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Datasheet for the decision of 18 June 2009

Case Number: T 1940/07 - 3.2.01

Application Number: 00108690.9

Publication Number: 1046524

IPC: B60H 1/00

Language of the proceedings: EN

Title of invention:
High pressure gas cooler for a refrigerant circuit of a motor-vehicle air-conditioning system

Patentee:
Valeo Klimatechnik GmbH

Opponent:
Behr GmbH & Co. KG

Headword:
-

Relevant legal provisions:
EPC Art. 123(2),(3)

Relevant legal provisions (EPC 1973):
EPC Art. 56, 87(1)

Keyword:
"Priority - same invention (yes)"
"Amendments - added subject-matter (no)"
"Amendments - opposition proceedings"
"Inventive step (yes)"

Decisions cited:
-

Catchword:

-

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Case Number: T 1940/07 - 3.2.01

D E C I S I O N
of the Technical Board of Appeal 3.2.01
of 18 June 2009

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 22 October 2007 revoking European patent No. 1046524 pursuant to Article 102(1) EPC 1973.

Composition of the Board:

Chairman: S. Crane
Members: J. Osborne
T. Karamanli

Summary of Facts and Submissions

I. The appeal is directed against the decision posted 22 October 2007 revoking European patent No. 1 046 524 which derived from an application having a filing date of 21 April 2000 and claiming priority of application DE 19918617 having a filing date of 23 April 1999.

II. In as far as relevant to the present decision, the following evidence was relied upon during appeal:

D8: DE-A-196 46 349;

D10: DE-A-198 30 757, published 13 January 2000;

D15: J. Wertenbach *et al*, "CO_2 Refrigeration Systems in Automobile Air-Conditioning", Proceedings of the International Conference on Ozone Protection Technologies, Washington D.C., 21-23 October 1996, 855-864;

D16: EP-A-0 779 481.

III. The opposition division had found that each of the independent claims 1 to 3 as granted was not entitled to the claimed priority right and that the respective subject-matter was not new in comparison with the disclosure of D10.

IV. At oral proceedings held on 18 June 2009 the appellant requested that the decision under appeal be set aside and the patent maintained in amended form on the basis of claims 1 to 21 according to the single request as

filed during the oral proceedings. The respondent requested that the appeal be dismissed.

V. Claim 1 according to the appellant's request reads as follows, whereby in comparison with the version as granted wording added is underlined and wording deleted is struck through:

"~~A high pressure gas~~ Gas cooler (2) for a supercritical CO_2 high-pressure refrigerant circuit for a motor-vehicle air-conditioning system having a refrigerant circuit, the refrigerant circuit comprising, in the flow direction of the refrigerant, the gas cooler (2) consisting in a stack of first heat-exchange flat tubes (8), an inner heat exchanger (6) operable to exchange heat between the high pressure and low-pressure sides, which communicates via the low-pressure side of the inner heat exchanger (6) with the intake side of a compressor (78),

characterised in that ~~the gas cooler (2) and~~ the inner heat exchanger (6) comprises a stack of second heat-exchange flat tubes (14) directly brazed to one another, allocated alternately to the high-pressure and to the low-pressure sides, the inner heat exchanger (6) being designed as a counter-current heat exchanger and is combined with the gas cooler (2) ~~are combined~~ to form a single unit."

Claims 2 to 21 specify features additional to those of claim 1.

VI. The respondent’s submissions as relevant to the present request may be summarised as follows:

The priority document concerns a gas cooler in the high-pressure region of an air conditioning system charged with CO_2 refrigerant. It is therefore clear that the gas cooler of that document must be capable of withstanding the pressures which exist in that region. Present claim 1, on the other hand, merely specifies a gas cooler "for" a supercritical CO_2 high-pressure refrigerant circuit and includes no features which would distinguish it from an evaporator for use in the low-pressure region of such a circuit. The composition according to D15 of an air conditioning system charged with CO_2 refrigerant is only the "most likely" one and therefore the provision of a supplementary unit in the low pressure region is not excluded. Moreover, heat-pump systems for heating electrically powered vehicles comprise such a unit in the low-pressure region of the circuit. The claim to priority therefore is not valid, resulting in D10 being state of the art. In as far as the application as originally filed defined a "high pressure gas cooler", there has also been an extension of subject-matter because claim 1 is no longer so restricted. Similarly, the independent claims as granted all specified a "high pressure gas cooler" so that present claim 1 results in an extension of scope of protection.

