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D E C I S I O N
of 26 November 1993

Case Number: T 0570/91 - 3.2.4

Application Number: 84307372.7

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Title of invention:
Pistons

Patentee:
AE PLC

Opponent:
Mahle GmbH

Headword:
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Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step (yes)"
"Closest prior art"

Decisions cited:
-

Catchword:
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Boards of Appeal

Chambres de recours

Case Number: T 0570/91 - 3.2.4

DECISION
of the Technical Board of Appeal 3.2.4
of 26 November 1993

Appellant: AE PLC
(Proprietor of the patent) Cawston House
Cawston
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Representative: Knott, Stephen Gilbert
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Respondent: Mahle GmbH
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Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 3 June 1991 and
dispatched on 13 June 1991 revoking European
patent No. 0 144 145 pursuant to Article 102(1)
EPC.

Composition of the Board:

Chairman: C.A.J. Andries
Members: H.A. Berger
J.-P.B. Seitz

Summary of Facts and Submissions

- I. The Appellant (Proprietor of the patent) lodged an appeal against the decision of the Opposition Division to revoke the patent No. 0 144 145. The decision was dispatched on 13 June 1991. The appeal and the fee for appeal were received on 29 July 1991. The statement setting out the grounds of appeal was received on 14 October 1991 and defined three sets of claims, called "first, second and third amendment in the appeal", forming the basis of respectively a main, a first subsidiary and a second subsidiary request.

The Opposition Division had decided that the grounds for opposition specified in Article 100(a) EPC prejudiced the maintenance of the patent. The following prior art documents among those regarded as relevant by the Opposition Division have been taken into account as relevant documents during the appeal proceedings:

- (D1) DE-A-2 504 910
- (D4) US-A-1 561 030
- (D5) FR-A- 673 364.

- II. In response to a communication of the Board, the Appellant filed with the letter dated 18 October 1993 besides other amendments a new Claim 1 for the first subsidiary request (called "second amendment in the appeal").

Oral proceedings took place on 26 November 1993 during which the Appellant filed a new set of Claims 1 to 3, an adapted description and drawings as a basis for the main request.

From the further prior art documents cited during the appeal the following documents were discussed with regard to Claims 1 of the main and the first subsidiary requests in addition to document D1:

(D9) Mahle Prospektblatt "Renner, von denen man spricht", Mahle 6596 IX.73, published September 1973

(D10) Mahle Prospektblatt "Sieger fahren Mahle-Kolben und -Zylinder", Mahle 6709 a.I.77, published January 1977

III. The independent Claims 1 and 3 of the main request read as follows:

Claim 1:

"A piston for an internal combustion engine formed in one piece of the kind comprising a crown (20), at least two axially spaced piston ring grooves (28,29,30), a lowermost (30) of said at least two axially spaced piston ring grooves having upper and lower axially spaced and radially extending side walls (31,32) connected by a base (33), said upper radially extending side wall (31) being continuous around the piston, a skirt (25,26) extending around the piston beneath the lowermost of said at least two piston ring grooves (28,29,30) and having a lower edge, and a pair of co-axial bores (23) being provided for receiving a gudgeon pin, said pair of bores (23) intersecting the lower side wall (32) and the base (33) of said lowermost (30) of said at least two piston ring grooves, a piston ring in said lowermost of said pair of piston ring grooves being unsupported at the two diametrically opposed portions of said lower side wall (32) where the bores (23) intersect said lowermost (30) of said pair of piston ring grooves, the at least two piston ring

grooves (28,29,30) being formed in a ring band (21) surrounding the crown (20), said pair of bores (23) intersecting the ring band (21) and being located at least substantially equidistantly between the crown (20) and said lower edge."

