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D E C I S I O N
of 14 November 1995

Case Number: T 0247/94 - 3.2.4

Application Number: 87105432.6

Publication Number: 0241893

IPC: F02F 11/00

Language of the proceedings: EN

Title of invention:
Head gasket for closely adjacent cylinder bores and method for making same

Patentee:
FEL-PRO INCORPORATED

Opponent:
REINZ-Dichtungs-GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

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

Decisions cited:
-

Catchword:
-

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Case Number: T 0247/94 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 14 November 1995

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office dispatched on 24 January 1994 revoking European patent No. 0 241 893 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. A. J. Andries
Members: M. G. Hatherly
J. P. Seitz

Summary of Facts and Submissions

I. European patent No. 0 241 893 (resulting from application No. 87 105 432.6) was revoked by the decision of the opposition division dispatched on 24 January 1994.

II. An appeal was lodged against this decision on 22 March 1994, the appeal fee was paid on the same day. The statement of grounds of appeal was received on 31 May 1994.

III. The following prior art was considered in the opposition proceedings:

D1: US-A-1 843 297
D2: US-A-3 532 349
D3: US-A-4 243 231
D4: US-A-4 369 980
D5: GB-A-1 278 321
D6: US-A-4 480 844
D7: DE-C-1 294 102
D8: DE-A-2 604 253

The opposition division found that the subject-matter of the granted independent claims 1 and 10 was novel but not inventive.

IV. The respondents (opponents) filed no requests or arguments in reply to the statement of grounds of appeal. In reply to a communication from the board, the respondents withdrew their opposition in the letter of 11 April 1995.

The appellants (proprietors) submitted amended patent documents with the letter of 19 May 1995 and, following telephone calls from the rapporteur, minor corrections with the letters of 26 October 1995 and 3 November 1995.

V. The independent claim 1 is as follows:

"A head gasket assembly (10) for sealing communication with an engine block (B) having at least two closely spaced cylinder bores (C) and a head (H) of engines, especially in racing engines, comprising

- a generally flat main gasket body (12) of a laminated type which defines at least one pair of closely spaced combustion openings (16) therein,
- said main gasket body (12) defining an elongate zone of adjacency (34) of said pair of combustion openings (16) from which gasket body material is absent;
- armoring (14) for said combustion openings (16) comprising a pair of circular armor sections (18) connected by a bridge (20) in said zone of adjacency (34);
- said armor sections (18) including an upper leg (24) and a lower leg (22) to define, in cross-section, a U-shaped annulus for sealing of the peripheries of said combustion openings (16) to secure the armoring (14) to the main body (12) to provide an integrated head gasket assembly; the number of said sections (18) corresponds to the number of combustion openings (16);

characterized by

- an annular wire (26) of circular cross-section prior to compression disposed in each of said assembled armor sections (18) which are initially substantially oversized compared with the thickness

of the main gasket body; said wires (26) in the zone of adjacency (34) and in the zone of the bridge (20) are spaced from each other but in close proximity to each other;

- said wires (26), prior to compression, having a relatively high malleability and a high heat conductivity are at least about 10 to 20% greater in thickness than the thickness of the main gasket body (12), so that in the zone of adjacency (34) and in the zone of the bridge (20) as well as elsewhere, at least one of the legs (22, 24) of the armoring (14) stand off somewhat from the main gasket body (12);
- such that following the assembly of the gasket, the wires (26) are deformed by pre-compression into sealing engagement with each other in the zone of adjacency (34) providing an effective seal in the zone of adjacency (34);
- said wires (26) are in sealing engagement with each other after compression, so that the space between adjacent combustion openings (16) may be as little as about 3.56 mm (0.14 inch)."

VI. The appellants request that the decision under appeal be set aside and the patent maintained on the basis of the following patent documents:

- Claim 1:

  - the first part, on claims page 1, filed with the letter of 26 October 1995; and

  - the last part, on claims page 2, filed with the letter of 3 November 1995.

- Claims 2 to 4 filed with the letter of 3 November 1995.

- Description (in the following order):

  - pages 1 and 2 filed with the letter of 26 October 1995;

  - pages 3 and 4 and column 2 filed with the letter of 19 May 1995;

  - column 2 of the patent as granted, from line 54 (namely **"Brief Description of the Drawings**) to line 58 (ie to the end of the column);

  - columns 3 to 6 filed with the letter of 3 November 1995; and

  - column 7, lines 1 to 18 of the patent as granted.

- Drawings:

  - Figures 1 to 8, 8A and 9 of the patent as granted.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 All the features of the granted claim 1 are to be found in the present claim 1.

The additional features in the present claim 1 are all to be found in the patent specification as granted which was fairly based on the patent application as originally filed, this has not been called into question either in the opposition proceedings or in the appeal proceedings.

