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**Datasheet for the decision  
of 7 February 2008**

**Case Number:** T 1056/05 - 3.2.06

**Application Number:** 97201303.1

**Publication Number:** 0790756

**IPC:** B23K 9/00

**Language of the proceedings:** EN

**Title of invention:**

Plasma arc cutting process and apparatus using an oxygen-rich gas shield

**Patentee:**

HYPERTHERM, INC.

**Opponent:**

L'AIR LIQUIDE, S.A. A DIRECTOIRE ET CONSEIL DE SURVEILLANCE  
POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE

**Headword:**

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**Relevant legal provisions:**

-

**Relevant legal provisions (EPC 1973):**

EPC Art. 54, 56, 84

EPC R. 27(1)(b) and (c)

**Keyword:**

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**Decisions cited:**

-

**Catchword:**

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Case Number: T 1056/05 - 3.2.06

**DECISION**  
of the Technical Board of Appeal 3.2.06  
of 7 February 2008

**Appellant:**  
(Opponent)  
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**Decision under appeal:**  
Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
4 August 2005 concerning maintenance of  
European patent No. 0790756 in amended form.

**Composition of the Board:**

**Chairman:** P. Alting Van Geusau  
**Members:** M. Harrison  
W. Sekretaruk

## Summary of Facts and Submissions

- I. In its interlocutory decision posted on 4 August 2005, the opposition division found that European patent number 0 790 756 in its amended form met the requirements of the European Patent Convention.
- II. The opponent (appellant) filed an appeal against the decision, requesting revocation of the patent. In support of its arguments, the appellant relied on the following documents:
- D1: "Effect of plasma cutting with oxygen/nitrogen mixtures on the formation of defects when MAG welding carbon steels", B. Williamson, *Welding in the World*, vol. 27, No. 9/10, 1989, pages 282 to 285.
- D4: WO-A-89/11941
- D5: WO-A-91/02619
- D6: "How Plasma Arc Cutting Gases Affect Productivity" W.S. Severance et al, *Welding Journal*, February 1984, pages 35 to 39.
- D7: US 4 521 666
- III. In its reply the respondent (proprietor) requested, as a main request, dismissal of the appeal, or alternatively maintenance of the patent in an amended form based on first to fourth auxiliary requests filed with said reply.
- IV. Subsequent to issuing a summons to oral proceedings, the Board issued a communication on 11 October 2007, providing its comments *inter alia* on the question of the relevance of D7 to the main request and mentioning

- that the appellant had not yet commented on the auxiliary requests, at the same time inviting the appellant to do so.
- V. With its letter dated 11 October 2007, the appellant informed the European Patent Office that it would not attend oral proceedings and that it withdrew its request for oral proceedings.
- VI. Subsequent to a submission from the respondent requesting information as to whether oral proceedings would be held in view of the non-attendance of the appellant, the Board informed the parties that oral proceedings would take place as scheduled.
- VII. In its letter of 28 November 2007, the appellant provided further submissions concerning the alleged relevance of D7 to the requests on file, confirming its request for revocation of the patent.
- VIII. With its submission of 7 January 2008, the respondent provided further arguments in support of the main request and filed first to ninth auxiliary requests.
- IX. Oral proceedings were held before the Board on 7 February 2008, without the appellant being present as indicated in its letter of 11 October 2007.
- X. During the oral proceedings, the appellant presented a new (sole) request, replacing all other requests, said request containing further limitations compared to the seventh auxiliary request filed with its submission of 7 January 2008.

XI. Claim 1 of the (sole) request reads as follows:

"Use of a plasma arc cutting apparatus including a plasma arc torch (10) having a body (12), and electrode (24) and a nozzle (28) mounted at a first end of the body (12) in a mutually spaced relationship that defines a plasma chamber (30), and a first gas source (42) provides a first gas to a plasma flow path (48) in said body (12) that conducts first gas from a plasma gas inlet (10a) to the plasma chamber (30), a second gas source (46) provides a second gas to a secondary gas flow path (50) in said body (12) that conducts a secondary gas from a secondary gas inlet (10b) to an exit orifice (62), said secondary gas forming a shielding gas around the plasma gas, characterised in that the first gas source (42) further provides the first gas to the secondary gas flow path (50) such that the secondary gas is a mixture of the first gas and a second gas wherein one of said first gas and said second gas is a non-oxidising gas and the other is an oxidising gas, wherein said mixture is at least 40% oxidising gas, as measured by flow rate and wherein the flow ratio of said oxidizing gas and non-oxidizing gas is in the range 2:3 to 9:1."

