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Datasheet for the decision of 10 November 2009

Case Number: T 1293/08 - 3.2.04

Application Number: 03006751.6

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Language of the proceedings: EN

Title of invention:
Piston

Patentee:
BRP-Powertrain GmbH & Co. KG

Opponent:
KS Kolbenschmidt GmbH
Federal-Mogul Nürnberg GmbH

Headword:
-

Relevant legal provisions:
-

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:
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Case Number: T 1293/08 **-** 3.2.04

D E C I S I O N
of the Technical Board of Appeal 3.2.04
of 10 November 2009

Appellant: (Patent Proprietor)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 8 May 2008 revoking European patent No. 1348859 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

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

Summary of Facts and Submissions

I. This appeal is against the decision of the Opposition Division of 8 May 2008 in which European patent 1 348 859 was revoked.

The Opposition Division held that the ground for opposition of Article 100(a) EPC prejudiced the maintenance of the patent as granted, because the subject-matter of claim 1 did not involve an inventive step in view of the following documents:

D1: EP-A-0 385 390;
D2: EP-A-0 838 587.

The Division argued that it was not necessary to apply the "problem and solution approach" in detail, because document D2 explicitly mentioned that it is aimed at improving the arrangement of D1 and that therefore, the skilled person was explicitly told to apply the teaching of document D2 to the arrangement of D1.

II. The Patent Proprietor lodged the appeal on 1 July 2008 and paid the prescribed fee simultaneously. The statement of grounds of appeal was received on 5 September 2008.

III. First oral proceedings were arranged for 16 July 2009. On 2 July 2009, i.e. two weeks before these oral proceedings, the Appellant (Patent Proprietor) filed new sets of claims for a main and an auxiliary request, accompanied by a presentation and photos regarding a Finite Element Analysis. Since they appeared prima facie of relevance for the decision to be taken, the

Board decided to admit them into the proceedings and postponed the oral proceedings. In the second oral proceedings on 10 November 2009, the Appellant slightly amended claim 1 of its main request. The discussion focused on the question whether the subject-matter of claim 1 involved an inventive step for the skilled person starting from the closest state of the art known from document D1 in view of the teaching of document D2 and the Finite Element Analysis.

IV. The Appellant (Patent Proprietor) requested that the decision under appeal be set aside and that the patent be maintained based on claims 1 to 10 of the main request filed during the oral proceedings on 10 November 2009, columns 1 to 9 of the description filed for the main request with letter of 2 July 2009, and figures 1 to 7 of the patent as granted, or the auxiliary request filed with letter of 2 July 2009.

The Respondents 1 and 2 (Opponents 1 and 2) requested that the appeal be dismissed.

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

"A piston (1) for an internal combustion engine, comprising: a piston head (2) having an underside; the piston head (2) including a piston axis (11) extending in a generally longitudinal direction; a piston ring carrier (3) extending from the underside of the piston head (2), the piston ring carrier (3) having an outer periphery; a pair of piston pin bosses (5), the pair of piston pin bosses (5) being arranged along a boss axis (6) in a spaced apart relationship; the boss axis (6) being substantially perpendicular to the piston axis

(11); one of the pair of piston pin bosses (5) being located on one side of the piston axis (11) and the other of the pair of piston pin bosses (5) being located on an opposite side of the piston axis (11); a first plane (15) containing the piston axis (11) and the boss axis (6); a pair of piston skirts (7) extending from the outer periphery of the piston ring carrier (3); one of the pair of piston skirts (7) being located on one side of the first plane (15) and another of the pair of the piston skirts being located on the opposite side of the first plane (15); each of the pair of piston skirts (7) including a free end and a pair of opposed edges (8); a pair of connecting walls (10) extending from one of the piston skirts (7) on one side of the first plane (15), across a piston pin boss (5) to the other piston skirt (7) on the opposite side of the first plane (15); wherein the connecting walls (10) are connected to the edges (8) of the skirts (7); each of the pairs of connecting walls (10) being connected to the piston head (2) and having an inner surface (10a); first reference planes extending generally parallel to and spaced from the first plane (15); the first reference planes intersecting each of the connecting walls (10) along first intersecting curves; second reference planes extending generally perpendicular to the first plane (15) and the piston axis (11); the second reference planes intersecting each of the connecting walls (10) along second intersecting curves; each of the connecting walls (10) being at least partially convexly curved with respect to the opposing connecting wall (10) at the second intersecting curve on the inner surface (10a) of the connecting wall (10) respectively, each piston boss (5) having an inner lateral face (5a), a portion of the