The feature of "closely spaced" on claims page 1, lines 4 and 5 (using the numbering at the left hand side) is taken from column 3, lines 38 and 39 of the granted description; "head (H)" in line 5 from column 3, line 33; "especially in racing engines" in line 6 from column 6, line 43; "laminated type" in lines 7 and 8 from column 4, lines 10 and 11; "circular armor sections" in line 14 from column 3, line 42; "to secure the armoring (14) to the main body (12) to provide an integrated head gasket assembly" in lines 20 and 21 from column 4, lines 2 to 5; "annular" in line 25 from column 5, line 22; and "circular cross-section prior to compression" in lines 25 and 26 from column 2, lines 28 and 29. The feature of the assembled armor sections being initially substantially oversized compared with the thickness of the main gasket body (lines 26 to 28) is based on Figure 5 of the patent as granted. Lines 29 to 31 come from the granted claims 2 and 10 and from column 5, lines 21 and 22. In line 33, the feature of relatively high malleability is based on column 2, lines 26, 27 and column 5, line 50 to column 6, line 4. The high heat conductivity, also in line 33, is taken from claim 9. The words "at least about 10 to 20%" in line 34 come from column 5, line 27; the words "so that ... main gasket body (12)" on page 1, line 35 to page 2, line 3 come from column 5, lines 30 to 33; the words "such that following the assembly ... zone of adjacency (34)" on page 2, lines 4 to 6 come from column 5, lines 34 to 39; page 2, line 7 comes from column 6,

lines 13 and 14; the words "said wires (26) are in sealing engagement with each other after compression" on page 2, lines 9 and 10 come from claim 2; and the final part of the present claim 1 is derived from column 6, lines 56 and 57.

2.2 The dependent claims 2 to 4 correspond to the granted claims 3, 4 and 6 respectively.

2.3 The present **description** is merely an adaptation of the granted description to take account of changes to the claims and to acknowledge the prior art. The **drawings** are those of the granted patent, indeed those originally filed.

2.4 Thus the board has no objection under Article 123 EPC to the present version of the patent specification.

3. *Interpretation of claim 1*

The board considers that the wording "the space between adjacent combustion openings (16) may be as little as about 3.56 mm (0.14 inch)" (claims page 2, lines 10 to 12) indicates a lower limit on the combustion opening spacing. Thus the invention makes possible (but not obligatory) spacings down to a lower limit of about 3.56 mm (0.14 inch).

4. *The prior art*

4.1 Document D3 discloses an engine head gasket assembly 2 with two closely spaced holes 1 about which is inserted a metal grommet 3 (see Figures 1 and 2 and column 2, lines 18 to 22). In an area between the holes is mounted a graphite sheet 5 which exhibits an excellent resistance to heat (see column 2, lines 55 and 56).

4.2 Document D5 discloses an engine head gasket assembly with a laminated body and two closely spaced holes 10, 10A, each surrounded by a respective eyelet 3, 3A (see page 1, lines 75 to 87). Instead of there being gasket body material in a region between adjacent combustion openings there is a metal reinforcing member engaged on opposite faces by the flanges of each eyelet (see page 1, lines 40 to 44).

4.3 Document D1 discloses a head gasket assembly whose body is eg of sheet iron or steel (page 1, lines 38 to 40). A seating member (eg a copper wire - page 1, lines 45 and 46) about an opening 12 is held in place by a flanged retainer 16 (page 1, lines 56 to 60).

Document D2 discloses a head gasket assembly with a body having a metal core 10 and asbestos sheets 13 (see column 2, lines 56 to 59). A fire ring 14 around a combustion chamber opening is secured by a flange or grommet 15 (column 3, lines 65 to 71). The assembly of body, fire rings and flanges is compressed when installed between the engine head and block (see Figure 4).

It is clear for both documents D1 and D2 (see the respective Figure 1) that the body material is present in the area between the combustion chamber openings 12 and that the wire and retainer of one opening are spaced from those of the next.

Similar comments apply to document D4.

4.4 Figures 1 and 4 of document D6 show a fire ring 12' attached by a fire ring wrap 28 to a gasket body 18 around a single aperture therein.

Figure 1 of document D7 shows a helical spring ring 4 attached by a ring wrap 5 to a gasket body around a combustion chamber aperture.

Document D8 discloses one fire ring 4 (or two fire rings in Figure 3) attached by a fire ring wrap 3 to a gasket body 1 around an aperture therein.

The documents D6 to D8 are plainly not concerned with the area between cylinder apertures because they in fact deal only with one aperture. For example, document D6 not only fails to mention a plurality of cylinder apertures but specifically shows in Figure 1 a gasket assembly having only one aperture.

4.5 The board considers that a further search for the subject-matter of the present claim 1 is unnecessary since the most important features added to claim 1 as granted are derived from the other granted claims.

5. *Novelty*

Thus, after examination of the available prior art documents, the board is satisfied that none of them discloses a head gasket assembly having all the features set out in claim 1. This has not been in dispute in the opposition and appeal proceedings. The subject matter of claim 1 is thus to be considered as novel within the meaning of Article 54 EPC.

