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D E C I S I O N
of 14 May 1997

Case Number: T 0381/96 - 3.2.4

Application Number: 91101334.0

Publication Number: 0440247

IPC: F02F 11/00

Language of the proceedings: EN

Title of invention:
Metal gasket with sealing device with different spring constant

Patentee:
ISHIKAWA GASKET CO. LTD.

Opponent:
REINZ-Dichtungs-GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0381/96 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 14 May 1997

Appellant: (Opponent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 20 February 1996 concerning maintenance of European patent No. 0 440 247 in amended form.**

Composition of the Board:

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

Summary of Facts and Submissions

I. The interlocutory decision of the opposition division of the European Patent Office to maintain the European patent No. 0 440 247 in amended form was posted on 20 February 1996.

The appellants (opponents) filed an appeal against this decision on 30 April 1996, the appeal fee was paid on the same day. The statement of grounds of appeal was received on 28 June 1996.

II. The following documents were referred to during the appeal proceedings:

D1: JP-A-60/261 960
D2: US-A-4 834 399
D4: JP-A-61/255 250
D6: JP-U-57/18 744
D7: JP-U-57/144 249

III. Both parties attended oral proceedings on 14 May 1997. During the discussion the respondents (patentees) submitted an amended claim 1 reading as follows:

"A metal gasket (A, B) to be installed between two engine parts of an internal combustion engine and fastened by means of bolts, comprising a first plate (A10, B21), said first plate (A10, B21) including:

at least one first hole (Hc) situated inside the metal plate (A10, B21),

at least one sealing device (A11) formed around the first hole (Hc) so that when the metal plate (A10, B21) is tightened between the engine parts, the sealing device (A11) seals around the first hole (Hc),

a plurality of bolt holes (Hb) formed outside and around the first hole (Hc) and its sealing device, said bolts passing through the bolt holes (Hb) and tightening the engine parts together,

at least one second hole (Hw1, Hw3, B21d) situated adjacent to and outside the first hole (Hc) and its sealing device between two of said bolt holes (Hb), the first hole (Hc) and its sealing device being situated on one side of an imaginary straight line (A14, B14) linking between centers of said two bolt holes (Hb) adjacent to each other and said second hole (Hw1, Hw3, B21d) being arranged such that a substantial portion of the second hole (Hw1, Hw3, B21d) is located on the other side of said line (A14, B14), said imaginary line (A14, B14) extending along an outer portion of the metal plate (A10, B21), and

a bead (A15, B21a, B21e), as a whole, consisting of an inner section (A15a, B21b, B21f) near the first hole (Hc) and a remainder on said other side, formed around the second hole (Hw1, Hw3, B21d), said bead being formed without interruption between the first hole and the second hole,

said inner section (A15a, B21b, B21f) of the bead (A15, B21a, B21e) having a spring constant weaker than the remainder (A15b, B21c, B21g) of the bead (A15, B21a, B21e) so that when the metal plate (A10, B21) is tightened between the engine parts, the bead (A15, B21a, B21e) can be compressed equally to securely seal around the second hole (Hw1, Hw3, B21d)."

IV. In the appeal proceedings the appellants argued that the subject-matter of claim 1 was obvious from the state of the art and in particular from a combination of document D1 and document D2 or D6. The problem of sealing over the whole area of a gasket was known, the

gasket being firmly pressed in the area of each bolt hole and the area along the line joining adjacent bolt holes but the gasket bulging with increasing distance from these areas and it being necessary to achieve a good sealing at the raised outer edges of the gasket.

They stated that the problem had been recognised in documents D2 and D6 where the upstanding edge areas were provided with beads whose spring constant was suited to the given conditions. The difference added by the present claim 1 of the beads changing their spring constant along their circumferential length was known from document D1. Relating the change of spring constant to the distance from the first (or combustion chamber) hole was in practice the same as relating it to the distance from the bolt holes.

V. The respondents essentially countered the appellants' arguments, maintaining that combinations of the prior art documents would not have led to the subject-matter defined by the present claim 1.

VI. The appellants request that the interlocutory decision under appeal be set aside and the patent revoked.

The respondents request that the decision under appeal be set aside and the patent be maintained in the following amended form:

Claims: 1 as filed during the oral proceedings
2 to 9 as granted

Description: columns 1 and 2 as filed during the oral proceedings
columns 3 to 6 as granted

Drawings: Figures 1 to 5 as granted

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments to the patent as granted*

2.1 The present claim 1 consists of all the features of the originally filed claim 1 and of the granted claim 1 with some clarification of the relative positions of the holes and imaginary line, which can be seen from Figures 1 and 3 of the originally filed drawings.

Thus no objection arises under Article 123(2) EPC to the new claim 1 and, since this new claim 1 has a narrower scope than the granted claim 1, no objection arises under Article 123(3) EPC either.

2.2 Dependent claims 2 to 9 are still the granted claims 2 to 9.

2.3 The amendments to the granted description consist merely of an adaptation to the present claim 1. The drawings are those as granted.

2.4 Thus no objection arises under Article 123 EPC to the present version of the patent documents.

3. *Novelty*

A metal gasket as defined by the present claim 1 is not disclosed by any of the prior art documents available to the board. Novelty is moreover not disputed by the appellants.

Therefore the subject-matter of claim 1 is considered novel within the meaning of Article 54 EPC.

4. *Closest prior art, problem and solution*

4.1 Document D2 discloses a steel laminate gasket comprising a first plate and an adjacent second plate. The sealing device A50b, A50c, A50d around the hole A52 for the cylinder bore Hc is provided in the first, upper plate A50 while the bead A51b around the hole A60 for the water hole Hw is provided in the second, lower plate A51 (see Figures 4 and 5A; column 3, lines 35 and 36, 41 and 42, and 53 to 57; and column 4, lines 14 to 16 and 30 to 33). Column 5, lines 21 to 27 state that the "high pressure areas around the cylinder bores Hc are sealed only by the upper plate A50, while non-high pressure areas adjacent holes other than the cylinder bores Hc are sealed only by the lower plate A51. Therefore, best materials for the high pressure areas and non-high pressure areas can be easily selected."

Thus in this gasket there is no fixed relationship between the cylinder bore sealing device (in the upper plate) and the lower plate, and there is no fixed relationship between the water hole bead (in the lower plate) and the upper plate. Accordingly this gasket is of a basically different type to the one defined by the present claim 1, namely one which comprises a first plate including not only the first hole and its sealing device but also the second hole and its bead.

4.2 Document D4 discloses a gasket whose main plate 4 has a combustion chamber opening 6 which is surrounded by a bead 12 with a spring constant which varies according to the distance from the bolt holes 8, see Figures 1 to 3 and page 6, lines 5 to 33 of the German translation.

However the only holes in the gasket are the (first) combustion chamber opening 6 and the bolt holes, there is no second hole. Therefore neither could this document be an appropriate starting point for the invention.

4.3 Document D7 lacks a detailed description and is in part inconsistent (e.g. the reference numerals on Figure 3) but apparently discloses different beads in the cross section of Figure 3 (taken on the line A-A of Figure 2 for the cylinder bore 12) and the cross section of Figure 4 (taken on the line B-B of Figure 2 for the bolt hole 14). Thus, unlike the present claim 1, in document D7 the second holes and the bolt holes are one and the same.

4.4 The board concludes - with the agreement of the parties - that the closest prior art document is document D6 whose Figures 2 to 4 show a main plate 1 with a sealing device 3 surrounding a cylinder hole 2 (i.e. a first hole) and a bead 7 surrounding an oil hole 5 (i.e. a second hole) located on opposite sides of a line joining bolt holes 10. According to the German translation, claim 2 of document D6 states that the height of the bead around the oil hole is 25 to 90% of the height of the bead around the combustion chamber.

4.5 Starting from the gasket known from document D6 the board sees the problem to be solved by the invention as being to improve the sealing of the gasket over a greater area thereof.

4.6 Claim 1 concerns in particular a second hole which is situated between two bolt holes. This means, in Figure 1 of the patent for example, that the second hole Hw1 cannot wholly lie outside two bordering lines which are on either side of the imaginary straight line A14 joining the centres of the two bolt holes Hb and

which are tangential to the circumferences of said bolt holes. The first hole Hc and its sealing device are on one side of the imaginary line A14 and a substantial portion of the second hole is on the other side of the imaginary line. The second hole is surrounded by a bead whose inner section near the first hole has a spring constant weaker than the remainder of the bead. Accordingly when the metal plate is tightened between the engine parts, although the plate has a tendency to bulge in the areas outside the lines joining the bolt holes, the bead can be compressed equally to securely seal around the second hole.

4.7 The board thus considers that the features of the present claim 1 solve the problem presented by the gasket of document D6.

5. *Inventive step*

5.1 Document D6

5.1.1 In the gasket known from document D6, i.e. the gasket closest to that of the present invention, the height of the bead 7 around the oil hole 5 is different to the height of the bead 3 around the combustion chamber 2. Thus the different beads have different heights but each bead has a constant height around its circumference.

5.1.2 It is clear that there is no hint in document D6 itself to vary the bead height (and thus the spring constant) around the circumference of a single bead. The appellants argue however that the document teaches that the beads for holes inside the lines joining the centres of the bolt holes 10 have different heights to the beads for holes outside these lines.

5.1.3 The board however considers that the teaching of why the beads of different holes of the gasket known from document D6 are to have different heights is not very clear.

Firstly, it is clear that the oil hole 5 and its bead 7 in the main plate 1 are outside the line joining the adjacent bolt hole centres but the oil hole 5 and its bead 7 cannot be considered as lying "between two bolt holes" (see the above section 4.6).

Secondly, claim 1 of document D6 (according to the German translation) states that the height of the bead surrounding the combustion chamber as a high temperature part is 50 to 160% of the thickness of the main plate while claim 2 (German translation) only states that the height of the beads surrounding the cooling water passage and the oil passage as low temperature parts is 25 to 90% of the height of the bead of the combustion chamber. It thus appears that the determining factor in document D6 for the height of the bead for a particular hole is the temperature (low or high) in that hole.

5.2 Document D1

5.2.1 The gasket 23 shown in Figures 3 to 7 of document D1 has a sealing device surrounding a hole 26 for the combustion chamber B, various bolt holes 30, and a sealing device located outside all the various water cooling openings 29. The sealing device does not pass between the water cooling openings and the combustion chamber opening but can still be said to surround all the water cooling openings (at a lesser or greater distance therefrom).

The gasket has an inner plate 25 and outer plates 24a and 24b. The outer edge of the gasket is shown in cross section for various places on the periphery in Figures 5 to 7 which are cross sections on lines V-V, VI-VI and VII-VII respectively of Figure 3 and which show progressively wider inclined edge faces 31a and 31b of the inner and outer plates 24a and 24b. This width variation is done according to the required sealing capability, see page 8, lines 13 to 17 of the German translation of the document. According to page 8, line 18 to page 9, line 2 of the translation, in the area a on Figure 3 where the water outlet 22 is located, the force of the bolts is weakened and a high sealing capability is needed, so the steeply inclined edge faces 31a and 31b shown in Figure 5 are provided. On the other hand, in an area where the bolt force is adequately transmitted and where therefore no great sealing capability is required, e.g. around the bolt holes, slightly inclined edge faces are formed, e.g. Figure 7 taken on line VII-VII. It can be seen that the edge faces 31a and 31b on Figure 6 are inclined to a degree between those of Figures 5 and 7 and that Figure 6 is a section on line VI-VI on Figure 3, i.e. equidistant from two bolt holes 30.

5.2.2 The appellants conclude from this that in the gasket known from document D1 the bead around the (second) water holes changes its spring constant along its circumferential length, dependent on the distance from the bolt holes. They add that the difference added by the present claim 1 that the spring constant is dependent on the distance from the first (e.g. cylinder) hole is only a formal difference since in both the presently claimed gasket and that known from

document D1 the weaker spring constant is on the side of the bolt hole connecting line nearer to the first (cylinder) hole and the stronger spring constant is on the opposite side further away from the first (cylinder) hole.