If the priority date is considered as being valid the closest state of the art is disclosed in D15 which sets out the design parameters for an air-conditioning system charged with CO_2 refrigerant. In particular, it mentions compact size resulting from the use of a smaller quantity of refrigerant at higher pressures and suggests the use of a flat-tube gas cooler together with an internal, counter-flow heat exchanger. The

skilled person when attempting to put that teaching into effect would consider D16 which sets out to provide a compact unit incorporating a flat-tube condenser and an internal heat exchanger transferring heat between the high- and low-pressure regions of the circuit. The additional feature of the internal heat exchanger comprising brazed flat tubes is rendered obvious by D8 which provides a combined evaporator and heat exchanger in which both functional parts comprise stacked flat sections. In an alternative approach D16 is regarded as the closest state of the art and the problem solved is to adapt the conventional device for use in a system as disclosed in D15.

VII. The appellant submitted essentially that:

The term "gas-cooler" is established in the art and indicates that the device releases heat from a refrigerant in the high-pressure part of the circuit. For the skilled person it is clearly distinguished from an evaporator which adds heat to a refrigerant in the low-pressure part of the circuit. The locations of the two devices in the high- and low-pressure parts of the circuit imply differing abilities to withstand pressure and in combination with the now-specified suitability for a CO_2 refrigerant establish a valid priority claim. Similarly, the subject-matter has not been extended beyond the content of the application as originally filed. Moreover, the now-specified suitability for a supercritical CO_2 refrigerant circuit is a particular case of the high-pressure specification in claim 1 as granted so that the extent of protection has been reduced.

D15 in its abstract and summary indicates the difficulties faced by the skilled person when attempting to put into effect a motor-vehicle air-conditioning system using CO_2 refrigerant. Those difficulties arose from attempts to use devices from conventional air-conditioning systems. The skilled person therefore would not turn to D16 since it relates to a conventional system and contains no teaching relevant to being charged with CO_2. In particular, when seeking to solve the problem of providing a compact arrangement he would not consider state of the art which would be incapable of withstanding the high pressures of the CO_2 system. As regards the construction of the internal heat exchanger D15 suggests an arrangement employing concentric pipes and flat tubes are proposed only for the gas cooler itself. Indeed, the respondent has provided no evidence showing a heat exchanger constructed as a brazed stack of flat tubes. The skilled person seeking to provide a compact gas cooler for use with CO_2 refrigerant would not even consider D8 because it relates to an evaporator for use with conventional refrigerant and having an additional heat exchanger for the particular purpose of supplying a cooling liquid.

Reasons for the Decision

1. The patent generally relates to air conditioning systems for motor vehicles having carbon dioxide refrigerant. Such a system differs from a conventional system in as far as the heat exchanger known as a condenser is replaced by one termed a gas cooler and an additional component is provided, an internal heat

exchanger transferring heat between the high- and low-pressure regions of the system. The patent relates specifically to a unitary gas cooler and internal heat exchanger.

Amendment of claim 1

2. In the application as originally filed the independent claims were directed to a "high pressure gas cooler". According to the first paragraph of the description the invention related to "a high pressure gas cooler for a refrigerant circuit … and more particularly but not exclusively to a gas cooler for a supercritical CO_2 refrigerant circuit". In the detailed embodiments the gas cooler was located between the compressor and the throttle device and so in the high pressure side of a supercritical CO_2 refrigerant circuit. The application referred to D15 which gives an overview of the development of CO_2 refrigerant systems for motor vehicles. It discloses specifically that the systems operate at pressures of up to 50 bar on the low pressure side and up to 130 bar on the high pressure side. The teaching of the application as originally filed therefore was of a gas cooler which is capable of containing pressures of up to 130 bar. Present claim 1, on the other hand, specifies a gas cooler "for a supercritical CO_2 high-pressure refrigerant circuit for a motor-vehicle air-conditioning system" and further that it comprises, in the flow direction of the refrigerant, "the gas cooler …, an inner heat exchanger … which communicates … with the intake side of a compressor". It is not immediately evident from this definition of the layout of the system where in the circuit the gas cooler is located. The respondent

