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**Datasheet for the decision
of 30 October 2008**

Case Number: T 0612/07 - 3.2.04

Application Number: 97304503.2

Publication Number: 0816662

IPC: F02F 1/42

Language of the proceedings: EN

Title of invention:

A method for making a liquid cooled cylinder head for an internal combustion engine

Patentee:

Cummins Engine Company, Inc.

Opponents:

Perkins Engines Company Limited
MAN Nutzfahrzeuge AG
DEUTZ Aktiengesellschaft

Headword:

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Relevant legal provisions:

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Relevant legal provisions (EPC 1973):

EPC Art. 56, 114, 123(2)

Keyword:

"Discretion to admit late-filed documents exercised properly (yes)"

"Inventive step - auxiliary requests 1-4 (no)"

"Added matter - auxiliary request 5"

Decisions cited:

T 0748/91, T 0511/92, T 0823/96, T 0644/97

Catchword:

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Case Number: T 0612/07 - 3.2.04

DECISION
of the Technical Board of Appeal 3.2.04
of 30 October 2008

Appellant 1:
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
23 February 2007 concerning maintenance of
European patent No. 0816662 in amended form.

Composition of the Board:

Chairman: M. Ceyte
Members: M. Poock
C. Heath

Summary of Facts and Submissions

I. In its interlocutory decision of 23 February 2007, the Opposition Division decided that European patent No. 0 816 662 met the requirements of the European Patent Convention in the form of auxiliary request 2.

The Patent Proprietor lodged an appeal against this decision which was received with the appeal fee at the European Patent Office on 23 April 2007. The statement setting out the grounds of appeal was received on 2 July 2007.

Also Opponent 2 lodged an appeal against this decision which was received with the appeal fee at the European Patent Office on 12 April 2007. The statement of grounds of appeal was received on 19 June 2007.

Likewise Opponent 3 lodged an appeal against this decision which was received at the European Patent Office on 16 April 2007. The appeal fee was received on 18 April 2007 and the statement of grounds of appeal on 8 June 2007.

Opponent 1 did not file an appeal and, according to Article 107, second sentence EPC 1973, is a party to the appeal proceedings as of right.

II. The Opposition Division considered, inter alia, the following documents:

D2: DD-A-88 426;
D3: US-A-2 339 972;
D4: US-A-3 889 644;

D5: US-A-4 377 990;
D6: US-A-3 553 808;
D7: US-A-3 491 731;
D7a: WO-A-9 609 467;
D8: DE-A-4 433 280;

The Division held that claim 1 of the main request contravened the requirements of Article 123(2) EPC, and that the subject-matter of claim 1 of auxiliary request 1 lacked novelty in view of the disclosure of documents D8 or D7a. Document D7a, although filed after the expiry of the opposition period, was admitted into the proceedings because it "could be prima facie relevant for the decision".

III. Oral proceedings before this Board of Appeal took place on 30 October 2008.

Appellant 1 (Patent Proprietor) requested that the decision under appeal be set aside and that the patent be maintained based on one of the sets of claims according to auxiliary requests 1 - 5 as filed with letter of 30 December 2008. The main request was withdrawn with letter of 30 September 2008.

Appellants 2 and 3 (Opponents 2 and 3) and the party as of right (Opponent 1) requested that the decision under appeal be set aside and that the European patent No. 0 816 662 be revoked.

IV. Claim 1 reads as follows:

(i) Auxiliary request 1

"1. A method for making a liquid cooled cylinder head (20) for a multi-valve internal combustion engine (10), the head having an outer surface (26) and including a first cooling cavity (80) and a second cooling cavity (90) and the method comprising:

(a) casting the head without any integral liquid coolant passages connecting the first and second cooling cavities (80, 90) within the head;

(b) machining a first opening through the outer surface of the head to form a first passage (82) intersecting the first and second cooling cavities (80, 90) to provide for liquid coolant communication between the first and second cooling cavities (80, 90) within the head, wherein said machining includes drilling a bore into the head to form the first opening;

(c) closing the first opening formed by said machining in the outer surface of the head;

(d) machining a second opening through the outer surface of the head to provide a second passage (92) interconnecting the first and second cooling cavities (80, 90); and

(e) closing the second opening formed by said machining through the outer surface of the head; wherein said first cooling cavity (80) defines a lower cooling chamber and said second cooling cavity (90) defines an upper cooling chamber and the second passage (92) is positioned generally above the first passage (82) to vent air when coolant is introduced, and wherein the first passage has a first throat area, and the second passage has a second throat area, smaller than the first throat area".

(ii) Auxiliary request 2

Claim 1 reads as in the foregoing request except that the last feature reads as follows:

"... when coolant is introduced, the minimum throat area of the first passage (82) being at least twice the minimum throat area of the second passage (92)".

(iii) Auxiliary request 3

Claim 1 is as in the foregoing request with an amendment in feature b) "wherein the first passage (82) is generally horizontal".

(iv) Auxiliary request 4

"1. A method for making a liquid cooled cylinder head (20) for a multi-valve internal combustion engine (10), the head having an outer surface (26) and including a first cooling cavity (80) defining a lower cooling chamber and a second cooling cavity (90) defining an upper cooling chamber and the method comprising:

- (a) casting the head without any integral liquid coolant passages connecting the first and second cooling cavities (80, 90) within the head;
- (b) machining a first opening having a first throat area through the outer surface of the head to form a first passage (82) intersecting the first and second cooling cavities (80, 90) to provide for liquid coolant communication between

the first and second cooling cavities (80, 90) within the head, wherein said machining includes drilling a bore into the head to form the first opening;

(c) closing the first opening formed by said machining in the outer surface of the head;

(d) machining a second opening having a second throat area smaller than half the first throat area through the outer surface of the head to provide a second passage (92) interconnecting the first and second cooling cavities (80, 90); and

(e) closing the second opening formed by said machining through the outer surface of the head".

(v) Auxiliary request 5

Claim 1 is as in the foregoing request except that in feature d) was added "the second passage (92) being positioned generally above the first passage (82)" and further, the following features were added:

"(e) introducing coolant into the head (20);" and
"(f) venting air through the second passage during the introducing of coolant;"

V. Appellant 1 essentially argued as follows:

(a) Admission of document D7a

Document D7a does not add anything over document D8 except an unclear figure 7 which does not show a true cross-section. Furthermore, since the representative of the Opponent 2 had submitted

that he had drafted document D7a and D8, the Opponent was aware of document D7a at the time of filing the opposition. Therefore, he could have mentioned this document in the notice of opposition, if he wished to have it considered. Therefore, document D7a should not be admitted.

(b) Novelty (all requests)

Document D7a does not directly and unambiguously disclose feature a). The fact that all of the interconnecting passages of document D7a may be drilled from the outside of the heads does not amount to a disclosure that the head is cast without interconnecting passages and the passages are formed by drilling. Moreover, there is no explicit disclosure not to cast these passages. It is commonly known to cast as many parts as possible because it is expensive to drill after casting.

The same applies to features b) and d). Even if it were possible that openings are drilled through the outer surface of the head, this does not amount to a disclosure of these features in document D7a.

The person skilled in the art would understand the term "zumindest teilweise", i.e. at least partially, on page 9, lines 2 to 9 in document D7a to describe the situation where, although the passages are generally cast, they may be partially drilled in some instances. Thus, document D7a does not clearly and unambiguously disclose an

embodiment in which the head is cast without any integral liquid coolant passages.

The drawings in document D7a are no exact construction drawings but rather merely schematic diagrams. These figures show no scale or other indication that the drawings are to scale. However, dimensions obtained merely by measuring in a schematic drawing do not form part of the disclosure.

(c) Inventive step (all requests)

The skilled person is considered as a graduate engineer having experience in the field of the construction and casting of combustion engines. It is not apparent that a prejudice existed to cast as many parts as possible because machining is expensive. Rather, it has been usual practice to cast interconnecting passages and then to remove casting fins or artefacts by post-cast drilling. Reference is made to two affidavits to confirm the advances made by the claimed invention over the state of the art at the time. By machining the passages, the difficulties of detecting and removing casting fins to assure adequate coolant communication when the interconnecting passages are cast, are eliminated.

(d) The amendments in claim 1 of auxiliary request 5 do not contravene the requirements of Article 123(2) EPC because they are based on the disclosure of page 2, lines 23 - 27 and claim 8 in

combination with claim 11 of the application as filed originally.

VI. The other parties argued essentially as follows:

- (a) Document D7a is relevant for the decision to be taken. In addition to what is known from document D8 it shows the combination of a cylinder head and a cylinder block (see figure 7) and it can be seen that the passages can be drilled from the outside.
- (b) The subject-matter of claim 1 of all requests is not patentable over the teaching of document D7a, (see in particular page 2, lines 18 to 24). The practice of not casting interconnecting passages but instead forming them by post-cast drilling was known at the priority date, as evidenced by documents D2 to D7. But even if the subject-matter of claim 1 were considered to be distinguished from the method of document D7a, it does not involve an inventive step because it only requires practical and commonly known considerations to arrive at the claimed subject-matter.

Reasons for the decision

1. *Admissibility*

The appeal is admissible.

2. *Document D7a*

2.1 This document was filed after the opposition period had expired. Thus it has to be considered as being late filed and its admittance into the proceedings is a matter of discretion under Article 114(2) EPC 1973.

In contrast to document D8 which was filed in due time, document D7a shows the combination of a cylinder head and a cylinder block in figure 7 which is also described in the description. This disclosure is particularly relevant for the additional features of introducing coolant into the head and venting the air through the second passage in claim 1 of auxiliary request 5. Moreover it shows that the interconnecting passages can be drilled through the outer surface of the head. Hence, document D7a is more relevant for the decision to be taken than document D8.

Therefore, the Board does not see any reason to suspect that the Opposition Division has wrongly exercised its discretion to admit document D7a into the proceedings under Article 114(2) EPC 1973.

3. *Auxiliary request 1 - inventive step*

3.1 Closest prior art

3.1.1 Document D7a is considered to represent the closest prior art and discloses a method for making a liquid cooled cylinder head for a multi-valve internal combustion engine. The head 4 has an outer surface and includes a first cooling cavity 12 and a second cooling cavity. This method comprises:

- machining a first opening through the outer surface of the head to form a first passage 13 intersecting the first and second cooling cavities 12 and 14, 18 to provide for liquid coolant communication between the first and second cooling cavities within the head, wherein said machining includes drilling a bore into the head to form the first opening 13 (see in particular page 9, lines 2 - 4 and figures 2 and 6); and
- closing the first opening 13 formed by said machining in the outer surface of the head with plug 22 (see page 9, lines 4 and 5).

Thus, the Board concludes that the features b) and c) of claim 1 are disclosed in this document.

3.1.2 According to the well-established case law of the Boards of Appeal, any prior art disclosure anticipates a claimed feature if it can be inferred directly and unequivocally from that disclosure, including information which for the skilled person is implicit in what is explicitly disclosed (see e.g. T 511/92 of 27 May 1993, point 2.2, not published in the Official Journal of the EPO). In this respect, the Board concurs with the findings in T 823/96 (mentioned in "Case Law of the Boards of Appeal of the European Patent Office", 5. English edition 2006, page 261) that implicit matter must be a clear and unambiguous consequence of what is explicitly mentioned for the skilled person.

(a) Document D7a also discloses the step of:

- machining a second opening as a second passage interconnecting the first and second cooling cavities 12 and 18. This second passage is the inclined passage that can be seen in figure 2 and will be referred to in the following as the "inclined passage".

The inclined passage is described on page 3 in lines 17 to 21 as "Verbindungsbohrungen", i.e. connecting bores. Already this term implies that it is made by drilling, i.e. by machining. Such understanding is confirmed by the statement on page 9, lines 2 - 4. Although superfluous for the cooling bores 13, it is observed that also the inlet 10 and the cooling channels 19 can, at least partially, be drilled. Moreover, the skilled person, on the basis of the disclosure of this document, would drill the inclined bore, because it is a "metering" bore (see page 3, line 19: "dosierten Kühlstrom") which requires minimised variations in dimensional accuracy.

It is not explicitly described how the inclined passage is drilled. However, only two alternatives exist, either from the left side or from the top (see figure 7). Since the first alternative does not require a long drill as the second alternative, the Board is convinced that the skilled person would drill the hole from the left side of the cylinder head. Thus, on the basis of the disclosure of document D7a,

the skilled person would machine the second opening through the outer surface of the head to provide a second passage in the form of the inclined bore mentioned above as required by feature d) in claim 1. In figure 7 it can be seen that the outer surface through which the bore is drilled is closed by a plug. On the other hand, this cannot be seen in figure 2. However this must not mean that it is not drilled from the outer surface. It only means that the inclined passage shown in figure 2 has an axis not ending in the outer surface of the head that can be seen in figure 2.

Thus, the Board concludes that also features d) and e) of claim 1 are at least implicitly disclosed in document D7a.

- (b) Moreover, it discloses that the first cooling cavity 12 defines a lower cooling chamber and the second cooling cavity 14, 18 defines an upper cooling chamber as can be seen for example in figures 2 and 4. The inclined passage is positioned generally above the first passage 13 and thus vents air when coolant is introduced. It can be seen in figures 2 and 7 that the diameter of the inclined passage is smaller than the diameter of the first passage 13. Since the throat area increases with the square of the bore diameter, it can be stated that the inclined passage has a second throat area smaller than the first throat area of the first passage.

Thus, the Board concludes that also the last features of claim 1 are known from document D7a.

(c) Finally, document D7a discloses the step of:

- casting the head, see page 2, line 32 "beim Gießen des Zylinderkopfs".

However, the disclosure of this document leaves doubts whether the inclined bore is made only by drilling, thus not casted at all, or casted and then finished by drilling.

Therefore, the Board concludes that feature a) is not directly and unequivocally disclosed in this document.

3.2 Derivation of the technical problem

3.2.1 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 OJ EPO).

The technical problem to be solved is specified in paragraph [0004] of the patent specification and is based on a different document than the one mentioned above which is considered to represent the closest

prior art. In the method disclosed therein, the first and second passages are at least finally machined, so that casting fins are not present in these passages. Thus, the problem specified in the patent was already solved, at least partially.

Therefore, it is necessary to reformulate the technical problem based on the method known from document D7a.

3.2.2 Distinguishing features

(a) In view of the foregoing, the subject-matter of claim 1 is distinguished from the known method by feature a) i.e. that the inclined passage is completely made by drilling and is not cast at all.

(b) This ensures that an intricate inner core for forming the inclined passage can be avoided so that the casting procedure is simplified but also the producibility is improved (see patent specification, paragraphs [0003] and [0004]).

3.2.3 Formulation of the problem

Thus, the technical problem to be solved may be seen in providing a method for making a liquid cooled cylinder head for a multi-valve internal combustion engine with improved producibility.

3.3 Obviousness of the solution

3.3.1 The inclined passage could be fabricated either by drilling it completely, or by casting it first and then finishing it by drilling.

3.3.2 In the judgement of the Board, to select either one of these ways does not involve inventive considerations:

- (a) The skilled person is considered to be a graduate engineer with experience in the field of the construction and casting of combustion engines. He knows the advantages and disadvantages of these techniques. Casting is the technique of choice for the production of complex forms in an efficient and economical way. However, problems with the dimensional accuracy and intricate inner cores may be encountered. In contrast, with the machining of bores, a good dimensional accuracy can be achieved so that they may be used, for example, as metering bores. However, the expenditure of manufacture is higher.

- (b) In view of this and since drilling the second passage is a necessary step of the method of document D7a, it is an obvious choice for the skilled person not to cast the inclined passage at all but to completely drill it for avoiding an intricate inner core for forming the inclined passage.

The casting of the cylinder head without any integral liquid cooling passages connecting the first and second cooling cavities within the head according to feature a) of claim 1 is thus obvious for the skilled person.

3.3.3 Appellant 1 argued that it was usual practice to cast interconnecting passages, and then to remove casting

fins or artefacts by post-cast drilling. For that purpose two affidavits were filed to confirm the advances made by the claimed invention over the state of the art at the time.

It is not denied that the claimed method makes advances over the state of the art as stated in the two affidavits. However, this argument does not demonstrate the necessity of inventive considerations. When considering the state of the art it is necessary to consider all known practices, not only the most common practices or the practices carried out by Appellant 1. Therefore these two affidavits are not relevant for the assessment of inventive step.

Documents D2 to D7 demonstrate that the casting of interconnecting passages and successive removal of casting fins by post-cast drilling was not the only usual practice. In fact, documents D2 - D5 demonstrate that the bores are drilled.

3.3.4 In view of the foregoing, the Board concludes that the subject-matter of claim 1 of auxiliary request 1 does not involve an inventive step as required by Articles 52(1) and 56 EPC 1973. Consequently, auxiliary request 1 is not allowable.

4. *Inventive step - auxiliary requests 2 - 4*

4.1 Auxiliary request 2

4.1.1 It is the established case law of the Boards of Appeal that drawings are part of the disclosure of a patent

document and that proportions can be taken from drawings, see for example T 748/91 (not published).

In the present case, it can be seen in the drawings that the diameter of the inclined passage is less than the diameter of the bores 13 and 19. Therefore (see above 3.1.2(b)), the inclined passage has a second throat area smaller than the first throat area of the first passage.

It is questionable, though, whether the skilled person discerns from the drawings that the throat area of the first passage has to be at least twice the throat area of the second passage as required by claim 1 although it is appreciated that the respective feature in claim 1 is rather general, only defining a minimum requirement.

4.1.2 With the throat area of the inclined passage, the coolant exchange is controlled (see page 3, line 19). Since no surprising effects are achieved by this feature, the Board concludes that it is for the skilled person a simple matter of workshop practice to dimension the relative sizes of the passages to achieve the required flow. Hence, the skilled person selects the throat areas according to the intended coolant exchange.

4.1.3 Thus, also the subject-matter of claim 1 of this request does not involve an inventive step as required by Articles 52(1) and 56 EPC 1973.

4.2 Auxiliary requests 3

4.2.1 The feature added in its claim 1 in comparison with auxiliary request 2, is known from document D7a. Figure 2 shows a generally horizontal first passage 13.

4.2.2 Thus, the subject-matter of claim 1 of this request does not involve an inventive step for the same reasons as set out above for claim 1 of auxiliary request 2.

4.3 Auxiliary request 4

4.3.1 With auxiliary request 2 it is claimed that the minimum throat area of the first passage is greater or equal ("at least") twice the minimum throat area of the second passage. With auxiliary request 4 it is claimed that the second throat area is smaller than half the first throat area, i.e. that the first throat area is greater than (but not equal) twice the minimum throat area of the second passage. Hence, the throat area ratio claimed with auxiliary request 4 is already covered by auxiliary request 2.

4.3.2 Thus, the subject-matter of claim 1 of this request does not involve an inventive step for the same reasons as set out above for claim 1 of auxiliary request 2.

4.4 Consequently, none of auxiliary requests 2-4 was allowable.

5. *Auxiliary request 5 - Article 123(2)*

Claim 1 requires that the first opening is closed before the second opening is machined and coolant is

introduced into the head and vented through the second passage before the second opening is closed. However, original claim 8 discloses that the first and second openings are closed after the machining of the second opening has taken place. Since no other basis for the amendment in claim 1 of this request can be found or was indicated, it is concluded that claim 1 contravenes the requirements of Article 123(2) EPC 1973. Consequently, also auxiliary request 5 was not allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The registrar:

The Chairman:

G. Magouliotis

M. Ceyte