Claim 3:

"A piston for an internal combustion engine of the kind comprising a separately formed upper piston part (40) including a crown (42), at least two axially spaced piston ring grooves (44,45) and a pair of co-axial bores (47) for receiving a gudgeon pin, and a separately formed sleeve-shaped lower piston part (41) connected to said upper piston part and forming a skirt (51) whereby said upper piston part (40) forms an upper portion of a ring band (43) surrounding the crown, the lower piston part (41) providing at least one further piston ring groove (50) characterised in that said at least one further piston ring groove (50) is spaced axially from a lowermost (45) of said at least two piston ring grooves (44,45) by substantially the same axial distance as the spacing of said at least two axially spaced piston ring grooves (44,45) to provide a lower portion of said ring band formed as a continuation of said upper portion of the ring band, said pair of coaxial bores (46) terminating inwardly of said second piston part (41) so that the ends of said pair of gudgeon pin bores (46,47) are covered by said sleeve-shaped lower piston part and imaginary extensions thereof at least partially intersecting the ring band (43) through said at least one further piston ring groove (50) to reduce the overall height of the piston."

IV. The Appellant essentially argued as follows:

Document D1 mainly discloses a piston for a refrigerator compressor and would not be regarded as relevant state of the art by the skilled person designing a modern combustion engine piston with a reduced compression height. The most relevant prior art documents are documents D9 and D10 showing modern combustion engine pistons which however would not lead to the invention.

V. The Respondent essentially argued as follows:

Document D1 discloses all features of Claim 1 of the main request except the feature that the pair of bores is located substantially equidistantly between the crown and the lower edge. Since on page 8, last paragraph of said document D1 it is described that the piston can be used in combustion engines it is obvious with regard to documents D9 and D10 to provide the gudgeon pin bores about in the middle of the piston height. The skilled person could immediately see from document D1 that the compression height of a piston can be reduced by positioning the oil ring in the region of the gudgeon pin bores as is shown in the Figures 1 and 2. For the solution of the problem to reduce the compression height of a piston the skilled person would therefore take into account the teaching of document D1.

Even if the skilled person were to start from a piston, as shown in documents D9 and D10, he would pay attention to the teaching of document D1 which clearly states the possibility of using the piston described therein in a combustion engine and he would come on the basis of this state of the art to the piston as claimed in Claim 1 of the main request.

With regard to the angled position of the piston rings shown in Figures 1 to 3 of document D1, the Respondent expressed the opinion that, during operation of the piston, these rings touch not only the corresponding vertical part but also both horizontal parts of the piston ring grooves. The Respondent requested that this be confirmed by an expert since doubts were brought forward in this respect.

The Respondent further argued that the problem of reducing the compression height of the piston is not solved by the features of Claim 1 of the main request since the piston defined therein could have every imaginable height.

VI. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the following documents as filed during the oral proceedings on 26 November 1993 as the main request:

Claims: 1 to 3

Description: column 1, lines 1 to 24 up to and including the word "band", pages 2 and 3 to be inserted in column 1, after the word "band" of line 24, column 2 to column 4, line 56;

Drawings: Figures 1 to 4.

The Appellant further requested that the patent be maintained on the basis of two subsidiary requests.

VII. The Respondent (Opponent) requested that the appeal be dismissed and that an expert's opinion relating to the

functioning of the sealing rings (26,28) in document D1 be obtained.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments of the documents on file (main request)*

The Board accepts Claims 1 to 3, the description and the drawings of the main request with regard to Article 123(2) and 3, EPC. The allowability of the valid main request in this respect was not disputed by the Respondent.

3. *Novelty (main request)*

The Board ascertained during the examination of the cited prior art documents that none of them discloses a piston with all the features stated either in Claim 1 or in Claim 3 of the main request.

Furthermore, during the oral proceedings, the question of novelty with respect to the present claims was not raised any more.

The subject-matter of Claims 1 and 3 of the main request therefore is to be considered as novel in the meaning of Article 54 EPC.

4. *Closest prior art and problem to be solved (in general)*

- 4.1 It is established practice in the EPO, in order to use the "problem and solution approach" for an objective

assessment of inventive step, to determine the "closest prior art" to the claimed invention.

- 4.2 The assessment of inventive step of the subject-matter of an independent claim has to take into account the state of the art (Article 56 EPC, first sentence), that means everything (including all documents) made available to the public before the date of filing of the European patent application (Article 54(2) EPC).

Instead of making the effort of trying to proceed one by one from each single available prior art disclosure to the claimed invention, it is simpler to start from that available prior art disclosure which is "closest" to the invention, i.e. that which is the most promising starting point for an obvious development leading to the claimed invention. This closest prior art may be one particular embodiment of several disclosed by a document. After having made the above choice, the other prior art disclosures can therefore be neglected as starting points to assess inventive step because they are less promising than the closest prior art disclosure.

- 4.3 At least in mechanical embodiments the closest prior art must be unequivocally and clearly defined, at least for those constructional elements which are important for the claimed invention with which the closest prior art is being compared.

Before a person skilled in the art can ascertain the disadvantages of a particular embodiment in order to define objectively the problem to be solved, he must know the specific construction of that embodiment, particularly the specific constructional elements which are important for the claimed invention, otherwise right from the start speculative elements enter into the

consideration which will end in the formulation of the objective problem to be solved. In other words, it is doubtful that an objective problem can be formulated if the person skilled in the art starts from an embodiment which is not clearly defined and which, in order to be able to be considered as a starting point, needs to be completed with additional features which have to be taken or selected out of a number of undisclosed possibilities.

In the present case the starting point therefore should be a concrete, specific internal combustion engine (i.c.e.) piston whose construction has to be clearly defined, without needing to interpret or to add certain features.

Such an approach is in line with the normal development work of a person skilled in the art who normally starts from a specific embodiment and who tries to adapt, to modify or to improve that existing embodiment in order to solve the technical problem arising.

- 4.4 The Board wishes to emphasise that although a person skilled in the art is completely free in choosing a starting point, he will of course be bound afterwards by that choice (cf. T 335/88: section 4.2; T 404/91: section 4.2). If, for instance, for whatever reason it may be, a person skilled in the art prefers and decides to start from a specific compressor piston, he can further develop that piston but at the end of that development the normal result will still be a compressor piston and not an i.c.e. piston. In other words, the chosen closest prior art must be able or at least potentially able, perhaps after modifications, to obtain the same effects as those resulting from the claimed embodiment (cf. Rule 27(1)(c) EPC and decision T 495/91, section 4.2). Otherwise, such starting point prior art

could not lead a skilled person in an obvious way to the claimed invention.

4.5 It seems that in most cases it is appropriate to look particularly at those prior art disclosures which have something to do, be it explicitly or implicitly, with the problem set out in the application or opposed patent. These disclosures will normally either be capable of being further developed to arrive at the claimed invention or at least point thereto. The closest prior art, i.e. that which provides the strongest basis for an obvious objection, will then be selected from the above-mentioned disclosures.

5. *Closest prior art to the piston according to Claim 1 (main request)*

5.1 The Board shares the opinion of the Appellant that documents D9 and D10 disclose the prior art closest to the piston of Claim 1 of the main request, since these documents clearly show modern internal combustion engine (i.c.e.) pistons, which furthermore seem to have already been developed in the direction of the basic idea of the present invention, i.e. an i.c.e. piston with a decreased compression height.

The following pistons disclosed in these documents were considered during the oral proceedings to be pertinent: Document D9, page 2, at the bottom of the second column, "Geschmiedeter Kolben für BMW-Rennmotor 21, 89 mm Durchmesser, Leistung ca. 270 PS"; document D10, page 2, the three BMW pistons, "Geschmiedeter Kolben", and particularly page 6, bottom right-hand corner, "BMW, 2000 und 3000 ccm, Rennmotor".

These pistons disclosed in documents D9 and D10 are pistons for internal combustion engines, formed in one

piece of the kind comprising a crown, three (i.e. satisfying the wording "at least two") axially spaced piston ring grooves, a lowermost of said axially spaced piston ring grooves having upper and lower axially spaced and radially extending side walls connected by a base, said upper radially extending side wall being continuous around the piston, a skirt extending around the piston beneath the lowermost of said piston ring grooves and having a lower edge, and a pair of co-axial bores being provided for receiving a gudgeon pin, the piston ring grooves being formed in a ring band surrounding the crown.

It should be emphasised that both this prior art piston and the piston of the present invention comprise "a ring band surrounding the crown", which means in modern piston technology a compact group of interrelated grooves which are closely spaced to each other and located close to the piston crown.

Although dimensions are not disclosed in the indicated compact pistons according to documents D9 and D10 it is clear from the pictures that the gudgeon pin bores are located in the middle region of these pistons and that the pistons have a relatively small compression height.

Furthermore, it is clear for a person skilled in the art that modern i.c.e. pistons, such as those disclosed in documents D9 and D10, necessarily include features allowing the mounting of gudgeon pin retainers within the piston.

Summarising, having in mind the basic idea of reducing the compression height of an i.c.e. piston, the person skilled in the art would try to find as his starting point a prior art disclosure leading already in the direction of his basic idea i.e. he would start from an

i.c.e. piston which has already a relatively reduced compression height. Such pistons are disclosed in documents D9 and D10.

5.2 The Respondent and the first instance, relied on document D1 as the most relevant state of the art. Although, the title, the beginning of the description and the independent claims of D1 define a piston in general, the only specific embodiment disclosed in the description and drawings relates to a compressor piston. This is emphasised by the piston rings shown in the drawings and described in the description (see page 11) which are of an elastic flexible material comprising, for instance, Polytetrafluoroethylene (Claims 11 and 12) and are provided in an angled position in the piston ring grooves at least in the rest position of the piston. Furthermore, on page 12, first paragraph, the piston of D1 is compared with pistons without piston rings and on page 13, second paragraph, it is described that the piston rings produced by material of low friction have the effect that the piston is moved only on said material without substantially touching the cylinder. This teaching clearly leads away from an i.c.e. piston comprising a piston skirt to ensure through an oil film a support between the cylinder wall and the piston.

Furthermore, the main problem described in document D1 is to provide simple means for attaining compression, controlling lubricants and for keeping the gudgeon pin in position (see page 2, second paragraph). Nothing in document D1 points in the direction of a reduced compression height, nor could the compressor piston as shown in the drawings lead in that direction, so that a skilled person wanting to develop a piston to have a reduced compression height finds no logical basis therein. It should be emphasised in this respect that

the gudgeon pin bores of the piston of document D1 are in the lower part of the compressor piston which comprises a long upper part with respect to its lower part.

- 5.3 The Board also wants to stress that, in this specific case, on the basis of the general teaching as it is presented in the independent claims of document D1, no concrete specific construction of an i.c.e. piston is defined.

It is true that on page 8, last paragraph of document D1 it is suggested to use such a piston in a combustion engine. However, the piston actually shown and described is a piston for a compressor. Furthermore, apart from the general teaching (in the independent claims) to locate the oil scraping ring around the upper part of the gudgeon pin holes in order to avoid the use of the commonly known gudgeon pin retainer elements, in combination with the above cited paragraph on page 8, no further explicit or implicit indication is given of a concrete, specific i.c.e. piston construction. It may be that an i.c.e. piston construction, in general, is simple, nevertheless a multitude of i.c.e. constructions exists, so that a person skilled in the art wishing to define a specific starting point with the general teaching of D1 in mind, not only needs that general teaching, as such, but also has to make a choice between these existing i.c.e. pistons. Indeed, no information is for example given for an i.c.e. piston about the location of the gudgeon pin holes, about the piston skirt, about the piston ring area, or about the relation between these elements.