6. *Closest prior art, problem and solution*

6.1 Documents D3 and D5 are the only available prior art documents dealing with the zone of adjacency of combustion openings in a head gasket assembly. Unlike document D3, document D5 specifically states that the gasket assembly has a laminated body.

The board thus sees the gasket assembly closest to that of the present invention as being that disclosed by document D5. The features of the pre-characterising part of the present claim 1 are known from this document.

6.2 The board considers the problem when starting from the prior art gasket assembly disclosed by document D5 to be to provide an improved structure in the area between combustion openings corresponding to the engine cylinder bores to enable these to be located as close as possible in order that the cylinder bores can be as large as possible for a given size of engine block.

6.3 The board is satisfied that the objective problem can be solved by the features of the present claim 1 and in particular by the features of its characterising portion. The prior art gasket body is fragile in the area between the bores and may break away or delaminate thus destroying the sealing. In the inventive gasket assembly, the function of the gasket body material in the zone between the combustion openings is assumed by initially oversized wires around the combustion openings which are squashed to sealingly engage each other in the zone. Thus not only do the wires retain their customary function of sealing the cylinder bore openings but they also replace the gasket body material in the zone of adjacency by sealingly engaging each other there.

7. *Inventive step*

7.1 The only documents dealing with the zone of adjacency of combustion openings in a head gasket assembly are the above mentioned documents D3 and D5 but in the zone of adjacency each of these documents specifies the use of a material different to that of the grommet or eyelet respectively ie the gasket assemblies have both this material and the rings. In the inventive gasket,

however, the wires not only replace the gasket body material in the zone of adjacency by sealingly engaging each other there but retain their customary function of sealing the cylinder bore openings.

The board sees no hint in the available prior art that would lead the person skilled in the art to combine one or the other of these two documents with any other document in such a way as to arrive at a gasket assembly as defined in claim 1.

7.2 Combination of documents D3 and D6

It has been argued that the fact of the gasket assembly of document D3 having graphite in the zone of adjacency teaches the skilled person to replace the gasket body material in the zone by another, more suitable material. Adding the fire rings of document D6 to the gasket assembly of document D3 would result in the gasket assembly of Claim 1.

It is clear however that there would not be room in the zone of adjacency (see the centre of Figure 2 of document D3) for the grommet 3, the graphite 5 and the rings. To remove the graphite (having an excellent thermal conductivity and dimensional stability in the planar direction, good heat insulation and thermal expansion, and superior elasticity in the direction normal to the sheet face) and realise that its job could be performed only by the rings would not be obvious particularly since the rings already have completely different characteristics when compared with the graphite of document D3, namely dimensional stability in the planar direction and elasticity in the direction normal to the sheet face.

Moreover, in Figures 1 to 3 of document D6 the fire ring 12 is thicker than the gasket body 18, see column 3, lines 2 to 6. This fire ring is chemically bonded at 6 to the gasket body, i.e. there is no wrap. So if the skilled person were to combine this construction with that of Figure 2 of document D3, the result would be a gasket assembly with no wrap i.e. no armor section, this gasket assembly thus would not satisfy claim 1.

While Figure 4 of D6 shows a fire ring wrap 28 around a fire ring 12', it is not said that this ring is thicker than the gasket body 18'. Indeed it appears from Figure 4 that they are the same thickness. Accordingly if the skilled person were to combine this construction with that of document D3, the result would not satisfy claim 1 because the fire ring would not be thicker than the gasket body.

7.3 Combination of documents D5 and D6

The gasket assembly of document D3 is similar to that of document D5 whose gasket has a solid steel bridge reinforcement 15 or a composite reinforcement member of two metal members 19 and 20. The reasons why the combination of the teachings of documents D5 and D6 are not obvious, and moreover would not lead to the claimed gasket assembly, are analogous to those given in section 7.2 above.

7.4 Document D7

In an armor section 11 of the gasket assembly of document D7 is a spring 4 which is originally larger than the gasket body and is compressed during manufacture and installation of the gasket assembly.

It has been argued that it would be obvious to use a wire instead of the spring, thus arriving at a gasket assembly satisfying claim 1.

The board finds however that this pre-supposes that the skilled person knows of document D5 in order to fix his attention on the zone of adjacency. Thus in fact the skilled person would be combining the teachings of the two documents D5 and D7 and adding thereto his knowledge of gaskets having a wire inside an armor section. The board sees no hint in documents D5 and D7 to lead the skilled person in this direction.

7.5 The head gasket assembly according to claim 1 thus involves an inventive step within the meaning of Article 56 EPC.

8. The subject-matter of claim 1 is thus patentable as required by Article 52 EPC. The patent may therefore be maintained amended, based on the allowable independent claim 1, dependent claims 2 to 4 which concern preferred embodiments of the gasket assembly according to claim 1, the amended description and the drawings.

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 in the version set out in section VI above.

The Registrar: The Chairman:

N. Maslin C. Andries