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D E C I S I O N
of 29 January 2004

Case Number: T 0894/01 - 3.2.6

Application Number: 93109498.1

Publication Number: 0575857

IPC: B23K 11/25

Language of the proceedings: EN

Title of invention:

Methods and apparatus for fusing electrical conductors

Patentee:

AXIS S.p.A.

Opponent:

ATOP S.p.A.

Headword:

-

Relevant legal provisions:

EPC Art. 56, 123

Keyword:

"Amendments - allowability (yes)"

"Novelty (yes)"

"Inventive step (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0894/01 - 3.2.6

D E C I S I O N
of the Technical Board of Appeal 3.2.6
of 29 January 2004

Appellant: AXIS S.p.A.
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Respondent: ATOP S.p.A.
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Respondent: Celestino, Marco
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 3 July 2001
revoking European patent No. 0575857 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Alting van Geusau
Members: H. Meinders
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. European Patent Nr. 0 575 857, granted on application Nr. 93 109 498.1, was revoked by the Opposition Division by decision posted on 3 July 2001. It based the revocation on the finding that the subject-matter of the claims 1 of the patent as amended according to the main request as well as the auxiliary requests 1, 3, 4, 6 and 7 did not involve an inventive step. The auxiliary requests 2 and 5 were not admitted as their filing was considered an abuse of the procedure.

In arriving at this conclusion it referred in particular to the following documents:

D1: EP-A-0 419 849 and

D4: US-A-4 734 556.

Of the other documents available in the opposition proceedings also the following is relevant for the present decision:

D6: Qualifizierung des Widerstandpreßschweißens mit Gleichstrom zum Fügen von Hakenkollektoren mit lackisolierten Kupferdrähten, P.M. Schäfer, Techn.-wiss. Bericht, MPA Stuttgart (1990).

II. The Appellant (Patentee) both filed a notice of appeal against this decision and paid the appeal fee on 2 August 2001. On 2 November 2001 the grounds of appeal were filed, requesting maintenance of the patent according to any of the requests made in the opposition proceedings.

III. The Respondent (Opponent) replied to the statement of grounds of appeal with letter of 19 August 2002. With letter of 4 November 2003 the Board summoned to oral proceedings to be held on 29 January 2004, followed by a communication setting out its preliminary opinion, dated 29 December 2003. With fax received on 30 December 2003 the Respondent notified the Board that it would not attend the oral proceedings, that it no longer wished to contest the appeal, and that it withdrew its reply to the statement of grounds as well as the assertion that the alleged prior uses it had brought up in opposition formed part of the state of the art. It filed no further requests.

IV. Oral proceedings were held on 29 January 2004, at which the Appellant reduced his requests to a single request for maintenance of the patent on the basis of the following documents:

claims 1 to 20,

description, columns 1 to 9, both filed during the oral proceedings,

figures 1 to 13 as granted.

V. Independent claim 1 of the patent according to the request of the Appellant reads:

"An apparatus for performing a fusing operation of at least one wire (27) to an electrically conductive section (28) of an armature or a stator;

said apparatus comprising;

means for moving a fusing member (24) relative to said wire and said conductive section (28) in order to cause said fusing member (24) to contact and apply force to said conductive section (28) thereby plastically deforming it around said wire;

means for controlling said means for moving the fusing member in accordance with a predetermined fusing function of force or electrode displacement;

means for deriving an electric heating supply from an AC mains supply for heating the fusing member, the conductive section and the wire by passing a current through the fusing member, the conductive section and the wire; and

characterised in that said heating means comprises means (12, 14) for converting the AC mains supply to a DC supply; and

regulating means (16, 18, 30) for pulse modulating the DC supply in response to trigger signals based on a timing frequency which is substantially higher than that of the AC mains supply, and for adjusting the trigger signals during the fusing operation so that the electric heating supply is controlled during the fusing operation at the timing frequency in accordance with a predetermined electrical heating function, and means (22) for rectifying this electric heating supply into a smoothed DC electric heating supply to the fusing member, conductive section and wire, which supply is synchronised with the movement of the fusing member."

Independent claim 13 of that request reads as follows:

"A method for performing a fusing operation of at least one wire (27) to an electrically conductive section (28) of an armature or a stator;

said method comprising moving a fusing member (24) relative to said wire (27) and said conductive section in order to cause said fusing member to contact and apply force to said conductive section thereby plastically deforming said conductive section around said wire;

controlling said movement of the fusing member in accordance with a predetermined fusing function to control said applied force or the movement of said fusing member;

heating the fusing member, the conductive section and the wire by passing electric heating current derived from an AC mains supply through them; and

characterised by converting the AC mains supply to a DC supply; and regulating the DC supply by pulse modulating it in response to trigger signals based on a timing frequency which is substantially higher than that of the AC mains supply the timing signals being adjusted during the fusing operation so that the electric heating supply is controlled at the timing frequency during the fusing operation in accordance with a predetermined electrical heating function, and rectifying the electric heating supply into a smoothed DC electric heating supply to the fusing member,

conductive section and wire, which supply is synchronised with the movement of the fusing member."

VI. In support of his request the Appellant argued essentially as follows:

D1 constituted the closest prior art, from which the subject-matter of claims 1 and 13 differed by the characterising portions. It was not obvious to apply the teaching of D4, which related to inverters for resistance welding, to the fusing apparatus disclosed in D1, as both processes were different in their effect on the parts to be joined. Welding implied melting of the materials, due to the resistance generated between them by the current applied by an electrode which did not have a heating function as was the case in a fusing operation. In the latter the electrode had a high resistance, thus produced the heat which was conveyed by physical contact to the parts to be joined, thus not resulting in melting, but in a plastic deformation and joining the parts essentially by hot-forging.

D4, in any case, did not provide an indication to synchronise this supply with the movement of the electrode.

D6 related to a fusing apparatus with a DC supply rectified from an AC mains supply. The former was, however, controlled before rectification on the primary side, by a delta pulse generator. In its long list of problems encountered in fusing joints with this DC fusing apparatus it did not mention once any shortcomings in the power supply and its control. Thus

there was no incentive for the skilled person to look for a differently controlled power supply.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments - Article 123(2) and (3) EPC*
 - 2.1 Independent claims 1 (apparatus) and 14 (method) as granted, now claims 1 and 13, have been amended as follows (in brackets the basis for the amendment in the original application documents):
 - not only the wire is heated, but the fusing member and the conductive section as well, by passing a current through them (claims 1 and 20, page 1, lines 10 to 27, page 12, lines 6 to 17);
 - there are means for adjusting the trigger signals during the fusing operation to control the electrical heating supply at the timing frequency (page 10, lines 11 to 31);
 - the electrical heating supply is rectified into a smoothed DC electrical heating supply, which supply is synchronised with the movement of the fusing member (page 9, line 34 to page 10, line 10).

The amendments result in further limitation of the subject-matter of the independent claims as granted,

thus the requirements of Article 123(2) and (3) EPC are fulfilled.

3. *Inventive step (Article 56 EPC)*

3.1 Novelty of the subject-matter of the independent claims is given; the Board has ascertained that none of the available prior art disclosures discloses all features of these claims.

3.2 For the discussion of inventive step the closest prior art is considered by the Board to be constituted by D6, as this document discloses an apparatus and a method for performing fusing operations of a wire to an electrically conductive section of an armature or a stator according to the preambles of claims 1 and 13, which in addition comprises a DC supply rectified from an AC supply, a feature which is mentioned in the characterising parts of these claims. The power supply, and thus the electrical heating supply, is further controlled during the fusing operation in accordance with a predetermined electrical heating function (see page 190 referring to a two-stage fusing operation).

The arrangement known from D6 has the drawback that the DC supply is controlled on the primary side by a delta pulse generator, which does not allow for a precise control of the fusing process (see also patent in suit, column 1, lines 40 to 45). Also, the electrical heating supply is not related to the movement of the fusing member, i.e. to its position during the fusing operation (see column 2, lines 39 to 54).

The apparatus according to claim 1 and the method according to claim 13 solve this problem by providing regulating means for pulse modulating the DC supply in response to trigger signals based on a timing frequency substantially higher than that of the AC mains supply, while adjusting the trigger signals during the fusing operation to control the electric heating supply at the timing frequency, as well as means for rectifying the electric heating supply into a smoothed DC electric heating supply which is synchronised with the movement of the fusing member.

- 3.3 D4 relates to the provision of controlled electrical power to an electrode in a spot welding apparatus.

The Board considers D4 to be relevant art because it belongs to the field of spot resistance welding, which is a technical field close to the field of fusing with electrodes. This is for instance illustrated by the fact that D6, which definitely relates to fusing, mentions the fusing operation as resistance welding ("Widerstandsschweißen"). Further, the international patent classification for D4 is B23K 11/24 and for D1 B23K 11/25, a subgroup of the former.

The skilled person in search for a solution to the above mentioned problems will therefore consider this document, which concerns the optimisation of the power supply to spot welding electrodes to take account of the variations in resistance during spot welding. This is done by using a high inverter switching frequency and timing signals having the same frequency as the switching frequency.

3.4 Thus, D4 supplies the skilled person with the information on how to improve the DC power supply of the apparatus disclosed in D6 so that it can react faster to changing conditions during fusing. It, however, does not provide any indication to synchronise the DC electrical heating supply with the **movement** of the fusing member, nor to control that supply in accordance with a predetermined electrical heating function. The result is therefore that even when applying the power supply and its control as taught by D4 to the apparatus and method disclosed in D6, the skilled person would not arrive at the subject-matter of claims 1 and 13.

3.5 Even when taking D1 as closest prior art, as done by the Appellant as well as the Opposition Division in the decision under appeal, the conclusion would not be different. D1 is silent on the nature of the electrical power supply to the fusing member and how it is controlled, i.e. it lacks a disclosure of all the features of the characterising parts of claims 1 and 13. The problem to be solved is therefore the choice of an appropriate power supply for this fusing apparatus.

The Board concurs with the decision under appeal that the skilled person would contemplate a power supply and control as suggested by D4 for inclusion in the fusing apparatus and -method discussed in D1 (see also the reasons set out above). However, in applying the power supply and its control disclosed in D4 to the apparatus and method disclosed in D1 he would, in the end, not arrive at a fusing apparatus and a fusing method which has a DC power supply which is **controlled during the fusing operation in accordance with a predetermined**

electrical heating function and which is synchronised with the movement of the fusing member, as now claimed in claims 1 and 13.

3.6 Consequently the Board finds that the subject-matter of claims 1 and 13 involve inventive step.

The subject-matter of dependent claims 2 to 12 and 14 to 20 being for preferred embodiments of the apparatus claimed in claim 1 and the method claimed in claim 13 respectively (Rule 29(3) EPC) thus also fulfil the requirements as to inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:
 - claims 1 to 20 and
 - description, columns 1 to 9, both filed in the oral proceedings,
 - figures 1 to 13, as granted.

The Registrar:

The Chairman:

E. Görgmaier

P. Alting van Geusau