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Datasheet for the decision of 15 May 2018

Case Number: T 2498/13 - 3.2.04

Application Number: 05745371.4

Publication Number: 1756414

IPC: F02M25/07

Language of the proceedings: EN

Title of invention:
AN ARRANGEMENT FOR RECIRCULATION OF EXHAUST GASES OF A SUPER-CHARGED INTERNAL COMBUSTION ENGINE

Patent Proprietor:
Scania CV AB (publ)

Opponent:
MAHLE Behr GmbH & Co. KG

Headword:

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 2498/13 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 15 May 2018

Appellant: (Opponent)	MAHLE Behr GmbH & Co. KG Mauserstr. 3 70469 Stuttgart (DE)
Representative:	Grauel, Andreas Grauel IP Patentanwaltskanzlei Wartbergstrasse 14 70191 Stuttgart (DE)
Respondent: (Patent Proprietor)	Scania CV AB (publ) 151 87 Södertälje (SE)
Representative:	Thum, Bernhard Wuesthoff & Wuesthoff Patentanwälte PartG mbB Schweigerstraße 2 81541 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 18 October 2013 rejecting the opposition filed against European patent No. 1756414 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	A. de Vries
Members:	S. Oechsner de Coninck
	T. Bokor

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal, received on 17 December 2013 against the decision of the Opposition Division dated 18 October 2013 to reject the opposition against the patent EP 1 756 414, and paid the appeal fee the same day. The statement setting out the grounds of appeal was filed on 27 February 2014.

II. Opposition was filed against the patent as a whole and based on Article 100a) together with 52(1), 54(2) and 56 EPC.
The Opposition Division held that the grounds for opposition mentioned in Article 100 (a) EPC did not prejudice the maintenance of the granted patent having regard to the following documents in particular:

D2: EP 1 091 113 A2
D4: DE 203 18 321 U1

III. Oral proceedings were held on 15 May 2018.

IV. The appellant (opponent) requests that the decision under appeal be set aside and that the European patent be revoked.

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

V. The independent claim 1 as granted read as follows:
"An arrangement for recirculation of exhaust gases of a supercharged combustion engine (1) which is cooled by a first cooling system by means of a first coolant, whereby the arrangement comprises an exhaust line (3) intended to lead exhaust gases out from the combustion engine (1), an inlet line (7) intended to lead air at

above atmospheric pressure to the combustion engine (1), a return line (10) which connects the exhaust line (3) to the inlet line (7), so that via the return line (10) it is possible to recirculate exhaust gases from the exhaust line (3) to the inlet line (7), a first EGR cooler (12a) in which the recirculating exhaust gases in the return line (10) are cooled, as a first step, by the first coolant in the first cooling system, wherein the arrangement comprises a second EGR cooler (12b) in which the recirculating exhaust gases in the return line (10) are cooled, as a second step, by a second coolant in a second cooling system, characterised in that the second coolant is adapted to being at a temperature substantially corresponding to the temperature of the surroundings when it is led into the second EGR cooler (12b), that the first EGR cooler (12a) and the second EGR cooler (12b) constitute a composite unit and that the second cooling system comprises a coolant pump (19) by which the coolant is circulated through the cooling system."

VI. The appellant argues as follows:

- The expression "substantially corresponding to the temperature of the surroundings" is unprecise and should be interpreted broadly. D4 also discloses a coolant temperature downstream of the heat exchanger that has not been heated very much and therefore corresponds to substantially the ambient temperature as any reasonable temperature achievable with a two-stage cooler would fall within the claim, such as 30-40°C. The skilled person would see from Fig. 5 of D4 that low temperatures are easily achievable, given the cooling with sea water.
- As for inventive step the subject-matter is not inventive over a combination of D2 and D4, with either one as closest prior art, or either one taken alone,

and in combination with the common general knowledge of the skilled person. In particular, the skilled person would observe that the EGR temperature is not sufficiently low and would know how to modify the radiator/heat exchanger arrangement to optimise the cooling. This would be a clear and obvious problem to solve for the skilled person, if he would observe that an improvement can be achieved by even lower temperature of the recirculated EGR gases.

VII. The respondent argues as follows:
- The patent clearly explains the core of the invention in paragraph 14, see column 6, lines 28-43, that the coolant temperatures lies a few degrees above the ambient temperature, therefore the exhaust gas leaving the EGR cooler will also have a corresponding temperature. Therefore the interpretation of "substantially ambient temperature" is perfectly clear. Figs. 5 and 6 of D4 cannot be mixed when novelty is discussed. In Fig. 6 of D4 it is clear that the "Abgas-WT" heat exchanger 2b is behind the charge air cooler, so that it necessarily has a higher temperature.
- As for inventive step, starting from D4, the problem is to achieve the cooling of the recycled EGR to ambient temperature and thereby to reduce harmful exhaust gas components. The prior art contains no pointers to this solution. The skilled person would not arrive at an optimisation of the temperature by routine adaptation of D4 because the modification needed would imply splitting the low temperature circuit of D4, which lies beyond routine adaptation.

