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**D E C I S I O N**  
**of 21 November 2003**

**Case Number:** T 0592/01 - 3.2.6

**Application Number:** 93910938.5

**Publication Number:** 0641269

**IPC:** B23K 9/00

**Language of the proceedings:** EN

**Title of invention:**

Improved electrode for high current density plasma arc torch

**Patentee:**

HYPERTHERM, INC.

**Opponent:**

L'AIR LIQUIDE, Société Anonyme pour l'étude et l'exploitation  
des procédés Georges Claude

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 83, 84, 123(2), (3)

**Keyword:**

"Main request: added subject matter"

"Auxiliary requests 1 to 6: extension of scope"

"Auxiliary requests 7: intermediate generalisation"

"Auxiliary requests 8: subject matter not supported by the  
description"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 0592/01 - 3.2.6

**DECISION**  
of the Technical Board of Appeal 3.2.6  
of 21 November 2003

**Appellant:** L'AIR LIQUIDE, société Anonyme pour l'étude et  
(Opponent) l'exploitation des procédés Georges Claude  
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**Representative:** Pittis, Olivier  
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**Respondent:** HYPERTHERM, INC.  
(Proprietor of the patent) P.O. Box 5010  
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**Representative:** Attfield, Donald James  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 17 April 2001  
rejecting the opposition filed against European  
patent No. 0641269 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** P. Alting van Geusau  
**Members:** G. C. Kadner  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

- I. The mention of the grant of European patent No. 641 269 in respect of European patent application No. 93 910 938.5 claiming a US priority from 20 May 1992 was published on 8 July 1998.

Granted independent claims 1 and 11 read as follows:

"1. An electrode (42) for a plasma arc cutting torch, the electrode having (i) a body (42a) formed of a material having a high thermal heat conductivity and extending along the central axis of said torch to a bottom end, and (ii) an insert (44) of a material having a high thermionic emission that is secured in the bottom end (42f) of the body (42a) to provide an emissive surface (44a) with an area A exposed to the plasma gas and with an emissive spot (46) that becomes molten during cutting, wherein the said insert (42), said emissive surface area (44a) corresponding to the level of the operating current carried by the electrode (42), said emissive surface area (44a) being (i) at least equal to the area of the emissive spot (46) produced by cutting at a given operating current level, whereby a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided, characterised in that the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>) the emissive surface area (44a) is sufficiently small that the insert material in said

emissive area does not boil, and the diameter of the insert (44) exceeds the diameter of said emissive spot (46) by an amount that isolates the arc from the electrode (42)."

"11. A method of extending the life of an electrode (42) of a plasma arc cutting torch, particularly a high definition torch having a high current density and a small diameter emissive spot (46) on an insert (44) of a high thermionic emission material secured in a bottom end (42f) of a body (42a) of a high heat conductivity material wherein the area of the insert (44) exposed to the nozzle (24) is at least as great as the area of said emissive spot (46), and a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided, characterised in that the area of the insert (44) exposed to the nozzle (24) is not sufficiently large to result in a boiling of the insert (44) material during cutting and the diameter of the insert (44) exceeds the diameter of said emission spot (46) by an amount that isolates the arc from the electrode (42)."

II. Notice of opposition was filed on 20 February 1999 by the Appellant (Opponent) on the grounds of Article 100(a), (b) and (c) EPC.

III. By decision of the Opposition Division announced during the oral proceedings on 21 March 2001 and posted on 17 April 2001 the opposition was rejected.

The Opposition Division was of the opinion that the subject-matter claimed complied with the requirements of the EPC. In particular, the subject-matter of

claims 1 and 11 did not extend beyond the content of the application as filed and was disclosed in a manner sufficiently complete to enable a skilled person to carry out the invention. Furthermore it was novel and inventive when compared to the prior art cited by the Opponent in the opposition proceedings.

