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**Datasheet for the decision  
of 18 October 2011**

**Case Number:** T 0715/09 - 3.2.03

**Application Number:** 01830170.5

**Publication Number:** 1243859

**IPC:** F23Q 7/00

**Language of the proceedings:** EN

**Title of invention:**

Glow plug arranged for measuring the ionization current of an engine, and a method for manufacturing the same

**Patentee:**

Federal-Mogul Ignition Srl

**Opponent:**

BERU AG

**Headword:**

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**Relevant legal provisions:**

EPC Art. 56

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

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**Keyword:**

"Inventive step (no)"

"Party not attending oral proceedings is deemed to rely on its written submissions (point 2 of Reasons)"

**Decisions cited:**

T 0745/92

**Catchword:**

-



Case Number: T 0715/09 - 3.2.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.03  
of 18 October 2011

**Appellant:** BERU AG  
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**Decision under appeal:** Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
21 January 2009 concerning maintenance of  
European patent No. 1243859 in amended form.

**Composition of the Board:**

**Chairman:** U. Krause  
**Members:** G. Ashley  
J.-P. Seitz

## **Summary of Facts and Submissions**

- I. European patent EP-B1-1 243 859 concerns a glow plug for measuring the ionization current inside the combustion chamber of a diesel engine, and a process for fabricating a glow plug. The granted patent was opposed for lack of novelty and inventive step (Article 100(a) EPC). The opposition division concluded that the patent could be maintained on the basis of an amended set of claims filed during the opposition proceedings as the patent proprietor's main request. The decision was posted on 21 January 2009.
- II. The above decision was appealed by the opponent, who filed notice of appeal on 30 March 2009, paying the appeal fee on the same day; a statement containing the grounds of appeal was filed on 2 June 2009.
- III. In accordance with Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), the Board issued a preliminary opinion of the case, together with a summons to attend oral proceedings.
- IV. In a letter dated 6 October 2011 the respondent announced that it would not be attending the oral proceedings.
- V. Requests

The appellant (opponent) requested that the above decision be set aside and that the patent be revoked. Oral proceedings are requested should the Board be considering an adverse decision.

The respondent (patent proprietor) requested that the appeal be dismissed.

VI. Claims

Claim 1 as maintained by the opposition division reads as follows:

"1. A glow plug for diesel engines, comprising:  
- a metal tubular body (12) provided with means (14) for fixing it to the cylinder head of an engine;  
- a metal sheath (24) carried by a the tubular body (12) and driven with interference into a cavity (16) of the tubular body;  
- a first electrical terminal (30) connected to a heating resistor (33) set inside the aforesaid sheath (24);  
- a second electrical terminal (32) electrically connected to the sheath (24); and  
- means for electrical insulation of the metal sheath (24) from the metal tubular body (12), wherein said sheath (24) comprises a layer (36) of insulating material applied on a portion (34) of the outer surface of said sheath (24),  
characterized in that said layer (36) of insulating material is applied by means of plasma deposition."

Independent claim 3 reads:

"3. A process for the fabrication of a glow plug for diesel engines, comprising the steps of:  
- providing a metal tubular body (12);

- providing a heating element (22) including a metal sheath (24), a heating resistor (33) contained inside the metal sheath (24), a first terminal (30) electrically connected to the resistor (33), a second terminal (32) electrically connected to the sheath (24), and a layer (36) of insulating material applied on a portion (34) of the outer surface of the sheath (24);  
- fixing the heating element (22) to the metal tubular body (12) by driving with interference the heating element into a cavity (16) of the tubular body (12); characterized in that said layer (36) of insulating material is applied by means of plasma deposition."

Dependent claim 2 and dependent claims 4 and 5 concern preferred embodiments of the glow plug of claim 1 and the process of claim 3 respectively.

#### VII. Prior Art

The following documents mentioned in the contested decision are of relevance:

E3: DE-C-199 20 766  
E7: DE-A-26 40 314  
E8: US-A-5 578 349  
E9: DE-U1-88 15 005

The following document, amongst others, was filed for the first time with the notice of appeal:

E10: Dr.-Ing. Hans-Dieter Junge "Dictionary of Engineering and Technology", Volume II, 6th Edition, page 677, Oscar Brandstetter Verlag, Wiesbaden.

VIII. Submissions of the Parties

The issue upon which the Board must decide is whether the claimed subject-matter has an inventive step. The submissions of the parties are summarised as follows.

(a) The Appellant's Case

The appellant submits that E3, and in particular the embodiment shown in Figure 4 and described in column 4, lines 7 to 12, represents the closest prior art.

The appellant argues that the conclusion of the opposition division that an interference fit is not disclosed in E3 is incorrect, as E3 refers to a "Preßsitzbereich" between the heating rod (2) and the tubular body (1). The terms "Preßsitzbereich" and "interference fit" are synonymous, as evidenced by the excerpt from the dictionary E10.

The glow plug of claim 1 and the process of claim 3 differ from E3 only in that the layer of insulating material is applied by means of plasma deposition.

The objective problem to be solved may therefore be seen in selecting a method that is suitable for applying an insulating coating to the metal sheath (the metal heating rod of the glow plug) so that it is capable of withstanding the high stresses resulting from an interference fit between the sheath and the tubular body of the glow plug.

Document E7 discloses a glow plug having a metal sheath which is coated by plasma deposition with an insulating layer. It is commonly known to the skilled person that plasma deposition yields extremely hard, wear-resistant layers having a high peel strength. Consequently the skilled person would apply the insulation layer described in E3 by means of plasma deposition, so that it can withstand the high stresses caused by the interference fit.

The same arguments apply to both the glow plug of claim 1 and the method of claim 3 showing that the subject-matter of these claims lack an inventive step.

(b) The Respondent's Case

The respondent agrees that the embodiment shown in Figure 4 of E3 represents the closest prior art.

E3 merely indicates that insulation (5) is provided in a force fit area between the tubular body (1) and the heating rod (2); there is no specific disclosure that the layer of insulating material must be applied to a portion of the outer surface of the heating rod. E3 also does not clearly indicate that the body and heating rod are held together by an interference fit and, as set out by the opposition division, the fit could result from frictional resistance without interference. Consequently, the subject-matter of claims 1 and 3 is distinguished from that of E3 by the following features:

- (i) the sheath is driven with interference into the cavity of the tubular body;

- (ii) the layer of insulating material is applied by plasma deposition.
- (iii) a layer of insulating material applied to a portion of the outer surface of the sheath.

The objective problem to be solved is to ensure a simple and effective connection of the sheath to the glow plug body while ensuring electrical insulation and gas tightness and guaranteeing the necessary tolerances of coaxiality and roundness between the shaft and the tubular body.

E3 itself provides no indication as to how the ceramic coating should be made, and in particular how it should be applied in order to achieve the effects set out above.

In E7 the metal sheath is connected to the tubular body by means of molten glass. There is no suggestion of driving the sheath inside the cavity of the tubular body to create an interference fit. Although the insulation material on the sheath is applied by plasma spray, its function is to insulate it from the resistor wire and not from the tubular body. Hence there is no teaching that the sheath and the tubular body should be bonded by an insulating layer applied by plasma deposition.

The skilled person is familiar with glow plugs (international patent class F23Q7/00), but there is no reason to assume that he has knowledge of the surface treatment of metals (international patent class C23C) and, more specifically, plasma deposition technology.



Hence the skilled person is in no position to apply such techniques in the manufacture of glow plugs.

The claimed subject-matter has therefore an inventive step over the cited prior art.

### **Reasons for the Decision**

1. The appeal is admissible.

2. Oral Proceedings

The respondent stated in the letter of 6 October 2011 that it would not be present at the proposed oral proceedings, hence is deemed to rely solely on its written submissions. The decision meets the request of the appellant and, as it can be reached on the basis of the written submissions of both parties, there is no need for the oral proceedings to be held.

3. Admissibility of Document E10

The appellant has submitted an extract from a technical dictionary (E10), in order to support the submission that "Preßsitzbereich" involves an interference fit in the sense of claim 1. As a dictionary, it would be expected that its content belongs to the common knowledge of the skilled person. E10 was filed with the grounds of appeal in order to address the interpretation of the expression "Preßsitzbereich" given by the opposition division in its decision, hence it relates directly to why, in the view of the appellant, the contested decision was wrong. For these

reasons the Board exercises its discretion under Article 13(1) RPBA to admit E10 into the proceedings.

#### 4. Inventive Step

##### 4.1 Closest Prior Art

The disputed patent addresses the difficulty of ensuring electrical insulation and gas tightness between the sheath of the glow plug and the insulating body, and identifies the main causes of the problem as being the large number of component parts necessary for making known glow plugs and the difficulty of achieving the necessary tolerances of coaxiality and roundness (see paragraphs [0003] and [0004] of the disputed patent).

Both parties and the opposition division consider E3, which discloses a similar glow plug for diesel engines, as being the closest prior art, and the Board sees no reason to depart from this view. Figure 4 of E3 discloses an embodiment in which the glow plug has a metal tubular body (1), a heating rod (2) (which equates to the sheath of the disputed invention) and an insulating part (5) formed between the tubular body and the heating rod. The invention of E3 seeks to avoid complex and cost intensive production whilst achieving a high degree of precision and reliable component (column 1, lines 41 to 49). Since E3 is concerned with similar problems to those of the disputed patent, it makes a suitable starting point for the assessment of inventive step.

4.2 Differences

4.2.1 The opposition division was of the view that the claimed glow plug differs from that of E3 in terms of the following features:

- (i) the sheath is driven with interference into the cavity of the tubular body;
- (ii) the layer of insulating material is applied by plasma deposition.

4.2.2 The respondent submits that E3 also fails to disclose:

- (iii) a layer of insulating material applied to a portion of the outer surface of the sheath.

The embodiment of Figure 4 of E3 shows a metal tubular body (1), a heating rod or sheath (2), with the insulating part (5) formed between the tubular body and the heating rod. The insulating part is described in respect of other embodiments in E3 as being made of an insulating material (6), such as metal oxide, sandwiched between two support tubes (7, 8) (see column 2, lines 22 to 32). However, for the embodiment shown in Figure 4, which is described in column 3, lines 7 to 12 and claim 12, the insulation is said to be formed from a ceramic coating formed in the region between the tubular body (1) and the heating rod (2); there is no mention of support tubes and none are shown in Figure 4. It is thus clear that insulating material is applied directly to a portion of the outer surface of the sheath, hence feature (iii) is disclosed in E3.

4.2.3 The opposition division and respondent are of the view that an interference fit (feature (i) above) is not clearly disclosed, as E3 merely states that the sheath is pressed onto the tubular body in a conventional manner or is connected by shrink fitting, rolling or drawing. The appellant, on the other hand, argues that feature (i) is derivable from E3, since it refers to a "Preßsitzbereich" between the metal sheath (2) and the tubular body (1) (see column 3, lines 7 to 9). The Board is also of the view that an interference fit would result from forcing the surfaces of the sheath and body together in the manner described in E3. This view is also supported by the extract from a technical dictionary (E10), which translates "interference fit" as "Preßpassung", indicating that "Preßsitzbereich" involves an interference fit.

4.2.4 The claimed glow plug differs from the embodiment shown in Figure 4 of E3 only that the coating of insulating material has been applied by plasma deposition.

#### 4.3 Objective Problem

E3 simply states that the insulation is formed by a ceramic coating and no indication is given as to how the coating is to be applied (column 3, lines 8 to 10). The objective problem to be solved is therefore, as formulated by the appellant, to select a suitable method for coating the metal sheath, bearing in mind that the coating lies between two parts that are held together by means of an interference fit.

#### 4.4 Solution

4.4.1 Plasma deposition is a generally well known technique for coating objects with a ceramic layer that is hard and wear resistant, but the question is whether it is obvious to use plasma deposition for applying the insulating coating as described in E3.

Documents E7, E8 and E9 all describe the manufacture of glow plugs in which a ceramic coating step carried out by plasma deposition.

4.4.2 E7 discloses a glow plug having a metal sheath (17) and a tubular body (11) that corresponds to tubular body (12) of the disputed patent. The metal sheath (17) extends beyond tubular body (11), and in this region it is coated with two insulation layers (23 and 27); a heating element (24) is sandwiched between these layers. These insulation layers are applied by plasma deposition. Hence plasma deposition is known for coating the metal sheath, albeit not in the region between the metal sheath and the tubular body which, as pointed out by the respondent, is coated with glass.

4.4.3 E8 also concerns a glow plug and describes coating the plug by plasma deposition with a protective layer to protect the plug from the corrosive environment. Use of such a coating to form an insulating layer between a metal tubular body and a sheath is not described.

4.4.4 E9 describes the application of a coating (20) by plasma deposition to the surface of a glow plug (see last paragraph on page 5). The coating (20) is porous and is intended to reduce the effects of thermal

gradients (see sentence bridging pages 4 and 5); it is applied on top of a dense, abrasive resistant, insulating coating (13); it is not said how the latter coating (13) is applied.

4.4.5 The skilled person reading E3 is looking for a means for applying the insulating coating. None of the documents E7, E8 or E9 explicitly discloses plasma deposition of an insulating coating in the region between the tubular body and sheath of a glow plug, hence the opposition division concluded that the claimed subject-matter had an inventive step.

4.4.6 In addition, the respondent submits that the skilled person versed in the art of glow plugs would not, as part of his common knowledge, be aware of plasma deposition technology. Support for this submission is that glow plugs and surface treatment techniques are in two completely different classes according to the international patent classification scheme, namely F23Q7/00 and C23C respectively. The Board disagrees for the following reasons.

IPC classification alone is no reason for determining whether or not two pieces of prior art can be combined. The mere fact that two documents have the same classification is no reason for saying the combination of the teachings is obvious (see T 745/92 at point 1.4 of the reasons). Likewise the mere fact that the technologies have been given different IPC classes does not necessarily mean that they cannot be combined.

4.4.7 In the present case E7 to E9 indicate that it is well known to use plasma deposition in the manufacture of glow plugs. Faced with the problem of finding a suitable method for applying the insulation coating shown in Figure 4 of E3, the skilled person would first turn to known methods in the field of glow plug manufacture.

Aware that plasma deposition generally provides hard, wear resistant ceramic coatings, it does not require any inventive activity for the skilled person to select this technique for making the glow plug of Figure 4 of E3.

4.5 Consequently, the glow plug of claim 1 lacks an inventive step.

**Order**

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

The decision under appeal is set aside.

The patent is revoked.

The Registrar:

The Chairman:

D. Sauter

U. Krause