Reasons for the Decision

1. The appeal is admissible.

2. Background of the invention, interpretation of claim 1

2.1 The patent relates to an arrangement for recirculation of exhaust gases of a supercharged combustion engine. According to paragraph 5, the patent seeks to improve such an arrangement in such a way that the recirculation of exhaust gases does not result in the combustion engine's performance being inferior to that of a similar combustion engine not provided with recirculation of exhaust gases.

In the claim 1 this idea is realised by the fact that the exhaust gases in the EGR cooler are cooled by a second circulating coolant which is adapted to being at a temperature substantially corresponding to the temperature of the surroundings when it is led into the second EGR cooler and that the first and second EGR coolers constitute a composite unit and that the second cooling system comprises a coolant pump by which the coolant is circulated through the cooling system.

2.2 Using established interpretation principles for a claim as explained in the Case Law of the Boards of Appeal, 8th edition, 2016, (CLBA) II.A 6.1, the skilled person already understands from contextual reading of the above two features contained in the characterising portion of claim 1 that by exposing the coolant in the radiator directly to ambient air, the temperature of this second coolant circulating in the EGR cooler 12b can be as close as possible to the temperature of the surroundings when it is used to cool the exhaust gas. Further using his technical knowledge in thermodynamics, it is quite clear that the temperature of the coolant exiting the radiator 20 cannot reach the same temperature as ambient air, but must exceed this value. For that reason the term "substantially" is

understood to define a temperature that corresponds to the ambient temperature within practically realizable tolerances, i.e. that approaches that value as closely as is practically possible in the claimed arrangement.

2.3 This limited coolant temperature renders it possible to reduce temperature of exhaust gas exiting the EGR cooler to reach a temperature closer to that of the cooled supercharged air. This otherwise clear teaching derived from the simple contextual reading of the claim is also confirmed by paragraph 6 of the patent. In column 2, lines 34 to 39 of paragraph 6 it is explained that as the inlet temperature of the second coolant corresponds to the temperature of the surroundings when it is led into the second EGR cooler, it can provide cooling of the exhaust gases to a temperature which exceeds the temperature of the surroundings by only a few degrees.

2.4 The Board may agree with the appellant, that the definition of the coolant's temperature substantially corresponding to the temperature of the surroundings does not provide an exact definition of the relevant temperature, in the sense that this definition does not provide a very narrow temperature range, as this may vary depending on the surroundings. Nonetheless the skilled person will have a good understanding of what this means, certainly in the context of the whole disclosure and using his technical understanding (See also Case Law of the Boards of Appeal, 8th edition, 2016, (CLBA) II.A 3.6). The feature "temperature of the surroundings" stated in the claim is not a permanent property of the arrangement itself, but depends on the ambient environment where the arrangement is used, and may be different in different locations. What the claimed arrangement achieves is that the (second)

coolant will also be adapted to this temperature, due to the arrangement of its stuctural components, so that the cited prior art arrangements also have to be analysed in their working state in their given "surrounding". Thus, taking typical standard sea level conditions as an example, if the temperature of the surroundings were say 15° C, the skilled person would understand "ambient temperature" to mean a temperature relatively close to that temperature, within a range of maybe only 1 or 2°C. He would however, in this example, not consider a temperature of 30°C to 40°C as ambient temperature as suggested by the appellant.

3. Novelty

3.1 Document D4 depicts in its figure 6 an exhaust gas heat exchanger for cooling the exhaust of a motor vehicle internal combustion engine with exhaust gas recycling in two stages. In figure 6 the two stages are realized in separate high and low temperature cooling circuits, each with associated EGR coolers 2a, 2b ("HT Abgas-WT", respectively "NT Abgas-WT"). The low temperature cooling circuit is referenced as 31 and explained in paragraph 34. It is common ground that the document is silent on the particular temperature regimes other than that one is high and the other lower. The coolant circulates in the low temperature circuit 31 as follows: Starting from the cooler 38 ("NKRadiator"), where the coolant is cooled by cooling air ("Kühlluft") the coolant passes through a pump represented on the left hand side in line 31 and is then used to cool the supercharged intake air in the charge air cooler (LLK) 37 before entering the EGR cooler 2b.

3.2 The appellant does not deny that having left the cooler 38 and upon entry into the EGR cooler 2b the coolant

temperature will have risen. He however submits that it still would be at a temperature corresponding to the temperature of the surroundings because this expression is broad and should not be too narrowly construed.
In the Board's view as indicated in item 2.4 above, if the term "substantially" allows for some variation - necessarily - above ambient temperature, the interpretation of such variation is nevertheless more limited than submitted by the appellant. Even if D4 does not give any particular temperature values, by following the path of the coolant as it circulates it can easily be inferred that its temperature must rise significantly above ambient temperature when it enters the EGR cooler 2b. The cooling air ("Kühlluft") entering the cooler 38 (Rückkühler) downstream of the heat exchanger 2b can be assumed to be at ambient temperature, so that the coolant exiting the cooler 38 also can be assumed to be at (or close to) ambient temperature. It then passes through the circulation pump, where its pressure and therefore also temperature is slightly increased. Subsequently, it cools the supercharged intake air in the charge air cooler (LLK) 37 where its temperature is further increased. As the charge air temperature is considerably above ambient temperature, even if cooled in a first stage (in EGR high T cooler 2a), the coolant temperature will rise significantly above ambient temperature.

3.3 The appellant also argues that in the embodiment according to Fig 5 of D4 the coolant will have a temperature substantially matching that of the surroundings when it enters the EGR cooler 2b ("NT-Abgas-WT"), because it would have been cooled to a temperature substantially below ambient by sea water in heat exchanger (MKW-WT) 2. However, this is mere speculation. After heat exchange with sea water in the

heat exchanger 22, the coolant is first heated in the charge air cooler (LLK 23), and thereafter brought into heat exchange contact with engine lubricant at an even higher temperature in the oil cooler 24 (Öl-WT). In the Board's understanding these two temperature increases, which will each be significant, make it highly unlikely that the coolant will be at substantially ambient temperature when it enters the EGR cooler 2b.

3.4 Therefore, the subject-matter of claim 1 is considered novel with respect to the disclosure of D4, and the Board thus confirms the findings of the Opposition Division in that respect.

4. Inventive step

4.1 The appellant substantiated lack of inventive step in particular starting from the document D4. It is clear from the above that D4 also discloses an arrangement for recirculation of exhaust gases of a supercharged combustion engine, and indeed represents a suitable starting point.

4.1.1 As follows from the above, the subject-matter of Claim 1 differs from D4 at least by the fact that exhaust gases in the EGR cooler are cooled by a circulating coolant which is adapted to being at a temperature substantially corresponding to the temperature of the surroundings when it is led into the EGR cooler.

4.1.2 Circulating coolant at a relatively lower temperature close to ambient increases the cooling effect in the EGR cooler. The objective technical problem can be formulated accordingly, as how to further improve or optimise cooling in the EGR cooler. This problem is

also closely related and thus derivable, from the subjective problem defined in paragraph 4 of the patent to optimise engine's performance in view of the exhaust gases recirculation.

4.1.3 The Board does not concur with the submission of the Appellant that the skilled person wishing to optimise the low temperature circuit in D4 would consider inverting the positions of the LLK cooler 37 with the EGR cooler 2b as a matter of obviousness. Faced with the problem of optimising cooling, the skilled person in the Board's view will only consider such routine measures that are known to him and which involve straightforward adaptation of the D4 arrangement that do not alter its basic design, such as dimensional changes. However, to ensure that the coolant temperature entering the EGR cooler 2b is at substantially ambient temperature would require changing the existing arrangement by exchanging the downstream location of the EGR in D4 with the LLK thus entailing a modification of its basic layout. Such a re-design or re-engineering of the basic cooling concept of D4 goes well beyond simple or routine optimisation. The Board concludes that for this reason the skilled person would not as a matter of obviousness modify the D4 cooling scheme to arrive at the features of claim 1 as granted.

4.2 The appellant-opponent also submitted in writing that the subject-matter of claim 1 lacked an inventive step starting from D2 in combination with D4 or his own technical knowledge.

4.2.1 D2 discloses a EGR cooling system of a turbocharged diesel engine. One embodiment features a two stage EGR cooling system, see Fig. 2, and paragraph 15. One of

the stages (cooler 38) is an integral part of the engine cooling system 42, the other (via cooler 36) is part of a separate cooling system with its own air cooled radiator 52. Figure 2 gives temperatures for the coolant upon entry into (and exit from) either cooler, which is 120°C (130°C) for cooler 36, and 90°C (100°C) for the low temperature cooler 38. In the alternative embodiment of figure 3, an EGR cooler 136 is part of a high temperature cooling loop comprising a secondary radiator 152 (see paragraph 27). According to paragraph 30 (col. 6, lines 40-41) this radiator operates at a higher temperature than the secondary radiator 52 of the embodiment in figure 2.

4.2.2 Neither of these embodiments discloses a circulating coolant which is adapted to being at a temperature substantially corresponding to the temperature of the surroundings when it is led into the repective EGR cooler 38 or 136. The subject-matter of claim 1 thus differs from D2 at least by this feature. Based on the same technical effect as identified in relation with D4 above, the objective technical problem can again be formulated as optimizing cooling of the EGR.

4.2.3 In the Board's view, lacking any hint or pointer in either documents D2 or D4 as to a coolant temperature that is substantially that of the surroundings their combination, whether obvious or not, cannot result in the claimed invention.

4.2.4 In particular, and contrary to the appellant's submission, the Board finds that the temperature values of the coolant in D4 upon entering either EGR cooler are much higher (at 90°C or 130°C) than ambient, as this will be understood by the skilled person (see above). Nor is there any suggestion in D2 that this

should or could be ambient temperature. As already observed above D4 lacks any teaching or incentive to propose such a further lowered coolant temperature.

4.3 The Board concludes, therefore, that considering the various combinations of D4 with D2 or vice versa as submitted by the appellant, the subject-matter of claim 1 as granted involves an inventive step within the meaning of Article 56 EPC.

5. In the light of the above, the Board confirms the Opposition Division's decision to reject the opposition, Article 101(2) EPC.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated