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**Datasheet for the decision
of 21 August 2008**

Case Number: T 1370/06 - 3.2.04

Application Number: 98962749.2

Publication Number: 1036270

IPC: F02M 25/07

Language of the proceedings: EN

Title of invention:

Arrangement for a combustion engine

Patentee:

Volvo Lastvagnar AB

Opponents:

DaimlerChrysler AG
Scania CV AB

Headword:

-

Relevant legal provisions:

-

Relevant legal provisions (EPC 1973):

EPC Art. 56

Keyword:

"Inventive step - no (all requests)"

Decisions cited:

T 0644/97

Catchword:

-



Case Number: T 1370/06 - 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 21 August 2008

Appellant: Volvo Lastvagnar AB
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Respondent 2: Scania CV AB
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 6 July 2006
revoking European patent No. 1036270 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: M. Ceyte
Members: M. Poock
T. Bokor

Summary of Facts and Submissions

I. This is an appeal against the decision of the Opposition Division of 6 July 2006 in which European patent No. 1 036 270 was revoked.

The Opposition Division held that the subject-matter of claims 1 and 7 did not involve an inventive in view of the following documents:

D5: JP-A-08 240 156;

D6: JP-A-63 125 162;

D8: EP-A-0 596 855;

D13: EP-A-0 489 263;

D17: WO-A-9 740 270.

It was obvious for the skilled person to combine the closest prior art known from document D6 with either one of documents D8, D13 or D17 and thus to arrive at the claimed subject-matter.

II. The Patent Proprietor lodged the notice of appeal on 4 September 2006 and paid the prescribed appeal fee simultaneously. The statement of grounds of appeal was received on 13 November 2006.

In the appeal proceedings, oral proceedings were held on 21 August 2008.

III. The Appellant (Patent Proprietor) requested that the decision under appeal be set aside and the patent be maintained on the basis of any of the sets of claims filed with the letter of 18 July 2008 as main, first or second auxiliary request.

The Respondents (Opponents) requested that the appeal be dismissed.

IV. Claim 1 of the main request reads as follows:

"A method for reduction of harmful emissions from a diesel engine (1) in an engine arrangement, said arrangement comprising: a diesel engine (1) having at least one cylinder (2), an intake (3, 4) for the supply of air, an exhaust outlet (9, 10) for discharging exhaust gases, a further line (15) for recirculation of exhaust gases from said outlet (9, 10) to said intake (3, 4) for the reduction of harmful emissions from the engine (1), said further line (15) being provided with a cooler (18) for cooling the exhaust gases recirculated to said intake (3, 4), a controllable valve (16) arranged in said further line (15), said valve being continuously controllable between an open and a closed condition, a turbocharger unit (11) comprising a first means (12) for absorbing energy from the exhaust gases and a means (14) for compressing air to said intake (3, 4) a second means (22) for absorbing energy from the exhaust gases arranged downstream of said first means (12) for building a pressure in said outlet (9, 10) surmounting the pressure in said intake (3, 4), and a power transmission (25) between said second means (22) and a crankshaft (24) associated with the engine (1), said method comprising the steps of: arranging said turbocharger unit (11) and said second means (22) such that a pressure is achieved on the exhaust side of the engine (1) which is higher than the pressure on the intake side, and continuously adjusting the controllable valve (16) between an open and a

closed condition to provide variation of the aperture area of the valve between different extremes in the operating conditions of the engine."

Claim 1 of auxiliary request 1 is as in the main request, except for an amendment in its last feature which reads as follows:

"and continuously adjusting the controllable valve (16) between an open and a closed condition such that the flow of EGR gas is adjusted for an optimum reduction of NO_x emissions, whereafter the injection point in time required to achieve minimum fuel consumption is determined without exceeding the given NO_x level".

Claim 1 of auxiliary request 2 is as in the main request, except for its last feature which reads as follows:

"and continuously adjusting the controllable valve (16) between an open and a closed condition to provide variation of the aperture area of the valve between different extremes in the operating conditions of the engine such that the flow of EGR gas is adjusted for an optimum reduction of NO_x emissions, whereafter the injection point in time required to achieve minimum fuel consumption is determined without exceeding the given NO_x level".

V. The Appellant argued that the subject-matter of claim 1 of the main request involved an inventive step for the following reasons:

(a) Main request

- (i) Document D6 does not represent the closest prior art because it addresses a completely different problem, i.e. to improve fuel economy at low loads of a turbo compound engine. It has no cooler provided in the exhaust recirculation circuit and does not unambiguously disclose to continuously adjust the controllable valve throughout the operating range of the engine. The sentence on page 6, lines 15 to 20 is an inadvertently made sentence contradicting the whole teaching of this document. In contrast, document D5 is seen to represent the closest prior art.

- (ii) Upon request of the chairman in the oral proceedings, the problem was defined as to effectively control the exhaust gas recirculation flow rate over a wide range of diesel engine operating conditions.

- (iii) The skilled person would not consider the teaching of document D8 for the solution of this problem due to various reasons. It does not relate to a turbo compound engine. A different problem is addressed therein, i.e. to remove soot and particulate from the exhaust gas recirculation passage. Any improvements in NO_x emissions due to cooling of the recirculated exhaust gases is expected only when the load is above 30% (page 2, line 43-45). Documents D6 and D8 existed for at least 3 years side by side.

Moreover, document D13 demonstrates the skilled person's common general knowledge of the beneficial effects the supply of intake air at a high temperature has on the reduction of NO_x emissions.

- (iv) But even if the skilled person combined the method known from document D6 with the teaching of document D8, he would not arrive at the claimed method. In such case, only the intake passage is provided with an intercooler, as described on page 2, lines 19, 20 and not the recirculation line as claimed.

Therefore, none of the cited documents motivates the skilled person to provide a cooler in the exhaust gas recirculation line.

- (b) Auxiliary requests 1 and 2

The solution to the problem to retain the advantages of the method of document D6 with an optimum reduction of NO_x emissions is not obvious.

In the oral proceedings a graph was shown and explained in which the NO_x emissions and the fuel consumption were visualised over the injection point in time. The later the injection point in time is, the higher is the fuel consumption and the lower are the NO_x emissions.

Therefore, the optimisation of these parameters required inventive considerations.

VI. The Respondents argued that the subject-matter of claim 1 of any of the requests does not involve an inventive step for the following reasons:

(c) Main request

(i) The reduction of NOx emissions is not limited only to the low-load region in the methods known from documents D5 or D6.

(ii) In document D6, it is mentioned on page 5, lines 7 to 11 that the control valve is fully closed in the regions above medium-load. The only feature of claim 1 which is not known from this document is the provision of a cooler in the gas recirculation line. This solves the problem to further reduce the NOx emissions.

(iii) The solution of this problem is obvious for the skilled person in view of document D8. The method disclosed therein is suitable for diesel engines (see page 2, line 5 - 7) and discloses the reduction of NOx emissions and fuel consumption (see page 2', line 43 - 45).

(d) Auxiliary requests 1 and 2

The additional features in claim 1 of these requests, do not require inventive considerations. There is a general need for reducing NOx emissions

and fuel economy. Since the legal environmental requirements take precedence over the consumers requirements for fuel economy, it is obvious to first adjust the control valve in the recirculation line of document D6 for an optimum reduction of NO_x emissions and then the injection point in time to achieve minimum fuel consumption without exceeding the given NO_x level.

Reasons for the Decision

1. The appeal is admissible but not well founded.
2. *Inventive step - main request*
 - 2.1 Closest prior art
 - 2.1.1 Document D6 discloses a method for the reduction of harmful emissions from a diesel engine in an engine arrangement. The diesel engine 1 has at least one cylinder, an intake for the supply of air fed by the intake passage 2, an exhaust outlet feeding the exhaust passage 3 for discharging the exhaust gases, and a further line 10 for recirculation of exhaust gases from said outlet to said intake in which a controllable valve 11 is arranged. A turbocharger unit is provided comprising a first means 4 for absorbing energy from the exhaust gases and a means 7 for compressing air to said intake, a second means 5 for absorbing energy from the exhaust gases is arranged downstream of the first means 4 for building a pressure in said outlet surmounting the pressure in said intake. A power

transmission 8 is provided between the second means 5 and a crankshaft 9 associated with the engine.

The turbocharger unit and the second means 5 are arranged such that a pressure is achieved on the exhaust side of the engine which is higher than the pressure on the intake side. The controllable valve 11 is continuously adjusted (page 4, line 30 to page 5, line 1; page 5, lines 7, 8 and page 3, last paragraph) between an open and a closed condition to provide variation of the aperture area of the valve between different extremes in the operating conditions of the engine, i.e. between low and high load conditions.

2.1.2 In contrast, document D5 does not relate to a diesel engine and does not disclose a continuous control of the controllable valve and has fewer features in common with claim 1 as the method known from document D6.

2.1.3 Consequently, the Board considered the method of document D6 to represent the closest prior art.

2.2 Formulation of the technical problem

2.2.1 It is established case law of the Boards of Appeal that an objective definition of the technical problem to be solved should normally start from the technical problem that is described in the patent in suit. Only if it turns out that an incorrect state of the art was used to define the technical problem or that the technical problem disclosed has in fact not been solved, can an inquiry be made as to which other technical problem objectively existed (see e.g. T 644/97 of 22 April 1999, point 2.3, not published in the OJ EPO).

According to paragraph [0009] of the patent specification, it is the object of the invention to provide an improved arrangement for a combustion engine, particularly a diesel engine being equipped with an EGR system and a turbocharger, providing an adequate propulsion pressure for the EGR gases, so as to achieve a reduction of the NO_x emissions of the engine.

However, such a problem has already been solved by the method known from document D6, see in particular page 6, lines 12 to 14.

Therefore, it is necessary to reformulate the technical problem based on the method known from document D6.

2.2.2 The problem mentioned by the Appellant in the oral proceedings, i.e. to effectively control of the exhaust gas recirculation flow rate over a wide range of diesel engine operating conditions, is based on paragraph [0028] of the patent specification. However, it is also fully solved by the method known from document D6, see page 4, lines 30 to page 5, line 1; page 5, lines 25 to 27; page 6, lines 15 to 17.

2.2.3 Derivation of the objective technical problem.

(a) According to document D6, at low loads, the valve opening is increased, such that a large amount of exhaust gas is recirculated (page 3, last paragraph; page 5, lines 25 to 30) which leads to an increased reduction of NO_x emissions, as stated on page 6, lines 12 to 14.

Upon transfer from the low load to the medium and high load conditions, the valve opening is reduced (page 4, paragraph 1). Hence, a large amount of the exhaust gas is directed to the first and second turbine whereas only a smaller portion thereof is recirculated. In this transfer state, the reduction of NO_x emissions is lower than at the low load condition.

The statement on page 6, lines 15 to 20 is fully consistent with the one on page 4, paragraph 1 and there is no contradiction with the whole teaching of the document, as alleged by the Appellant.

- (b) With the method step "arranging said turbocharger unit and said second means such that a pressure is achieved on the exhaust side of the engine which is higher than the pressure on the intake side, and continuously adjusting the controllable valve between an open and a closed condition to provide variation of the aperture area of the valve between different extremes in the operating conditions of the engine" in the second portion of claim 1, the features of the arrangement, i.e. the diesel engine, the controllable valve, the turbocharger means, etc. have become a necessary part of the method claim 1. In other words, the provision of "said arrangement" is implicitly claimed.

Thus, the subject-matter of claim 1 is distinguished from the known method by the feature that the further line is provided with a cooler

for cooling the exhaust gases recirculated to the intake.

- (c) Hence, the recirculated exhaust gas is cooled and enters the combustion chamber at a lower temperature. This has the known effect that the amount of NO_x compounds in the exhaust gas is reduced (see, e.g., patent specification, column 1, lines 27 to 30 and column 5, lines 4 to 6).
- (d) In view of the above, starting from the method known from document D6, the technical problem to be solved may be formulated as providing a method in which the amount of NO_x compounds in the exhaust gas is reduced when the engine load is increased from low load to high load.

2.3 Obviousness of the solution

2.3.1 Document D8 relates to the field of diesel combustion engines. (page 2, paragraph 2).

It addresses the problem to reduce the NO_x emissions not only at low loads of the engine but also when it is operated at high loads (page 2, lines 36 - 39 and page 2, line 5 - 22). For the solution it is proposed to cool the recirculated exhaust gas (page 2, lines 20, 21) by cooler 22 in the recirculation passage. Contrary to the Appellant's view, this teaching is not limited to loads above 30%, because on page 2, lines 43 to 45 it is specified as a preferred but not as the sole range.

In any event, the range above 30% load describes loads in the transfer state from low to high loads. Hence, this aspect of the problem mentioned above is explicitly addressed in this document.

Thus, it can be stated that document D8 relates to the same technical field, addresses in essence the same technical problem and proposes in essence the same features for its solution as the method of claim 1.

2.3.2 The Appellant referred to document D13 to demonstrate the skilled person's common general knowledge of the beneficial effects the supply of intake air at a high temperature has on the reduction of NO_x emissions.

However, the Board does not share this view. As described in the patent specification, column 1, lines 27 to 30 and lines 46 to 52 and in document D8, page 2, lines 43 to 45, for example, it is commonly known that the cooling of the recirculated exhaust gas reduces the NO_x emissions. In view of this common general knowledge, document D13 cannot hinder the skilled person to apply the teaching of document D8 on the method of document D6, i.e. to provide a cooler in the further line 10 of document D6 for cooling the exhaust gases recirculated to the intake, and to thus arrive at the solution of claim 1.

2.3.3 For these reasons, it is concluded that the method of claim 1 of the main request does not involve the inventive step required by Article 56 EPC 1973.

3. *Inventive step - auxiliary requests*

3.1 The amended features in claim 1 of these requests require that two parameters have to be optimised over the injection point in time, i.e. optimum reduction of NO_x emissions and minimum fuel consumption (see also patent specification, paragraph [0030]).

3.2 It is common ground that a general need for optimising the reduction of NO_x emissions and the fuel economy exists (see, for example, document D6).

Finding a suitable compromise between two competing parameters comes, in the judgement of the Board, within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can be readily contemplated in advance.

Moreover, since legal environmental requirements take precedence over the consumers requirements for fuel economy, clear incentives existed to first adjust for an optimum reduction of NO_x emissions and then to determine the best injection point in time for minimum fuel consumption without exceeding a given NO_x limit.

Hence, the subject-matter of claim 1 is obvious to the skilled person having regard to the state of the art.

3.3 For these reasons, it is concluded that the method of claim 1 of auxiliary requests 1 and 2 does not involve the inventive step required by Article 56 EPC 1973.

4. Consequently, none of the main, first or second auxiliary requests is allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

G. Magouliotis

M. Ceyte