Claim 6 of the request reads as follows:

"A method of improving the cutting speed and cut quality of a plasma arc torch (10) operating on a metal workpiece (36) where the torch (10) has a plasma gas flow that forms a plasma jet wherein said plasma gas is a first gas from a first gas source, and a secondary gas flow that forms a shield around the plasma gas, the method comprises: providing a second gas from a second

gas source to the secondary gas flow, characterised in that forming said secondary gas flow of a mixture of said first gas from said first gas source and said second gas wherein one of said first gas and said second gas is an oxidising gas and the other is a non-oxidising gas such that said secondary gas flow is a mixture of oxidizing gas and non-oxidizing gas, wherein the oxidizing gas comprises at least 40% of the flow as measured by flow rate and wherein the flow ratio of said oxidizing and non-oxidizing gas is in the range of 2:3 to 9:1."

XII. The appellant provided no arguments in response to the further auxiliary requests filed with the respondent's letter of 7 January 2008 and, due to its non-attendance, no arguments against the (sole) request filed during oral proceedings.

Concerning the various sets of claims filed on 7 February 2006, in summary, the appellant submitted that D7 disclosed a secondary gas (with any, preferably high, amount of oxygen) supplied to a nitrogen gas plasma. Since the resultant jet should only contain oxygen and nitrogen, the secondary gas implicitly contained a mixture of oxygen and nitrogen. It was anyway not inventive to form the secondary gas as a mixture of oxygen and nitrogen, since the quantity of nitrogen in the secondary gas could be extremely small and without effect. Claim 1 of the main request lacked inventive step over D1 or D4 (or D5) in light of D6. D1 disclosed identical plasma and shielding gases, but due to their separate functions it was obvious to use oxygen for the plasma and a different gas for shielding, as taught by D6. Since D1 disclosed mixtures of oxygen

and other high oxygen content gases as a shielding gas, routine experimentation on shielding gases (of D1) would mean the invention would be arrived at without inventive skill. Starting from D4 which disclosed nitrogen as both plasma and shielding gases, D6 taught that shielding gas with a high oxygen content was beneficial; it was mere routine to arrive at a nitrogen/oxygen mixture satisfying the conditions of claim 1.

XIII. The arguments of the respondent can be summarised as follows:

The amendments made in claim 1 of the request, compared to the version of claim 1 of the request considered allowable (in the decision under appeal) by the opposition division, added *inter alia* the feature that the flow ratio of the oxidizing to non-oxidizing gas was in the range of 2:3 to 9:1. This was disclosed in the filed application on page 8, lines 10 and 11. The secondary gas was further defined as a shielding gas, different to the secondary gas in D7, for example, which was used in the plasma. The amendment defining that the first gas source provided the first gas to the secondary gas flow path was based for example on the disclosure in column 8, lines 5 to 7 and in the sentence bridging pages 12 to 13 in the filed application. The same disclosure applied to the amendments made to claim 6. Corresponding text was also found in the opposed patent. The requirements of Article 123(2) EPC 1973 were thus met.

The independent claims 1 and 6 were delimited with respect to D6 and D6 was also mentioned in the

description. Amendments to the description were made for consistency with the claims.

In relation to claim 1 of the decision under appeal, D7 lacked relevance as to novelty or inventive step as no mixture of gases in the secondary gas was disclosed and no teaching existed in D7 or any other document for the skilled person to modify this. D1 disclosed only identical gases for the plasma and secondary gas flows, whereas D6 disclosed using only singular gases for the secondary gas flow, i.e. not mixtures. D4 only disclosed the use of nitrogen for plasma and shielding gases and nothing else. D6 disclosed the use of a nitrogen plasma gas and a shielding gas of nitrogen, oxygen, carbon dioxide or air. The skilled person had no lead in any prior art documents to provide the secondary gas with the specific mixture of gases defined in the claims.

## **Reasons for the Decision**

### **1. *Amendments***

(i) The amendments made in claim 1 and claim 6 compared to the claims of the allowable request in the decision underlying the appeal are based on the application as filed (for the flow ratio in the secondary gas see e.g. page 8, lines 10 and 11 and claim 7 as filed; for the use of the secondary gas as a shielding gas see e.g. page 6, line 19, page 15, lines 19 to 24; for the supply of gas from the first gas source to the secondary flow path see e.g. page 12, line 27 to page 13, line 2). An unambiguous basis for the



amendments is thus present in the content of the application as filed. The same text is also found in the granted patent. Thus the requirements of Article 123(2) EPC 1973 are met. Likewise each of the amendments made in claim 1 and claim 6 provides a limitation with respect to the independent claims of the patent as granted and also with respect to the independent claims according to the decision underlying the appeal. The requirements of Article 123(3) EPC 1973 are thus met and also the amendments made do not contravene the principle of prohibition of *reformatio in peius*.

In the written submissions made during the appeal proceedings, the appellant made no objection under Article 123 EPC to any of the amendments compared to the granted patent or the filed application.

(ii) The filing of the (new) request during oral proceedings is considered admissible by the Board.

First, the request is based on the seventh auxiliary request filed with the letter of 7 January 2008, which itself followed the Board's communication of 11 October 2007 and the appellant's submission of 28 November 2007. The Board also finds that the appellant had sufficient opportunity to comment on the submission of 7 January 2008 either in writing or by attending oral proceedings and making comments orally. The amendments made in the new request (compared to the previous seventh auxiliary request) are also considered appropriate and necessary since they overcome an objection under Article 84 EPC 1973 due to a typographical error (i.e. claim 1 of the seventh

auxiliary request originally stated that the "secondary gas is a mixture of the first gas and a second gas and a mixture of non-oxidising gas and oxidising gas", which statement is obviously incorrect), and they also avoid an objection concerning the principle of prohibition of *reformatio in peius* (due to the definition in claim 1 and claim 6 found acceptable in the decision under appeal, which stated that "one of said first gas and said second gas is a non-oxidising gas and the other is an oxidising gas", which statement had been omitted in the respective claims, but which was reinstated in claims 1 and 6).

The appellant raised no objection to the admissibility of the requests.

(iii) The amendments to the description were made for reasons of consistency with the amended claims (Article 84 EPC 1973) and to meet the requirements of Rule 27(1)(b) and (c) EPC 1973. The amendments are considered by the Board to be appropriate and necessary to conform to the amended claims of the (sole) request.

## 2. *Novelty and inventive step*

### (i) Novelty

Against the claims of the sole request filed during oral proceedings, the appellant filed no specific objection. The appellant had the opportunity to file objections at least against the seventh auxiliary request (which is even further limited by way of the new (sole) request), in writing or by attending oral proceedings, but did not avail itself of the

opportunity to do so. However the Board has *ex officio* conducted an examination of the request on the basis of arguments, facts and evidence on file.

The arguments brought forward by the appellant in relation to the cited prior art do not however relate to a disclosure in the prior art of (at least) the feature according to which the "flow ratio of said oxidizing gas and non-oxidizing gas is in the range 2:3 to 9:1" which is present in claim 1 and claim 6.

In regard to the subject matter of claim 1 and claim 6, a disclosure of this feature has also not been found in the prior art cited by the appellant during the Board's *ex officio* examination.

With regard to the disclosure in D7 per se, the Board finds that the secondary gas therein ("any oxygen containing reactive gas") is firstly not a mixture of gases at all but merely oxygen or another single gas which contains oxygen in some form (e.g. carbon dioxide). Column 5, lines 57 to 63 of D7 (mentioned by the appellant in relation to the requests filed with the letter of 7 February 2006) only refers to the effluent which should comprise only nitrogen and oxygen, and in particular oxygen concentration of above 40% and preferably 60 to 75%. However, this is no evidence that a mixture of gases of oxygen and nitrogen has been used as the secondary gas; different supplied quantities of oxygen and nitrogen supplied to the plasma and further gas inlet can account for the presence of these gases in the effluent. Further, in relation to the subject matter of claims 1 and 6, it is notable that there is no disclosure in D7 that a secondary gas mixture of

oxidising and non-oxidising gases is used which could have a flow ratio between 2:3 and 9:1 as defined in claims 1 and 6.

It is also noted that this particular feature of flow ratio of non-oxidising and oxidising gases (2:3 and 9:1) was already present in claim 7 of the patent as granted and no specific arguments were made against it in the opposition as filed or in the appeal proceedings, apart from the very general statement in the opposition as filed that all dependent claims lacked novelty or inventive step.

Thus, on an *ex officio* examination, at least in respect of this feature, and due to the lack of any argument from the appellant stating where this feature might be found in the prior art, the subject matter of claim 1 and claim 6 is found by the Board to be novel with respect to the cited prior art and therefore the requirement of Article 54 EPC 1973 is met.

(ii) Inventive step

In regard to inventive step, and in the absence of any argument or evidence against the presence of inventive step in respect of the subject matter of claims 1 and 6 of the request on file and in particular in regard to the presence of the flow ratio feature discussed above with respect to novelty, the Board finds, based on an *ex officio* examination of the case, that the subject matter of claim 1 and claim 6 involves an inventive step with respect to the cited prior art and with respect the arguments brought forward by the appellant in respect of that prior art. In particular, starting

from D6, which is regarded as being the closest prior art for considering inventive step due to the use of different gases for shield and plasma gases, and which discloses the features in the preamble of each of claim 1 and claim 6, the problem to be solved by the claimed invention may be regarded as being the improvement of the cutting speed (see e.g. paragraph [0015] of the patent). The feature of flow ratio of 2:3 to 9:1 is also discussed in paragraph [0042] of the patent for example, and is stated as providing the advantage of increasing the cutting speed of the torch in mild steel. D6 discloses (page 37, right hand column) the use of nitrogen plasma gas together with a shielding secondary gas supplied in the form of the singular gases oxygen, carbon dioxide, air or nitrogen (in descending order of performance), without any suggestion that a mixture of gases could be beneficial. In the "Conclusions" section on page 39, item 2 of D6, oxygen bearing shielding gases were considered most effective with the examples of singular gases (100% oxygen, carbon dioxide and air) being quoted. No suggestion, either in D6 or in the other prior art cited, can however be found of using a mixture of first and second gases, as defined, with the specific flow ratio of gases defined in claim 1 and claim 6.

The remaining cited prior art is more remote than D6; D4 only discloses the use of identical gases, specifically nitrogen, for shielding and plasma, the same being the case for D5 (see page 1 and page 13 thereof), it being noted that the appellant made no specific reference to any passages whatsoever in D5; D1 only discloses the use of identical gases for the plasma and shielding gases, even though the gases may

be of differing types. The Board therefore concludes that none of the prior art contains a hint that different gas combinations would be beneficial in some way, nor that testing of different shielding gases with varying shielding gases should occur, nor in any sense that different flow ratios of first (plasma) and second gases, as defined in the claim, in the combination of gases of the secondary gas used for shielding would provide beneficial cutting effects.

In the absence of any argument to the contrary from the appellant and based on the Board's *ex officio* examination, the Board thus finds that this particular feature (at least) in combination with the other features of claim 1 and claim 6 in relation to the cited prior art, defines subject matter involving an inventive step. The requirement of Article 56 EPC 1973 is therefore met.

**Order**

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

1. The decision under appeal is set aside.
2. The case is remitted back to the opposition division with the order to maintain the patent on the basis of:
  - (a) the description consisting of columns 1 to 14, including insert A, as filed during the oral proceedings of 7 February 2008,
  - (b) claims 1 to 8 as filed during the oral proceedings of 7 February 2008,
  - (c) figures 1a to 5 as granted.

The Registrar:

The Chairman:

M. Patin

P. Alting van Geusau