5.2.3 The board however cannot accept this reasoning. Firstly, it seems from Figure 3 and page 8, line 18 to page 9, line 2 of the translation that the same spring constant, namely that provided by the edge face inclination shown on Figure 5 taken on line V-V of Figure 3, is provided throughout the area a whereas points on the bead in this area a are at varying distances from the bolt holes. Secondly it appears from Figure 3 that the bead has the same width to either side of the section line VI-VI until it closely approaches the bolt holes, so that the spring constant in this region is not dependent on the distance from the bolt holes. The teaching of the document D1, see page 8, lines 23 to 29 of the translation, is that steeply inclined edge faces are provided where a high sealing capability is required, giving a high spring force when the gasket is clamped between the cylinder head and the cylinder block.

5.3 If the skilled person skilled in the art were to apply the teaching of document D1 to the teaching of document D6 then he would first need to be clear about what these two documents in fact teach. While each document discloses variations in the spring constants of beads, neither - in the opinion of the board - teaches that these variations are dependent on either the distance from the first (combustion chamber) hole or on the distance form the bolt holes. Accordingly even their combination would not yield the subject-matter of the present claim 1.

5.4 Even if it were to be accepted that, in the gasket known from document D1, the spring constant varied according to the distance from the bolt holes, this would not necessarily lead the skilled person to the present invention. If he was to provide a varying width bead (along the lines of that of document D1 but with separate beads located closely around each second, water hole 29, that is also between the respective water hole 29 and the cylinder hole 26) then he would vary the spring constant along the circumferential length of each bead according to the distance from the bolt holes. This would lead to points on the inner part of the bead (between the water hole and the cylinder bore) having greater spring constants than some points on the outer part (on the side of the water hole away from the cylinder bore). Such a gasket would not fall within the scope of the present claim 1.

5.5 An argument of the appellants, based on a differing interpretation of the expression "between two bolt holes" to that given in the above section 4.6 , concerns a second hole that is located far away not only from the bolt holes but also in a radial direction from said first hole, so that the shortest distance to each bolt hole is in fact that part of the second hole nearest to the first hole. In such a configuration, argue the appellants, the remainder of the second hole would need a greater spring constant. However as already explained, such a configuration is not covered by the invention since such a second hole is not located "between the bolt holes" in the meaning of the present invention.

5.6 Moreover it must be borne in mind that in the gasket known from document D6 the oil hole bead 7 has a lower height and thus apparently a lower spring constant than the combustion chamber bead 3. Thus the spring constant is lower for the bead which is on the outer side of the

line joining the bolt hole centres than it is for the bead which is on the inner side of the line. If this teaching were to be applied to vary the height of a single bead then the result would be that the lower spring constant would be in the region on the side further away from the combustion chamber hole. This would however be the opposite to the solution provided by the present claim 1 which states that the inner section of the second hole's bead near the first hole has a spring constant weaker than the remainder of the bead further away from the first hole. Thus in the invention the greater spring constant is away from the first hole.

5.7 The appellants' allegation that claim 1 is formulated in such general terms that gaskets known from the prior art fall within its scope cannot succeed since they have not provided even a single example of such a novelty-destroying gasket and indeed they accept that the subject-matter of claim 1 is novel.

5.8 It is known, for example from document D4, to vary the spring constant of a sealing device around the combustion chamber hole according to the distance from the bolt holes surrounding the combustion chamber. While it is also known in gaskets known from other documents to choose different spring constants for the sealing devices of different types of hole, these spring constants are the same around the periphery of the particular sealing device, there is no disclosure in these documents of the spring constant varying around a single hole. Moreover there is no clear teaching in the available prior art that these different spring constants for different types of hole should be chosen as a function of the distance from the

bolt holes. Still further, there is no teaching in the available prior art that these different spring constants should be chosen as a function of the distance not from the bolt holes but from a first hole e.g. a combustion chamber hole.

5.9 Thus the board finds that it would not be obvious to use the teachings of the documents relied upon in the appeal proceedings, taken singly or in combination, to arrive at a gasket as set out in the present claim 1.

6. The subject-matter of claim 1 is thus patentable as required by Article 52 EPC. The patent may therefore be maintained amended based on this allowable independent claim and on claims 2 to 9 which are dependent on claim 1.

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 following version:

Claims: 1 as filed during the oral proceedings
2 to 9 as granted

Description: columns 1 and 2 as filed during the oral proceedings
columns 3 to 6 as granted

Drawings: Figures 1 to 5 as granted.

The Registrar: The Chairman:

N. Maslin C. Andries