inner surfaces (10a) of the connecting walls (10) near the piston head (2) continuously merging into the lateral face (5a) of the piston boss (5), **characterized, in that** each of the connecting walls (10) being at least partially convexly curved with respect to the opposing connecting wall (10) at the first intersecting curves on the inner surface (10a) of the connecting wall (10) respectively; and each of the connecting walls (10) being at least partially convexly curved with respect to the opposing connecting wall (10) at the first and the second intersecting curves on the inner surface (10a) of the connecting wall (10) respectively between the underside of the piston head (2) and a boss plane, the boss plane being perpendicular to the first plane (15) and the piston axis (11) and containing the boss axis (6)".

VI. On the decisive issues, the Appellant argued essentially that the subject-matter of claim 1 involved an inventive step for the following reasons:

From the closest prior art, the subject-matter of claim 1 is distinguished by its characterising features. The twofold curvature of the inner surfaces of the connecting walls solves the problem to provide a low-weight piston in which the stress in the transition area between the piston head and the piston pin bosses is minimised while maintaining flexible or soft support for the piston skirt. The Finite Element Analysis demonstrates that this is the objective technical problem.

VII. The Respondents disagreed and argued essentially as follows:

The skilled person would apply the teaching of document D2 on the piston known from document D1, which represents the closest prior art, because they refer to the same technical problem of further reducing the piston weight. By doing so, the skilled person would arrive at a piston as described in claim 1. If in such piston, the pin bosses were not fully supported by the connecting walls, the skilled person would simply increase the length of the pin bosses so that their lateral faces merge into the connecting walls. Such approach is a simple matter of routine engineering and does not require inventive considerations.

The skilled person would consider document D2, because also the problem to minimise stress was addressed therein, and because it explicitly describes the aim to improve the piston disclosed in document D1, so that both documents have to be considered as a unit. Document D2 guides the skilled person from the known piston in a typical "one-way street" situation to the claimed subject matter.

The Finite Element Analysis fails to demonstrate the improvement of the known piston by the claimed subject-matter.

In the statement of grounds of appeal, Respondent 2 had mentioned that the subject-matter of claim 1 does not involve an inventive step in view of other combinations from the state of the art. In this respect, a general reference was made to statements in the notice of

opposition. This argument, however, was not pursued in the further appeal procedure.

Reasons for the Decision

1. The appeal is admissible and well-founded.

2. *Inventive step - Main request*

2.1 Document D1 discloses a piston for an internal combustion engine with a pair of piston skirts 3, 3'. Their edges are connected to a pair of piston pin bosses 6 by connecting walls 4. As can be seen in the bottom view of Figure 2, these connecting walls are convexly curved on their inner surfaces with respect to the opposing connecting wall at the second intersecting curve as defined in claim 1. However, the connecting walls are straight on their inner surface with respect to the opposite connecting wall at the first intersecting curves as defined in claim 1. Hence, the skirts and their edges extend perpendicularly and straightly from the underside of the piston head. The skirts have rectangular form when seen from the left or right side in Figure 2.

Also document D2 relates to a piston for an internal combustion engine. It is aimed at improving the piston assembly of D1 so as to reduce its weight while simultaneously complying with the requirements of pistons in terms of strength and a low noise level (see column 2, first paragraph) by the following measures:

Firstly, the skirt edges 20 are made to taper from their foot portion to their head portion at the underside of the piston head, i.e. the width of the skirt is larger at their foot than near the head (see column 2, lines 8 to 12). According to column 5, lines 31 to 38 the skirt edges must not be shaped as shown in the figures but could be concavely shaped.