concludes that present claim 1 relates to a gas cooler which may be in the low-pressure side of the circuit and therefore is no longer restricted to being a "high pressure" gas cooler. It therefore takes the view that the claim has been amended in such a way as to extend the content of the patent beyond that of the application as originally filed.

2.1 In a conventional refrigeration circuit the refrigerant at high pressure after leaving the compressor loses heat in a condenser and at low pressure after passing through the throttling device gains heat in an evaporator. D15 states that the new circuit "will most likely consist of a compressor, a gas cooler, an internal heat exchanger, an expansion device, an evaporator and a refrigerant receiver" (point 3). The skilled person understands from this statement that the gas cooler replaces the condenser of the conventional circuit and also gleans from the following paragraph why different terminology is used: "at supercritical conditions … condensation of the refrigerant does not take place in a gas cooler". Similarly, in the present patent specification the only disclosed position of the gas cooler is directly downstream of the compressor (figure 4 and paragraph [0039]).

2.2 In the board’s view, therefore, the only reasonable interpretation of the term in present claim 1 is that it designates a component which is suitable to be located in the high-pressure part of the supercritical CO_2 refrigeration circuit.

2.3 The respondent further argues that the term "gas cooler" is also used to designate a component which

removes heat from a refrigerant in a heat-pump system for heating electrically powered vehicles and concludes that this indicates that the term has no established meaning. However, the term when given its meaning in the context of the present patent is a clear one and its use elsewhere is of no relevance.

2.4 The board also does not accept the respondent's argument that the composition according to D15 of an air conditioning system charged with CO_2 refrigerant is only exemplary and that an additional gas cooler might be employed also in the low-pressure part of the circuit. In the absence of any reasoned support for this argument it must be regarded as purely hypothetical and is unable to put into question the interpretation of the skilled person as set out above.

2.5 The board therefore finds that the amendment does fulfil the requirements of Article 123(2) EPC.

3. The same reasoning as above on the part of the respondent leads it to conclude that the protection conferred by the patent is extended beyond that as granted. The board disagrees with the respondent for the same reasons as already set out in points 2.1, 2.2 above and finds that the requirements of Article 123(3) EPC are fulfilled.

4. The board is satisfied that no other objections arise from the amendments and since no others were raised by the respondent the matter need not be treated further.

Priority

5. The disclosure of the priority document in its broadest sense is of a gas cooler for a supercritical CO_2 high-pressure refrigerant circuit of a motor-vehicle air-conditioning system in which the gas cooler is located between the compressor and the throttle device and so in the high-pressure part of the circuit. The priority document refers to D15 the disclosure of which has been discussed under points 2, 2.1 above. The broadest teaching of the priority document therefore is of a gas cooler which is capable of operating in pressures of up to 130 bar. The respondent's view that present claim 1, by contrast, relates to a gas cooler which may be in the low-pressure side of the circuit and therefore is not restricted to being a "high pressure" gas cooler leads it to conclude that the subject-matter of present claim 1 is not 'the same invention' within the meaning of Article 87(1) EPC 1973. For the reasons already set out under points 2.1, 2.2 above, however, the board does not agree with the respondent and finds that the requirement for claiming priority in respect of the same invention according to Article 87(1) EPC 1973 is fulfilled. As a result, D10 does not form state of the art for the present patent.

Inventive step

6. The board is in agreement with both parties that the closest state of the art for considering inventive step is the disclosure of D15. D15 explains that it is desirable to change to CO_2 as a refrigerant in automotive air-conditioning systems and sets out some of the consequences of the change. In particular, it

discloses a gas cooler immediately downstream of the compressor and an "internal heat exchanger" which in comparison with a conventional refrigeration circuit is an additional component providing for heat transfer between the refrigerant in the high- and low-pressure parts of the circuit. In addition to the background of the system D15 gives an overview of the installation of a prototype system in a vehicle. In that particular installation the gas cooler is a "tube-in-fin unit with expanded tubes" mounted in front of the engine radiator but it is suggested that it may alternatively be a flat-tube design. According to D15 the internal heat exchanger is "in its simplest design, a concentric pipe-counterflow-heat exchanger". However, the installation is only a prototype and in the summary it is stated that "there is still considerable progress necessary in the development of the CO_2 system concerning stress-proof, light weight, compact and efficient components". The disclosure of D15 is correctly represented in the two-part form of claim 1, the subject-matter of which therefore differs therefrom by the features in the characterizing portion. The corresponding problem is to put the experimental teaching of D15 into effect, whereby it is implicit that the brazed flat-tube construction as claimed is adapted to cope with the pressures resulting from the use of CO_2 refrigerant, particularly taking account of the following (see patent specification paragraph [0004]):

- a desire to minimise the number of pressurised connections;

– a desire to minimise space requirements whereby the additional component, namely the internal heat exchanger, should as far as possible not increase the space requirement and permit conversion of a vehicle equipped with a conventional refrigerant air-conditioning system to one having supercritical CO_2 refrigerant.

6.1 D16 relates to improvements in efficiency of conventional refrigeration systems by introducing an additional heat exchanger providing heat transfer between the refrigerant in the high- and low-pressure parts of the circuit. In the embodiment according to figures 9, 10 the additional heat exchanger is provided as a single unit with the condenser. The additional heat exchanger takes the form of a tubular housing having a longitudinal dividing wall of high thermal conductivity separating and allowing heat transfer between the high- and low-pressure flows. Because the teaching of D16 is directed to the use of conventional refrigerant the matter of the ability of the heat exchanger portion to withstand high pressure-differentials is not addressed and the skilled person would see no motivation to adopt that construction for use with CO_2 refrigerant. Even if he were to follow the teaching of D16 to provide a compact system by combining the heat exchanger and gas cooler/condenser, he still would not have the presently claimed brazed stack of flat tubes suitable for use at the pressures associated with the use of CO_2 refrigerant.

6.2 The respondent argues that the skilled person would turn to D8 for the feature of the brazed stack of flat tubes. However, D8 is silent as regards refrigerant,

from which it is apparent that the teaching is not directed towards suitability for CO_2. Moreover, it proposes modifying not the condenser but the evaporator. It follows that D8 is directed towards modifying a component located in the low-pressure side of a system which is inherently at a lower pressure than that to which the present patent relates. Furthermore, the problem addressed by D8, namely providing cooled liquid for lowering the temperature of areas of the vehicle which are remote from the evaporator or parts such as seats which otherwise would cool more slowly than the air in the vehicle, is wholly unrelated to that addressed in the present case. Since in the case of D8 both the problem and the solution differ from the present case any suggestion that it would motivate the skilled person to adopt the presently claimed construction can only result from *ex post* considerations.

7. In the respondent’s alternative approach D16 is considered as the closest state of the art and the problem is to adapt a known unitary condenser and internal heat exchanger for use with the CO_2 refrigerant, whereby the solution would be found in D15. However, D15 discloses only constructions of prototype components which anyway differ from those presently claimed and the teaching of D8 is, as when beginning from D15, of no relevance.

8. On the basis of the foregoing the board concludes that the subject-matter of claim 1 involves an inventive step (Article 56 EPC 1973). Since claims 2 to 21 contain all features of claim 1 the same conclusion applies also to them.

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 with the order to maintain the patent on the basis of the following documents:

   – claims 1 to 21 and description pages 2 to 7 submitted in the oral proceedings;

   – drawings as granted.

The Registrar: The Chairman:

A. Vottner S. Crane