IV. On 23 May 2001 notice of appeal was lodged against this decision by the Appellant (Opponent) together with payment of the appeal fee. The statement of grounds of appeal was filed on 29 June 2001. The objections under Article 100(a), (b) and (c) EPC put forward in the opposition proceedings were maintained. Furthermore, reimbursement of the appeal fee was.

V. In a communication dated 10 October 2003 the Board submitted its provisional opinion on the basis of the documents on file.

Regarding the amendments carried out during the examination proceedings, granted claim 1 appeared to contain added subject-matter which was not disclosed in the application as originally filed (Article 123(2) EPC).

The objections submitted under Article 100(b) EPC appeared to be a matter of clarity governed by Article 84 EPC, which was not a ground for opposition. If during oral proceedings it were to be established that the present wording of claim 1, or an amended wording which was formally acceptable under Article 84 and 123(3) EPC, fulfilled the requirement of Article 123(2) EPC, it would be necessary to establish whether the invention as thus claimed was sufficiently

disclosed in the patent in suit for it to be carried out by a skilled person.

Furthermore, novelty and inventive step would have to be discussed taking into account in particular

D1: FR-A-2 173 875

D4: US-A-4 679 524

D9: FR-A-2 650 470.

As regards the request for reimbursement of the appeal fee, the Board did not see any reason for such reimbursement because of the absence of a procedural violation committed by the Opposition Division.

VI. Oral proceedings were held on 21 November 2003.

The Appellant requested that the decision under appeal be set aside and that European patent No. 641 269 be revoked. The request for reimbursement of the appeal fee was withdrawn.

The Respondent (Patentee) requested that the appeal be dismissed and that the patent be maintained as granted (main request) or alternatively, that it be maintained on the basis of the claims in accordance with auxiliary requests 1 to 7 filed with the letter dated 11 November 2003 or auxiliary request 8 filed during the oral proceedings.

Claim 1 according to auxiliary requests 1 to 8 reads as follows (the differences compared to granted claims 1 or 11 are in **bold**):

Auxiliary request 1:

"1. An electrode (42) for a **high definition** plasma arc cutting torch, the electrode having (i) a body (42a) formed of a material having a high thermal heat conductivity and extending along the central axis of said torch to a bottom end, and (ii) an insert (44) of a material having a high thermionic emission that is secured in the bottom end (42f) of the body (42a) to provide an emissive surface (44a) with an area A exposed to the plasma gas and with an emissive spot (46) that becomes molten during cutting, wherein the said insert (44), said emissive surface area (44a) corresponding to the level of the operating current carried by the electrode (42), said emissive surface area (44a) being (i) at least equal to the area of the emissive spot (46) produced by cutting at a given operating current level, whereby a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7 \text{ A/m}^2$  ( $6.0 \times 10^4 \text{ amperes/inch}^2$ ) is provided, characterised in that the size of said emissive spot (46) ~~is selected in coordination with the operating current level so that the~~ **in combination with the operating current level yields a** current density of the arc rooted at the insert area during cutting **which** is substantially constant at a value of at least  $1.860 \times 10^8 \text{ A/m}^2$  ( $1.2 \times 10^5 \text{ amperes/inch}^2$ ) the emissive surface area (44a) is sufficiently small that the insert material in said emissive area does not boil, and the diameter of the insert (44) exceeds the diameter of said emissive spot (46) by an amount that isolates the arc from the electrode **body** (42)."

Auxiliary request 2:

"1. An electrode (42) for a plasma arc cutting torch, the electrode having (i) a body (42a) formed of a material having a high thermal heat conductivity and extending along the central axis of said torch to a bottom end, and (ii) an insert (44) of a material having a high thermionic emission that is secured in the bottom end (42f) of the body (42a) to provide an emissive surface (44a) with an area A exposed to the plasma gas and with an emissive spot (46) that becomes molten during cutting, wherein the said insert (44), said emissive surface area (44a) corresponding to the level of the operating current carried by the electrode (42), said emissive surface area (44a) being ~~(i)~~ at least equal to the area of the emissive spot (46) produced by cutting at a given operating current level, whereby a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7 \text{ A/m}^2$  ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided, characterised in that the ~~size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8 \text{ A/m}^2$  ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)~~ **radius of the emissive surface area (44a) exceeds the radius of the emissive spot (46) by 0.076 to 0.152 mm (0.003 to 0.006 inches)** the emissive surface area (44a) is sufficiently small that the insert material in said emissive area does not boil, and the diameter of the insert (44) exceeds the diameter of said emissive spot (46) by an amount that isolates the arc from the electrode **body** (42)."



Auxiliary request 3:

"1. An electrode (42) for a **high definition** plasma arc cutting torch, the electrode having (i) a body (42a) formed of a material having a high thermal heat conductivity and extending along the central axis of said torch to a bottom end, and (ii) an insert (44) of a material having a high thermionic emission that is secured in the bottom end (42f) of the body (42a) to provide an emissive surface (44a) with an area A exposed to the plasma gas and with an emissive spot (46) that becomes molten during cutting, wherein the said insert (44), said emissive surface area (44a) corresponding to the level of the operating current carried by the electrode (42), said emissive surface area (44a) being (i) at least equal to the area of the emissive spot (46) produced by cutting at a given operating current level, whereby a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7 \text{ A/m}^2$  ( $6.0 \times 10^4 \text{ amperes/inch}^2$ ) is provided, ~~characterised in that the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8 \text{ A/m}^2$  ( $1.2 \times 10^5 \text{ amperes/inch}^2$ )~~ **radius of the emissive surface area (44a) exceeds the radius of the emissive spot (46) by 0.076 to 0.152 mm (0.003 to 0.006 inches),** the emissive surface area (44a) is sufficiently small that the insert material in said emissive area does not boil, and the diameter of the insert (44) exceeds the diameter of said emissive spot (46) by an amount that isolates the arc from the electrode **body** (42).

Auxiliary request 4:

~~"1. An electrode (42) for a plasma arc cutting torch,~~  
~~the electrode~~ **A high definition plasma arc torch**  
**including an electrode (42)** having (i) a body (42a)  
formed of a material having a high thermal heat  
conductivity and extending along the central axis of  
said torch to a bottom end, and (ii) an insert (44) of  
a material having a high thermionic emission that is  
secured in the bottom end (42f) of the body (42a) to  
provide an emissive surface (44a) with an area A  
exposed to the plasma gas and with an emissive spot  
(46) that becomes molten during cutting, wherein the  
said insert (44), said emissive surface area (44a)  
corresponding to the level of the operating current  
carried by the electrode (42), said emissive surface  
area (44a) being (i) at least equal to the area of the  
emissive spot (46) produced by cutting at a given  
operating current level, whereby a constant current  
density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided,  
characterised in that the size of said emissive spot  
(46) ~~is selected in coordination with the operating~~  
~~current level so that the~~ **in combination with the**  
**operating current level yields a** current density of the  
arc rooted at the insert area during cutting **which** is  
substantially constant at a value of at least  $1.860 \times 10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>) the emissive surface  
area (44a) is sufficiently small that the insert  
material in said emissive area does not boil, and the  
diameter of the insert (44) exceeds the diameter of  
said emissive spot (46) by an amount that isolates the  
arc from the electrode **body** (42)."

Auxiliary request 5:

~~"1. An electrode (42) for a plasma arc cutting torch,~~  
~~the electrode~~ **A high definition plasma arc torch**  
**including an electrode (42)** having (i) a body (42a)  
formed of a material having a high thermal heat  
conductivity and extending along the central axis of  
said torch to a bottom end, and (ii) an insert (44) of  
a material having a high thermionic emission that is  
secured in the bottom end (42f) of the body (42a) to  
provide an emissive surface (44a) with an area A  
exposed to the plasma gas and with an emissive spot  
(46) that becomes molten during cutting, wherein the  
said insert (44), said emissive surface area (44a)  
corresponding to the level of the operating current  
carried by the electrode (42), said emissive surface  
area (44a) being (i) at least equal to the area of the  
emissive spot (46) produced by cutting at a given  
operating current level, whereby a constant current  
density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided,  
~~characterised in that the size of said emissive spot~~  
~~(46) is selected in coordination with the operating~~  
~~current level so that the current density of the arc~~  
~~rooted at the insert area during cutting is~~  
~~substantially constant at a value of at least  $1.860 \times$~~   
 ~~$10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)~~ **radius of the emissive**  
**surface area (44a) exceeds the radius of the emissive**  
**spot (46) by 0.076 to 0.152 mm (0.003 to 0.006 inches)**  
the emissive surface area (44a) is sufficiently small  
that the insert material in said emissive area does not  
boil, and the diameter of the insert (44) exceeds the  
diameter of said emissive spot (46) by an amount that  
isolates the arc from the electrode **body** (42)."

Auxiliary request 6:

~~"1. An electrode (42) for a plasma arc cutting torch,~~  
~~the electrode~~ **A high definition plasma arc torch**  
**including an electrode (42)** having (i) a body (42a)  
formed of a material having a high thermal heat  
conductivity and extending along the central axis of  
said torch to a bottom end, and (ii) an insert (44) of  
a material having a high thermionic emission that is  
secured in the bottom end (42f) of the body (42a) to  
provide an emissive surface (44a) with an area A  
exposed to the plasma gas and with an emissive spot  
(46) that becomes molten during cutting, wherein the  
said insert (44), said emissive surface area (44a)  
corresponding to the level of the operating current  
carried by the electrode (42), said emissive surface  
area (44a) being (i) at least equal to the area of the  
emissive spot (46) produced by cutting at a given  
operating current level, ~~whereby a constant current~~  
~~density over said insert emissive area (44a) of  $9.300 \times$~~   
 ~~$10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided,~~  
characterised in that the ~~size of said emissive spot~~  
~~(46) is selected in coordination with the operating~~  
~~current level so that the current density of the arc~~  
~~rooted at the insert area during cutting is~~  
~~substantially constant at a value of at least  $1.860 \times$~~   
 ~~$10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)~~ **radius of the emissive**  
**surface area (44a) exceeds the radius of the emissive**  
**spot (46) by 0.076 to 0.152 mm (0.003 to 0.006 inches)**  
the emissive surface area (44a) is sufficiently small  
that the insert material in said emissive area does not  
boil, and the diameter of the insert (44) exceeds the

diameter of said emissive spot (46) by an amount that isolates the arc from the electrode **body** (42)."

Auxiliary request 7:

"1. A method of extending the life of an electrode (42) ~~of~~ **for a high definition** plasma arc cutting torch, particularly a high definition torch having a high current density and a small diameter emissive spot (46) on an insert (44) of a high thermionic emission material secured in a bottom end (42f) of a body (42a) of a high heat conductivity material wherein the area of the insert (44) exposed to the nozzle (24) is at least as great as the area of said emissive spot (46), and a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided, characterised in that the area of the insert (44) exposed to the nozzle (24) is not sufficiently large to result in a boiling of the insert (44) material during cutting and the diameter of the insert (44) exceeds the diameter of said emission spot (46) by an amount that isolates the arc from the electrode **body** (42) **by the radius of the emissive area (44a) exceeding the radius of the emissive spot (46) by 0.076 to 0.152 mm (0.003 to 0.006 inches).**"

Auxiliary request 8:

"1. A method of extending the life of an electrode (42) of a **high definition** plasma arc cutting torch, having a high current density and a small diameter emissive spot (46) on an insert (44) of a high thermionic emission material secured in a bottom end (42f) of a body (42a) of a high heat conductivity material, wherein the area

of the insert (44) exposed to the nozzle (24) is at least as great as the area of said emissive spot (46), and a constant current density over said insert emissive area (44a) of  $9.300 \times 10^7$  A/m<sup>2</sup> ( $6.0 \times 10^4$  amperes/inch<sup>2</sup>) is provided, characterised in that the area of the insert (44) exposed to the nozzle (24) is not sufficiently large to result in a boiling of the insert (44) material during cutting and the diameter of the insert (44) exceeds the diameter of said emission spot (46) by an amount that isolates the arc from the electrode (42)."

VII. In support of its requests the Appellant essentially put forward the following submissions:

Granted claim 1 contained subject-matter which had not been disclosed in the application as originally filed. Whereas in the description and in the original claim 1 the emissive surface area of the insert corresponded to the level of operating current carried by the electrode, in granted claim 1 the size of the emissive spot was selected in coordination with the operating current level. However, the area of the emissive spot adjusted itself to the operating current and could not therefore be a selected value.

Even if the wording of granted claim 1 was based on an error it could not be corrected without violating Article 123(3) EPC; the feature which had not originally been disclosed could not be deleted without extending the scope of the protection conferred.

The added subject-matter objection also applied to claim 1 of the auxiliary requests 1 to 6. The emissive

spot selected in coordination with the operating current was a feature which had not originally been disclosed. Since this feature had been removed and replaced by others, these requests were not admissible under Article 123(3) EPC because the scope of protection now covered embodiments not previously protected.

The teachings of claim 1 according to the seventh auxiliary request included features which were only disclosed in a combination of particular embodiments of the subject-matter claimed (page 4, lines 30 to 33). Isolating these features of a particular combination and using them in a generalised way violated Article 123(2) EPC, and therefore this request was not admissible.

The subject-matter defined in the eighth auxiliary request was not disclosed clearly and completely enough to be carried out by a skilled person. Therefore none of the requests should be allowed.

VIII. The submissions of the Respondent are summarised as follows:

Claim 1 complied with Article 123(2) EPC because the feature concerning the selection of the emissive spot was clearly understood by a skilled person. The size of the emissive spot was related to the current density, and from the disclosure of the patent as a whole it was clear that the size of the emissive area corresponded to that of the emissive spot. Even if a distinction was made between the terms "emissive spot" and "emissive area", the skilled person would recognise that the use

of the term "emissive spot" was erroneous and would therefore understand that it was intended to mean the emissive area.

The introduction of amendments according to auxiliary requests 1 to 6 made the subject matter narrower with respect to the main request, and accordingly the scope of protection was also limited.

At least the claims according to auxiliary requests 7 and 8 met the requirements of the EPC because the apparatus claims had been deleted, and therefore the feature which allegedly violated Article 123(3) EPC was no longer present. The border radius newly introduced was clearly defined in the patent specification.

Thus at least the seventh or eighth auxiliary request should be allowed.

## **Reasons for the Decision**

1. The appeal is admissible.
2. *Main request*
  - 2.1 According to Article 123(2) EPC a European patent may not be amended in such a way that it contains subject-matter which extends beyond the application as originally filed.

The originally filed application documents specify that the emissive area corresponds to the level of the operating current carried by the electrode, such that



the current density over the emissive area is  $9.3 \times 10^7$  A/m<sup>2</sup>. The specific size of the emissive spot and the current density over the emissive spot area are values which are not disclosed as selected values, but are merely operating results for the torch when the standard tests are performed as described in the application (see page 9, second paragraph, to page 11, second paragraph).

2.2 According to the first characterising feature of claim 1 as granted, "the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)". This size, however, as explained above, is an operating result depending on the operating current.

2.3 Selecting the size of the emissive spot is fundamentally different from selecting the emissive area in a technical sense. Thus there is no basis in the application documents as filed for selecting the size of the emissive spot (see above). Consequently claim 1 of the main request contains subject-matter which was not originally disclosed, and thus is not allowable (Article 123 (2) EPC).

3. *First to seventh auxiliary requests*

3.1 In accordance with Article 123(3) EPC the claims of the European patent may not be amended during opposition proceedings in such a way as to extend the protection conferred.

3.2 In product claim 1 of auxiliary requests 1 and 4, the first characterising feature whereby "the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)"

is replaced by the wording:

"the size of said emissive spot (46) in combination with the operating current level yields a current density of the arc rooted at the insert area during cutting which is substantially constant at a value of at least  $1.860 \times 10^8$  A/m<sup>2</sup> ( $1.2 \times 10^5$  amperes/inch<sup>2</sup>)".

3.3 As explained above in point 2.3, the feature whereby "the size of the emissive spot (46) is selected ..." was not disclosed in the application as originally filed. However, this feature, which was included in granted claim 1, cannot be deleted and replaced by a technically different feature without violating Article 123(3) EPC. For the reasons explained above, the statement that "the size of said emissive spot (46) in combination with the operating current level yields a current density ..." is different from the statement

that "the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density ...", and is therefore an *aliud* which changes the scope of protection of the claim. The present facts are a classic example of a case falling under the so-called *inescapable trap* following from the requirements of Article 123(2) and (3) EPC, for which problem no solution is possible in the present case. Therefore, since the claim 1 in question has an extended scope compared with the granted claim 1, auxiliary requests 1 and 4 are not allowable under Article 123(3) EPC.

3.4 In product claim 1 of auxiliary requests 2, 3, 5 and 6, this first characterising feature

"that the size of said emissive spot (46) is selected in coordination with the operating current level so that the current density of the arc rooted at the insert area during cutting is substantially constant at a value of at least  $1.860 \times 10^8 \text{ A/m}^2$  ( $1.2 \times 10^5 \text{ amperes/inch}^2$ )"

is replaced by the wording:

"the radius of the emissive surface area (44a) exceeds the radius of the emissive spot (46) by 0.76 to 0.152 mm (0.003 to 0.006 inches)".

3.5 The deletion and replacement of this feature included in granted claim 1 is not possible without violating Article 123(3) EPC (see also point 3.3 above).

3.6 Additionally, the replacement feature, which according to the Respondent was disclosed in the patent

specification (page 4, lines 30 to 33), is related to the specific example according to Table I. Since the values of the emissive spot are only disclosed in combination with the values in the Table, their isolated introduction into a claim is not allowable under Article 123(2) EPC, there being no basis for such an intermediate generalisation in the application as filed.

3.7 In addition to a clarifying amendment relating to a "high definition" plasma arc cutting torch, the wording "*electrode body (42) the radius of the emissive surface area (44a) exceeds the radius of the emissive spot (46) by 0.76 to 0.152 mm (0.003 to 0.006 inches)*" was added to claim 1 of auxiliary request 7 based on claim 11 as granted und relating to a method.

3.8 The amendment of this claim is not admissible for the same reasons as those given in point 3.6 above, because the added feature was only disclosed in a specific combination and no basis for an intermediate generalisation is derivable from the patent application documents.

#### 4. *Auxiliary request 8*

4.1 For the purpose of assessing the patentability of amended claims, all the requirements of the EPC have to be considered.

Although the patent description states that heating is more closely linked to the diameter of the insert than other factors such as flow rates or coolants, the skilled person in this technical field is well aware

that the cooling of the electrode body is essential to obtaining the desired temperature gradient and therefore has an influence on the temperature of the insert, which is crucial.

4.2 Therefore, when a current is applied to produce a current density in the claimed range, the temperature of the area of the insert, and consequently the danger of boiling, depends not only on the geometric relationship between the diameter of the insert and the diameter of the emission spot but also on the cooling gradient. According to the description the tests were carried out with water at 4°C and a flow rate of 50,000 watts/m°C, whereas claim 1 is silent about these conditions. Since claim 1 lacks at least one essential feature, the Board concludes that amended claim 1 of this request does not meet the requirements of Article 84 EPC in that its subject-matter in the present form is not supported by the description.

5. For the above reasons, the Board has arrived at the conclusion that, since none of the requests is allowable, the patent has to be revoked.

**Order**

**For these reasons it is decided that:**

The patent is revoked.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau