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**D E C I S I O N**  
**of 7 January 2003**

**Case Number:** T 0781/02 - 3.2.4

**Application Number:** 97106637.8

**Publication Number:** 0803645

**IPC:** F02D 21/08

**Language of the proceedings:** EN

**Title of invention:**  
A compression-ignition type engine

**Applicant:**  
TOYOTA JIDOSHA KABUSHIKI KAISHA

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 84

**Keyword:**

"Clarity of claims - yes (after amendment)"

**Decisions cited:**

-

**Catchword:**

-



**Case Number:** T 0781/02 - 3.2.4

**D E C I S I O N**  
**of the Technical Board of Appeal 3.2.4**  
**of 7 January 2003**

**Appellant:**

TOYOTA JIDOSHA KABUSHIKI KAISHA  
1, Toyota-cho  
Toyota-shi  
Aichi-ken (JP)

**Representative:**

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**Decision under appeal:**

**Decision of the Examining Division of the  
European Patent Office posted 25 April 2001  
refusing European patent application  
No. 97 106 637.8 pursuant to Article 97(1) EPC.**

**Composition of the Board:**

**Chairman:** C. A. J. Andries  
**Members:** T. Kriner  
H. Preglau

## Summary of Facts and Submissions

I. The Appellant (Applicant) lodged an appeal on 22 June 2001, against the decision of the Examining Division, dispatched on 25 April 2001, refusing the European patent application No. 97 106 637.8. The fee for the appeal was paid simultaneously and the statement setting out the grounds of appeal was received on 24 August 2001.

II. The Examining Division held that the application did not meet the requirements of Article 84 EPC, because claim 1 was not clear.

III. The Appellant requested that

- the appealed decision be set aside (see letter of 22 June 2001),
- the case be remitted to the Examining Division (see letter of 24 August 2001, page 5/10, paragraph 2), and
- a patent be granted on the basis of the following documents:

Claims:           No. 1 filed with letter of  
                    24 August 2001;  
                    Nos. 2 to 15 as originally filed;  
                    Nos. 17, 18 as originally filed, to  
                    be renumbered to claims 16, 17;

Description:      pages 1, 2, 4 to 25 as originally  
                    filed;  
                    pages 3, 26 filed with letter of

24 August 2001;

Drawings: Figures 1 to 27c as originally  
filed.

Additionally the Appellant requested oral proceedings, if the Board tended to maintain the decision of the examining Division (see letter of 24 August 2001, page 10/10, paragraph 3).

IV. Claim 1 reads as follows:

"A compression-ignition type engine having a combustion chamber, an intake passage, and an exhaust passage, said engine comprising:

injection means for injecting fuel in the combustion chamber and forming fuel droplets diffused in the combustion chamber, the mean value of the particle size of said fuel droplets being larger than 500  $\mu\text{m}$ ; and

injection time control means for controlling said injection means to carry out an injecting operation by said injection means at a predetermined timing during a period from the start of an intake stroke to approximately 60 degrees before top dead center of the compression stroke;

characterized by further comprising

an exhaust gas recirculation passage interconnecting the exhaust passage to the intake passage; and

exhaust gas recirculation control means for controlling an amount of exhaust gas recirculated to the intake passage from the exhaust passage, wherein an exhaust gas recirculation ratio (amount of recirculated exhaust gas/(amount of recirculated exhaust gas + amount of intake air)) is made more than approximately 40 percent at least when the engine is operating under

a heavy load."

- V. In support of his requests, the Appellant relied essentially on the following submissions:

Claim 1 of the present application had been amended so as to overcome the objections of lack of clarity on which reason the decision to refuse the application was based.

The particle size was now concretely specified so that it did no longer refer to the temperature of the fuel droplets of the main ingredient of the fuel.

With respect to the claimed exhaust gas recirculation ratio, it was clear that the gas amounts would be calculated on a mass basis which was usual in the present technical field and would automatically be applied by the skilled person. Since gas masses, irrespective whether they were expressed in grams or in mols, specified a certain concentration of gas molecules, the exhaust gas recirculation ratio as defined in claim 1 did not only make sense but also delivered reliable and reworkable results. In comparison to the calculation of the exhaust gas recirculation ratio on a mass basis, the calculation of this ratio on a volume basis would make no sense, since the gas volume within the combustion chamber of a combustion engine was subject to considerable changes during the working cycle of the engine.

Hence, the request for rectification of the contested decision and for continuation of the examination by the Examining Division was justified.

## Reasons for the Decision

1. The appeal is admissible
2. *Amendments*

The present claim 1 differs from the originally filed claim 1 in that the feature according to which

- the mean value of the particle size of the fuel droplets is larger than a predetermined particle size at which the temperature of the fuel droplets having said predetermined particle size reaches a boiling point of a main ingredient of said fuel, which boiling point is determined by pressure in the combustion chamber, at about the top dead center of the compression stroke,

has been replaced by the feature according to which

- the mean value of the particle size of the fuel droplets is larger than 500  $\mu\text{m}$ .

Moreover, the feature according to which

- the engine comprises an exhaust gas recirculation control means for controlling an amount of exhaust gas recirculated to the intake passage from the exhaust passage to make an exhaust gas recirculation ratio more than approximately 40 percent at least when the engine is operating under a heavy load,

has been amended as follows:

- the engine comprises an exhaust gas recirculation control means for controlling an amount of exhaust gas recirculated to the intake passage from the exhaust passage, wherein an exhaust gas recirculation ratio (amount of recirculated exhaust gas/(amount of recirculated exhaust gas + amount of intake air)) is made more than approximately 40 percent at least when the engine is operating under a heavy load.

Both amendments are supported by the originally filed description, see in particular page 1, lines 5 to 16; page 11, lines 12 to 16; page 12, lines 4 to 16; page 15, lines 29 to 35; and page 30, claim 16.

Dependent claims 2 to 15 have not been amended; dependent claims 17 and 18 have merely to be renumbered to claims 16 and 17; and the description has only been adapted to the amended claim 1.

Consequently the amendments of the application meet the requirements of Article 123(2) EPC.

### 3. *Clarity*

- 3.1 With respect to the feature concerning the particle size, the mean value of the particle size is no longer defined in relation to the temperature of the main ingredient of the fuel to be burned. The present claim 1 only requires that the mean value of the particle size of the fuel droplets has to be larger than 500  $\mu\text{m}$ . Such a size of fuel droplets is determinable for example by a Phase Doppler Particle

Analyser (PDPA). Hence, the feature according to which the mean value of the particle size of the fuel droplets is larger than 500  $\mu\text{m}$ , provides a clear technical teaching which can be determined by a procedure which is usual in the art.

- 3.2 With respect to the feature concerning the exhaust gas recirculation ratio, the Board agrees to the Appellant's opinion according to which the skilled person would calculate this ratio on a mass basis and not on a volume basis.

Although it is correct (as stated in the contested decision of the Examining Division) that the units "litres", "grams" and "mols" are used in the field of combustion engines, this is not true for the determination of the exhaust gas recirculation ratio. This ratio which in the specialized literature is usually only described in percent, is defined by the ratio of the mass of the recirculated exhaust gas to the sum of the mass of the recirculated exhaust gas and the mass of intake air (see for example "Untersuchungen zur Motorsteuerung von Ottomotoren mit thermodynamischen Kenngrößen", R. Dolt, Dissertation an der TU Darmstadt, 2000, Seiten 86, 87).

The use of "mols" or "grams" in order to express the mass of the recirculated exhaust gas and of the intake air results in each case in the same exhaust gas recirculation ratio.

The use of volumes (unit: "litres") for the determination of the exhaust gas recirculation ratio is not known from the specialized literature. Moreover, with respect to the pressure differences in the



manifolds, the exhaust gas recirculation passage and the combustion chamber, the use of volumes would make no sense.

Hence, the feature according to which an exhaust gas recirculation ratio (amount of recirculated exhaust gas/(amount of recirculated exhaust gas + amount of intake air)) is made more than approximately 40 percent at least when the engine is operating under a heavy load, is also clear.

- 3.3 With respect to the above findings and since all further features of claim 1 are obviously clear, the Board is convinced that the present claim 1 meets the requirements of Article 84 EPC.

4. *Procedural matter*

The Examining Division rejected the present application exclusively on the ground of lack of clarity of claim 1. Since this objection has been overcome by the amended claim 1, the case is remitted to the first instance for the examination of the further requirements of the EPC, as requested by the appellant in his letter of 24 August 2001.

5. Since the Board sets aside the decision under appeal, no oral proceedings are required.

## 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 of the application on the basis of the following documents:

Claims:                   No. 1 filed with letter of 24 August 2001;  
                              Nos. 2 to 15 as originally filed;  
                              Nos. 17, 18 as originally filed and to be renumbered to claims 16, 17;

Description:           pages 1, 2, 4 to 25 as originally filed;  
                              pages 3, 26 filed with letter of 24 August 2001;

Drawings:               Figures 1 to 27c as originally filed.

The Registrar:

The Chairman:

G. Magouliotis

C. Andries