Secondly, the connecting walls between the respective skirt edges are designed to follow the course of the tapering skirt edges (see column 2, lines 12 to 23). When the edges are shaped concavely as set out in the preceding paragraph, the connecting walls will, thus, be convexly curved on their inner surface with respect to the opposing connecting wall at the first intersecting curve as defined in claim 1. Moreover, the curvature and inclination of the connecting wall in the first reference planes does not change along the length of the connecting wall between two opposing skirt edges.

However, the connecting walls are not convexly curved on the inner surface at the second intersecting curve in the meaning of claim 1, because, in a bottom view, the connecting walls extend straight or curved towards the outside (column 9, lines 23 to 32) but not curved towards the inside.

2.2 It is not disputed that document D1 represents the closest prior art.

The claimed piston differs in essence from the embodiment of Figure 2 of D1 in that the connecting walls are convexly curved on their inner surfaces with

respect to the opposite connecting wall at the first intersection curves. Thus, in comparison with the embodiment shown in Figure 2, the inner surface of the connecting walls is convexly curved in two directions, i.e. at the first and the second intersection curves in the transition area between the underside of the piston head and the pin bosses.

The patent specification points out in its introductory part that stresses can occur in the transition area if the piston pin bosses are not joined in an optimal manner:

In the prior art assembly dealt with in paragraph [0005] of the specification, the connecting walls are said not to optimally support the piston pin bosses, so that such an arrangement "also causes major stresses in the transition area between the piston pin bosses and the underside of the piston head".

In the prior art piston assembly of paragraph [0006], the major stresses which can occur in the transition area may "lead to cracking in extreme operating operations".

In paragraph [0008] dealing with a further prior art piston assembly, the connection to the underside of the piston head is said to introduce major stresses.

Paragraph [0009] is concerned with a prior art Ω piston having piston pin bosses and skirt sections that are joined to each other by connecting walls. Although the support for the piston skirt in this Ω piston is relatively flexible, "the stress distribution in the

transition area between the piston boss and the underside of the piston head is not favourable".

Finally in paragraph [0011] dealing with a further prior art arrangement, the stress distribution in the transition area is also said to be not favourable.

This specification thus leaves no doubt that the crux of the invention is to reduce the stresses in the transition area between the piston pin bosses and the underside of the piston head while retaining a relatively flexible support for the piston skirts and without increasing the piston weight.

The Board does not share the Respondent's view that the reduction of the piston weight should be part of the definition of the objective technical problem. It is appreciated that the Finite Element Analysis presents a weight reduction of about 3,2% of the piston A (invention) in comparison with the piston B (document D1). However, such a slight reduction could be explained with the tolerances which are inherent to the underlying calculation model. Therefore and in the absence of other evidence, the Board was unable to conclude that with the distinguishing features of the claimed invention, the weight of the D1 - piston is reduced.

Accordingly, as suggested in paragraph [0015] of the patent specification, the patent is based on the technical problem of providing a low-weight piston that reduces stress in the transition area while simultaneously retaining a flexible or soft support for the piston skirts.

2.3 D2 does not teach or suggest in any way to deal with the problem of the invention, i.e. that of reducing the stresses which may lead to cracking in extreme operating conditions, in the transition area between the pin bosses and the underside of the piston head.

The technical problem posed in D2 is solved by the provision of two piston skirts tapering upwardly in the circumferential direction and of connecting walls following the course of the lateral edges of the piston skirts so as to be inclined towards one another. Such an arrangement makes it possible for further material to be saved in the zones in which the piston skirt wall can be designed more narrowly (see in particular column 2, lines 23 to 30 of D2).

