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**D E C I S I O N**  
**of 5 March 2004**

**Case Number:** T 1014/02 - 3.2.4

**Application Number:** 94106058.4

**Publication Number:** 0621402

**IPC:** F02B 41/00

**Language of the proceedings:** EN

**Title of invention:**

Apparatus and method of fuel injection and ignition of  
internal combustion engine

**Patentee:**

Hitachi, Ltd.

**Opponent:**

DaimlerChrysler AG

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 100(c), 111(1), 123

**Keyword:**

"Amendments - broadening of claims (no)"  
"Remittal to the first instance for further prosecution"

**Decisions cited:**

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**Catchword:**

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Case Number: T 1014/02 - 3.2.4

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.4  
of 5 March 2004

**Appellant:** Hitachi, Ltd.  
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**Representative:** Beetz & Partner  
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**Respondent:** DaimlerChrysler AG  
(Opponent) D-70546 Stuttgart (DE)

**Representative:** Dahmen, Toni, Dipl.-Ing.  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 8 July 2002  
revoking European patent No. 0621402 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** C. A. J. Andries  
**Members:** T. Kriner  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

I. The appellant (patent proprietor) lodged an appeal, received at the EPO on 4 September 2002, against the decision of the opposition division posted on 8 July 2002 concerning the revocation of the European patent No. 0 621 402. The appeal fee was paid simultaneously and the statement setting out the grounds of appeal was received at the EPO on 15 November 2002.

II. Opposition was filed against the patent as a whole and based on Article 100(a) EPC in conjunction with Articles 52(1) and 56 EPC, on Article 100(b) EPC in conjunction with Article 83 EPC, and on Article 100(c) EPC in conjunction with Article 123(2) EPC.

The opposition division held in its decision that the patent as granted contained subject-matter which extended beyond the content of the application as filed, and therefore did not meet the requirements of Article 123(2) EPC.

Furthermore, the opposition division held that the subject-matter of the auxiliary requests 1 to 3 which were on file at that time was also not capable of meeting the requirements of Article 123(2) EPC (auxiliary request 2) or Article 123(3) EPC (auxiliary requests 1 and 3).

III. Oral proceedings took place on 5 March 2004.

The appellant requested that the decision under appeal be set aside and that the patent be maintained on the

basis of claims 1 to 8 filed during the oral proceedings.

The respondent (opponent) requested that the appeal be dismissed.

IV. The independent claims 1 and 5 of the appellant's present request (corresponding to claims 1 and 5 as granted) read as follows:

Claim 1:

"Method of fuel injection and ignition in an internal combustion engine with the steps of

- introducing air into the combustion chamber (21) of the engine,

- injecting fuel with a fuel injection valve (2) into the combustion chamber (21) in order to form a fuel/air-mixture

and

igniting the fuel/air-mixture with a spark plug (3), characterized in that

the spark plug (3) is disposed in a central portion of the combustion chamber (21) near the fuel injection valve (2),

a fuel jet flow B is injected into the combustion chamber (21) so as to pass by the spark plug (3) and generate flame kernels (40) having a size of 1 mm or more

and

in time of a small load when the accelerator pedal position  $\alpha$  is small, the ignition is performed by the spark plug (3) being ignited within the fuel injection time period in which energy of the fuel jet flow B is

available to disperse said flame kernels (40) in the combustion chamber (21), so that the flame kernels (40) are carried on the fuel jet flow B to increase the penetration force of the flame."

Claim 5:

"Apparatus for fuel injection and ignition in an internal combustion engine, comprising

- a fuel injection valve (2) having an injection port being opened in a combustion chamber (21) of the engine,

- a spark plug (3) for igniting a fuel/air-mixture being provided with injected fuel and air introduced in the combustion chamber (21)

and

- a control unit (8) for controlling the fuel injection and the ignition,

characterized in that

- the spark plug (3) is provided in a central portion of the combustion chamber (21) near the injection valve (2) in order to ignite a fuel jet flow B being injected into the combustion chamber (21) and generate flame kernels (40) having a size of 1 mm or more and

- the control unit (8) controls the spark plug (3) so as to be ignited within the fuel injection time period to ignite the fuel/air-mixture in the combustion chamber (21) in time of a small load when the accelerator pedal position  $\alpha$  is small, whereby energy of the fuel jet flow B is available to disperse said flame kernels (40), so that the flame kernels (40) are carried on the fuel jet flow B to increase the penetration force of the flame."

V. In support of his request the appellant relied essentially on the following submissions:

The opposition division's finding that the feature of the granted claims 1 and 5, concerning the generation of flame kernels having a size of 1 mm or more, had originally been disclosed only in connection with embodiments in which a flame nozzle was provided around the injection port, was not correct. In the general portion of the originally filed description (see EP-A-0 621 402, column 4, lines 20 to 26), the flame kernel size was described as an important thermodynamic condition for assuring that the flame kernels were not extinguished. This finding was expressed without being related to an individual embodiment of the claimed invention. The description according to which flame kernels having a size of 1 mm or more could be achieved by the provision of an opening portion of 1 mm or more in a flame nozzle, referred explicitly and exclusively to the case where a flame nozzle was arranged around the injection port of an injection valve (see EP-A-0 621 402, column 4, lines 26 to 32). However, this embodiment did no longer fall under the subject-matter of the present claims 1 and 5. When reading the originally filed description and in particular those portions mentioned above, it was obvious for the skilled person that there might be embodiments having a flame nozzle and embodiments without such a nozzle, and that the indispensable generation of a flame kernel size of 1 mm or more was disclosed irrespectively of any individual embodiment of the claimed invention. Therefore, the general feature that flame kernels having a size of 1 mm or

more had to be generated, was at least implicitly disclosed in the originally filed description, and the present claims met the requirements of Article 100(c) - 123(2) EPC.

VI. The respondent disputed the views of the appellant. His arguments can be summarized as follows:

The sections in column 4, lines 1 to 32 and in column 10, lines 11 to 23 of the originally filed description (see EP-A-0 621 402) showed on one hand that it was desired and necessary to have flame kernels having a size of at least 1 mm, and on the other hand that flame kernels of such a size could be generated by the provision of a flame nozzle having an opening portion of 1 mm or more. Since this was the only disclosure in the originally filed documents teaching how to generate flame kernels of the claimed size, the separation of the generation of a flame kernel size of 1 mm or more from the provision of a flame nozzle resulted in an extension of the originally filed disclosure. Therefore the present claims did not meet the requirements of Article 100(c) - 123(2) EPC.

## **Reasons for the Decision**

1. The appeal is admissible.
2. *Amendments*
  - 2.1 The originally filed description and drawings of the patent in suit undisputedly disclose a method having most of the features of the present claim 1 and an

apparatus having most of the features of the present claim 5 of the patent in suit (see in particular Figures 1 and 5 and the corresponding description in column 6, line 48 to column 7, line 46). However, the opposition division and the respondent both held that the following features were not comprised as such by the disclosure of the originally filed documents:

- (a) the fuel jet flow B is injected into the combustion chamber so as to pass by the spark plug and **generate flame kernels having a size of 1 mm or more** (claim 1);
- (b) the spark plug is provided ... near the injection valve in order to ... **generate flame kernels having a size of 1 mm or more** (claim 5);

but that they were disclosed only in combination with the feature according to which

- (c) a flame nozzle is provided on the injection port of the fuel injection valve, the diameter of the opening portion of the nozzle being 1 mm or more.

2.2 The size of the flame kernels is only mentioned in column 4, lines 20 to 32 and column 10, lines 11 to 23 of the originally filed and published application (EP-A-0 621 402). Each of these sections comprises two sentences. Each first sentence is pointing out that when the scale of the flame kernels becomes 1 mm or larger, the flame kernels grow and do not extinguish, and each second sentence describes that when a nozzle is provided flame kernels having a size of 1 mm or more can be achieved, when the diameter of the opening or



the openings of that nozzle provided downstream of an injector is made 1 mm or more.

The section in column 4, lines 20 to 32 reads as follows:

"Further, when the scale of the flame kernels becomes 1 mm or more, an amount of heat generation accompanied by combustion of the fuel-air mixture in the surroundings of the flame kernel becomes larger than a heat dissipation amount to the surroundings due to heat transmission, the flame kernel grows and is not extinguished. Accordingly, when the nozzle is provided on the injection port of the fuel injection valve, the diameter of the opening portion of the nozzle is made 1 mm or more, whereby the scale of the flame kernel is made 1 mm or more to grow the flame kernel and the extinction thereof can be prevented."

- 2.3 The first sentence of this section teaches that the generation of flame kernels having a size of at least 1 mm is indispensable for avoiding an extinction of the flame kernels. This teaching is described as a general requirement for a successful combustion initiated by a flame kernel, independent of any particular method of fuel injection and ignition or any apparatus for fuel injection and ignition.

The second sentence describes how the scale of the flame kernels can be made 1 mm or more, **when the nozzle** (obviously the nozzle mentioned in column 4, lines 1 to 3) **is provided on the injection port of the fuel injection valve**, namely by providing an opening portion of the nozzle having a diameter of 1 mm or more. This

wording can only be understood in such a way that the provision of an opening portion of a predetermined diameter in a flame nozzle is a possibility to achieve flame kernels having a size of 1 mm or more, but only in case where such a flame nozzle is provided on the fuel injection valve. However, it does not imply that the provision of a flame nozzle having an opening of at least 1 mm is the only way to generate flame kernels of 1 mm or more. On the contrary, when reading the second sentence in combination with the first sentence, it is obvious that in case where no flame nozzle is provided on the fuel injection valve, flame kernels of at least 1 mm have to be generated in another way.

The question whether or not the originally filed application discloses any other way of generating flame kernels of at least 1 mm, does not relate to the question whether or not features a and b mentioned in section 2.1 above are separately disclosed in the originally filed application, but only relates to the question whether or not the invention is disclosed sufficiently clear and complete for it to be carried out by a person skilled in the art.

Consequently the board comes to the conclusion that the features a and b, are not disclosed exclusively in connection with the provision of a flame nozzle (feature c) in the originally filed documents, but merely as a thermodynamic condition which is necessary for avoiding that the flame kernels are extinguished during the ignition of a fuel-air mixture.

- 2.4 It is correct that the suggestion of a flame nozzle having an opening portion of at least 1 mm seems to be

the only clear teaching in the originally filed documents of the patent in suit which shows how to achieve flame kernels of a size of 1 mm or more. However, this does not mean that the provision of features a and b in claims 1 and 5 without a feature concerning the provision of a flame nozzle (feature c) inevitably results in an extension of the disclosure of the originally filed documents.

As pointed out above, the general teaching, according to which flame kernels of at least 1 mm have to be generated, is (at least in the originally filed description in column 4, lines 20 to 32 of EP-A-0 621 402) not necessarily linked to the special teaching that such flame kernels can be achieved by the provision of a flame nozzle having an opening portion of a predetermined size. On the contrary, for the skilled person it is obvious that flames kernels of this size have to be generated in order to prevent their extinction, independently of the particular embodiment of the claimed method and apparatus.

Therefore the provision of features a and b in the present claims 1 and 5 without feature c does not result in an extension of the original disclosure of the patent in suit.

- 2.5 The features of dependent claims 2 to 4 are disclosed in Figures 10 a, b (claim 2), and Figures 13 to 15 (claims 3 and 4) in conjunction with the description of these figures (see column 6, line 55 to column 9, line 10; and column 10, line 48 to column 11, line 15; and column 12, lines 22 to 24). Claims 6 to 8 correspond to the originally filed claims 13, 15 and 16.

Furthermore, the present claims 1 to 8 correspond to the granted claims 1 to 5 and 8 to 10. Claims 6 and 7 as granted have been deleted, since the combinations defined in these claims (i.e. with granted claim 5) have not been disclosed in the originally filed documents of the patent in suit.

2.6 With respect to the above findings, the board comes to the conclusion that the present claims meet the requirements of Article 100(c) - 123 EPC.

3. *Remittal to the first instance*

Since the opposition division based its decision exclusively on Article 100(c) EPC in conjunction with Article 123(2) EPC, and since the other grounds for opposition cited in the opposition proceedings (Article 100(b) EPC in conjunction with Article 83 EPC, and Article 100(a) EPC in conjunction with Article 56 EPC) are not examined yet, the board remits the case to the opposition division for further prosecution, in accordance with Article 111(1) EPC, second sentence.

The further prosecution has to be restricted to the subject-matter covered by the present claims, or in other words to those embodiments of the invention without a flame nozzle, since these embodiments (as agreed by the appellant) are clearly excluded by the present claims.

The opposition division will have to assess whether or not the patent in suit discloses the subject-matter covered by the present claims, i.e. the embodiments

without a flame nozzle, sufficiently clear and complete for it to be carried out by a person skilled in the art (in particular whether or not it is sufficiently disclosed how flame kernels having a size of 1 mm or more can be generated without a flame nozzle), and - if this requirement is met - whether or not the claimed method and apparatus are new and involve an inventive step.

Furthermore, in case the patent is maintained the description and the figures have to be adapted to the claimed embodiments, at least to clarify that the embodiments comprising a flame nozzle (see the concerned figures and the corresponding description) do not form part of the claimed invention.

## **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 for further prosecution on the basis of claims 1 to 8 as filed during the oral proceedings on 5 March 2004.

The Registrar:

The Chairman:

G. Magouliotis

C. Andries