prior art document D1 relates to an alternator for a vehicle which includes a rotor (3) having claw-shaped magnetic poles fitted on a rotating shaft (6), cooling fans (12, 13), and a stator (2) which is disposed around the outer circumference of said rotor. The stator (2) has a coil wound therearound, which is connected into three-phase alternating-current connections, and is ventilated and cooled by said fans.

2.1 The stator (2) includes a stator core (32) in which a plurality of slots (35) are formed, and the stator coil is wound around said stator core, said stator coil being composed of a plurality of electric conductors jointed to each other. Each of said electric conductors includes a plurality of U-shaped conductor segments (33) inserted into each pair of slots from a first end of said stator core, said conductor segments (33) being bent in a

circumferential direction and jointed to each other so that said conductor segments are connected to other conductor segments, which are located at different slots, at the open ends thereof. The curved portions of said conductor segments at the first end of said stator core are disposed in a circumferential direction so as to constitute a counter-joint-side coil end (31a). Joint portions (331d, 332d, 332e, 331e) of said conductor segments (33) at a second end of said stator core are disposed in a circumferential direction so as to form a joint-side coil end (31b) (see D1, the first embodiment, paragraphs [0019] to [0030]; figures 1 to 5). According to lines 20 to 22 of paragraph [0044], the joint-side coil end (31b) and the counter-joint-side coil end (31a) of the stator of the first embodiment of D1 may be coated with thick films of varnish to provide vibration proof, and the gaps between the coil ends are absent. Therefore, D1 discloses a stator which comprises all the features recited in the preamble of claim 2, as well as the feature specified in the last paragraph of this claim.

2.2 The joint portions of the conductor segments at the joint-side coil end (31b) and the curved portions of the conductors segments at the counter-joint-side coil end (31a) of the first embodiment of D1 have different shapes (see figures 3 and 4). However, it is not specified in D1, nor unambiguously derivable from its disclosure, whether the total amounts of varnish applied to fill the gaps at the joint-side coil end and at the counter-joint-side coil end are different. Therefore, taking account that, according to the appellant, the average amount of application per unit area of the varnish applied to a coil end can be understood as the

total amount of varnish applied to said coil end, the subject-matter of claim 2 could only differ from the stator according to the prior art shown in D1 in that "the average amount of application per unit area of the varnish with which one of said coil ends (160a, 160b) is impregnated is larger than the average amount of application per unit area of the varnish with which the other of said coil ends (160a, 160b) is impregnated", as recited in the first paragraph of the characterising part of claim 2.

3. Different ways of applying varnish to the coil ends of the stator are described in D1. In paragraph [0030], column 8, lines 1 to 5, it is said that "To improve vibration proof and durability with respect to environments, an insulating member may bridge a plurality of joint portions. Preferably, the insulating member is thick only in regions contacting the joint portions". However, the situation at the counter-joint-side coil end is not described. Furthermore, paragraph [0036] of D1 discloses that "The first and second coil ends groups 31a and 31b are coated with thin films of resin, and all the gaps between the coil ends are not fully blocked thereby", and that "the thin films hardly affect air flows". According to paragraph [0044] of D1 (see *above*), the varnish can also be applied in such amounts that "the gaps between the coil ends are absent". Accordingly, in the judgement of the Board, D1 does not simply show stators in which the same total amounts of varnish are applied to the joint-side coil end and to the counter-joint-side coil end, as alleged by the appellant. D1 teaches also that a coil end can be coated with a thin film of varnish, so that the gaps are not fully blocked when the air flow should not be affected,

or with a thick film to fill the gaps with varnish when it is important to improve vibration proof.

4. A well known problem in the field of alternators is to improve cooling of the stator, in particular of the stator winding. Since D1 provides indications of the respective results on the cooling performance and vibration proof which would be obtained by thin films of varnish and thick films of varnish fully blocking the gaps of the coil ends, starting from the disclosed alternative in which the joint-side coil end and the counter-joint-side coil end are both coated with thick films of varnish filling the gaps between the coil ends, it would be obvious to the skilled person to apply a smaller total amount of varnish to the stator coil end where the rectifiers are disposed, which requires a higher cooling performance. This would reduce the amount of varnish coating the stator coil ends. In the view of the Board, this constitutes a necessary consequence that does not confer inventiveness to the obvious solution. A stator in which different total amounts of varnish are applied in this manner to the joint-side coil end and to the counter-joint-side coil end would not differ from the claimed stator. Accordingly, the subject-matter of claim 2 of the main request is not considered as involving an inventive step (Article 56 EPC) and the main request is not allowable.

Independent claim 2 of the auxiliary request

5. Claim 2 of the auxiliary request relates to a method of manufacturing a stator for an automotive alternator in which the stator comprises the same structural features as the stator recited in claim 2 of main request. The

process features of claim 2 simply specify that varnish is applied to the joint-side coil end and the counter-joint-side coil end **in such a manner that** the features set out in the characterising part of claim 2 of the main request are obtained. As it is obvious to wish to manufacture an obvious stator, the method of claim 2 of the auxiliary request does not meet the requirement of Article 56 EPC for substantially the same reasons as the stator according to claim 2 of the main request.

6. Since none of the versions of claim 2 according to the requests on file meets the requirements of the EPC, the appeal has to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

U. Bultmann M. Ruggiu