It is true that D2 also specifies especially in claim 4 that the connecting walls can be convexly or concavely curved on their inner surfaces with respect to the opposite connecting wall at the first intersecting curves. However, this prior art citation is wholly silent as to the technical effects that such a technical feature provides. Accordingly it does not give the skilled person any indication for applying this teaching to the known arrangement of D1.

2.4 Moreover and contrary to the appellant's submissions, the skilled person in applying the teaching of D2 to the piston of D1 would not have arrived at the claimed invention:

In doing so, the skirts 3, 3’ would be modified such that their edges 7, 8 curve concavely (in a side view)

and their width decreases from the original size at the foot towards the head. Since the connecting walls have to be designed to follow the course of the tapering skirt edges, the connecting walls 4 would be convexly curved not only in the second reference plane as in figure 2 of document D1 but also in the first reference planes. Thus, they would present a twofold curvature at the first and second intersecting curves.

However, the distance between the inner surfaces of the connecting walls 4 would not remain constant, as in figure 2 of document D1, but decrease from the foot towards the underside of the head. Hence, the portions of the connecting walls near the head portion would be moved inwards and end in the gap that can be seen in figure 2 between the two pin bosses 6. Therefore, portions of the connecting walls would loose contact with the respective pin boss 6, i.e. the pin bosses 6 would not be completely supported by the connecting walls 4.

As a result, the inner surfaces of the connecting walls 4 would not merge into the lateral face of the piston bosses 6 as required by the last feature in the preamble of claim 1. In other words, the application of the teaching of document D2 on the piston known from document D1 does not reveal all the features of claim 1.

2.5 The Board does not share the Respondents' view that it would be a simple matter of routine engineering not involving any inventive considerations to adapt the length of the pin bosses to this new course of the

connecting walls in order to fully support the pin bosses by the connecting walls.

First of all, there are several possibilities to cope with this problem. The pin bosses could be lengthened towards each other. This would, however, increase the total weight of the piston and also reduce the gap between the piston bosses which is critical because it would be more difficult to connect the piston to its piston rod. Moreover, the gap was already minimised for weight reasons.

Or, the course and profile of the connecting walls could be varied so that they merge into the lateral face of the piston bosses. However, this would offend the clear teaching of document D2 that the curvature and inclination of the connecting wall in the first reference planes does not change along the length of the connecting wall between two opposing skirt edges.

Since any of these possibilities would have an effect contradictory to at least one of the aims of documents D1 or D2, the Board is hesitant to conclude that the skilled person would use any of them when applying the teaching of document D2 to the piston known from document D1

Moreover, in this technical field, the piston design parameters are strongly interdependent and even a slight variation of one parameter might have significant effects on the other parameters. Therefore, in the view of the Board, it is not convincing to argue that such variation is only a matter of routine engineering for the skilled person.

2.6 Hence, the Respondents failed to convince the Board that the subject-matter of claim 1 was obvious from the combination of the piston known from document D1 with the teaching of document D2.

2.7 The same can be stated if the prior art according to, for instance, document D2 was used as the starting point for the "problem/solution – approach" when combined with a teaching as known from, for instance, document D1.

2.8 The Board therefore concludes that there is no teaching in the cited prior art for the skilled person to apply the teaching of document D2 to the piston of document D1. But even if he/she applied this teaching, the result would not be a piston in which the connecting walls have the claimed double convex form and merge into the side faces of the pin bosses as specified in claim 1. One would at best arrive at connecting walls having double convex form. Thus, the subject-matter of claim 1 of the main request meets the requirements of inventive step (Article 56 EPC 1973).

3. In view of the foregoing, the auxiliary request of the Appellant did not have to be considered.

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 as amended in the following version:

Claims:	1 to 10 of the main request filed in the oral proceedings of 10 November 2009,
Description:	columns 1 to 9 filed for the main request with letter of 2 July 2009,
Drawings:	figures 1 to 7 of the patent as granted.

The Registrar: The Chairman:

G. Magouliotis M. Ceyte