Taking into account the information of independent Claim 7 with regard to the remark on page 8, last paragraph, to which the Respondent drew attention during

the oral proceedings, there is, for instance, no information given about the kind of piston rings which are technically acceptable in an i.c.e. piston. According to the information given by the whole content of document D1, particularly shaped piston rings are essential. In reality, a skilled person would not try to use such shaped piston rings in i.c.e. pistons. In starting from document D1 to define an i.c.e. piston, the Respondent thereby created a theoretical, still non-existent, specific prior art. Such an approach to define the closest prior art is inappropriate, since such a starting point is based on an imaginary constructed embodiment, which can only be the result of an *ex post facto* analysis. According to the Board, document D1 does not provide a person skilled in the art with an enabling disclosure with respect to an i.c.e. piston.

5.4 Therefore, the skilled person knowing of all existing pistons (the available prior art) and trying to develop or to design a reduced height piston would not (due to the problem to be solved) and could not (due to lack of specific essential i.c.e. piston features) take the piston of document D1 as the starting point, that means as the closest prior art. It is thereby of no importance whether or not the elastic and flexible piston rings of the compressor piston (see page 12, lines 2 to 5) come into contact with the horizontal and vertical walls of the piston ring grooves during operation of the compressor piston.

6. *Technical problem to be solved and solution with regard to the piston according to Claim 1 (main request)*

6.1 According to the description column 1, lines 15 to 19, of the main request, the height of the block, and consequently the mass of the block is determined for a

given stroke of the piston at least in part by the axial length of the piston from the crown to the lower edge. In column 4, lines 12 to 24, of the main request, it is stated that the overall length of the piston from the crown to the lower edge can be decreased by the invention. This has the advantage that the compression height (i.e. the distance between the axes of the gudgeon pin bores and the top of the crown of the piston) is minimised.

As mentioned during the oral proceedings, the overall trend in modern i.c.e. pistons is to reduce as far as possible the mass of the pistons and the compression height.

The picture, page 6, in the bottom right-hand corner of document D10, which is considered as the most relevant prior art, shows a compact i.c.e. piston of small overall height with gudgeon pin bores in the middle region of the piston.

The objective problem to be solved by the invention therefore is the construction of an i.c.e. piston of further reduced overall height whereby also the piston mass is reduced.

6.2 This problem is solved by the positioning of the gudgeon pin bores so that they intersect the lower side wall and the base of the lowermost of the at least two piston ring grooves, as is stated in Claim 1 of the main request.

The features indicated in the claim give the skilled person the possibility to construct a more compact i.c.e. piston, i.e. to further reduce the compression height by positioning (shifting) the gudgeon pin holes

in the region of the lowermost ring groove of the compact ring band located around the crown.

- 6.3 The Respondent stated that the wording of Claim 1 does not solve the above-defined problem.

Although it is true that the wording of Claim 1 at first glance could lead to the conclusion that also pistons of great axial dimensions are claimed, a proper technical interpretation of the wording in the light of the description clearly teaches that the piston rings must lie close together and that, nevertheless, the lowermost piston ring groove must intersect the gudgeon pin holes. This interpretation of Claim 1 of the main request is supported by the feature that the ring band which comprises the lowermost ring groove surrounds the crown, i.e. the piston rings are located as close as possible to the crown.

It would be technically unrealistic in a modern i.c.e. piston to provide the lowermost ring, which can be a piston ring of any suitable conventional design (see column 3, lines 7 to 11 of the description of the main request), in the particular position defined in Claim 1 of the main request and to take into account the danger of oil leakage without using the advantage of a reduced compression height and therewith the reduced overall piston height.

Claim 1 therefore sufficiently defines the matter for which protection is sought and presents a solution to the above-defined problem.

7. *Inventive step of the piston according to Claim 1 (main request)*

7.1 The most relevant prior art documents D9 and D10 show i.c.e. pistons which are already of low height. There is no indication in these documents of a teaching to further reduce the height by a particular positioning of the gudgeon pin bores.

7.2 According to the arguments of the Respondent, the skilled person would immediately see from document D1 the possibility of reducing the piston height by the particular position of the lowermost piston ring shown and he would use this knowledge in combustion engine pistons with or without the usual fixing devices, such as snap rings or a connection of the gudgeon pin with the piston rod.

The Board cannot accept this, since a person skilled in the art would not be led to the claimed invention by the drawings in document D1 which clearly represent a typical compressor piston (and not an i.c.e. piston), and which do not at all suggest a compact piston, let alone a compact i.c.e. piston. It should be emphasised that it is the whole content of document D1 which defines and discloses its teaching, and not a single drawing or a single line of the description on its own.

Document D1 does not give any hint for the reduction of the piston height but describes as a main purpose (see page 2, second paragraph) to keep the gudgeon pin in position by the particular arrangement of the lowest piston ring, thereby avoiding conventional gudgeon pin retainers.

Following the established jurisprudence in the EPO, concerning the comparison of the problems to be solved

respectively in the opposed patent and in document D1, the Board is of the opinion that the general teaching of document D1, namely to locate the lowermost piston ring in such a way that the gudgeon pin is kept away from the cylinder wall, cannot guide a skilled person wanting to solve another, completely different problem to the present invention (cf. T 39/82, 1982, 419, section 7.3; T 142/84, 1987, 112, section 8.2; and T 673/91, section 4.2). Considering, on the one hand, that the i.c.e. piston according to document D10 is a modern compact i.c.e. piston, that according to the teaching of document D1 no conventional gudgeon pin retainer elements would remain in the modern compact i.c.e. piston, and that document D1 contains no indication relating to a specific ring construction for i.c.e. pistons to retain the gudgeon pin whereas, on the other hand, a specific ring construction seems to be essential in the compressor piston (see page 6, end of first paragraph; page 7, second paragraph to page 9, first paragraph), it is according to the Board very doubtful and technically unrealistic that such a general and peculiar teaching would be used in a modern compact i.c.e. piston having a ring band surrounding the crown, even with the problem indicated in document D1 in mind. Such an approach would rather be the result of an *ex post facto* analysis.

- 7.3 The remaining available prior art documents also do not suggest, in order to solve the above defined problem, modification of the closest prior art in such a way as to obtain the claimed piston. These documents were not mentioned any more during the oral proceedings.
- 7.4 The subject-matter of Claim 1 therefore involves an inventive step within the meaning of Article 56 EPC.

8. *Claim 3 (main request)*

With regard to independent Claim 3 of the main request, which is identical with Claim 3 as granted, the Respondent only referred in general to his arguments brought forward during the opposition proceedings. In his letter of 7 June 1990 (last page) filed during the opposition proceedings, the Respondent argued the obviousness of the teaching of Claim 3. He drew attention to documents D4 and D5 and gave an explanation thereto.

In its decision, the Opposition Division came to the conclusion that the granted Claim 3 is novel and involves an inventive step, and gave reasons therefor.

After examination of the relevant state of the art disclosed in documents D4 and D5 cited by the Respondent (Opponent) during the opposition proceedings, the Board confirms the reasoned decision of the Opposition Division with regard to Claim 3. There are no pertinent arguments against the claim.

The piston of Claim 3 of the main request is novel and involves an inventive step.

9. In view of the above, the patent in suit can be maintained on the basis of the Appellant's main request, that means Claims 1 to 3, the description and the drawings as defined in above section VI.
10. Therefore, there is no need to examine the Appellant's subsidiary requests.
11. At the end of the oral proceedings, both parties had an opportunity to comment on the amendments submitted by the Appellant (main request). Therefore, it is not

necessary to issue a communication pursuant to Rule 58(4) EPC (see Decision T 219/83, OJ EPO 1986, 211).

12. Since it is of no importance to the present decision whether or not the sealing rings of document D1 touch all horizontal and vertical walls of the piston ring grooves during the operation of the piston, the request of the Respondent to obtain an expert's opinion relating to the functioning of the sealing rings of document D1, is rejected.

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 that the further procedure, i.e. the maintenance of the patent as amended, be based on the documents defined in the above section VI as forming the Appellant's main request.
3. The request to obtain an expert's opinion is rejected.

The Registrar:




N. Maslin

The Chairman:



C. Andries

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