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File Number: T 111/89 - 3.2.1

Application No.: 84 200 617.3

Publication No.: 0 125 718

Title of invention: Method of executing an assembly in such manner  
that fretting corrosion will not occur

Classification: F16C 35/07

DECISION  
of 29 July 1991

Proprietor of the patent: SKF

Opponent: INA Wälzlager

Headword:

EPC Articles 83, 100(b)

Keyword: "Sufficiency of disclosure (no)" -  
"Funtional terms in claims"

Headnote



Case Number : T 111/89 - 3.2.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.1  
of 29 July 1991

**Appellant :**  
(Proprietor of the patent)

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**Respondent :**  
(Opponent)

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**Representative :**

**Decision under appeal :**

Decision of Opposition Division of the European  
Patent Office dated 24 November 1988 revoking  
European patent No. 0 125 718 pursuant to Article  
102(1) EPC.

**Composition of the Board :**

**Chairman :** F. Gumbel  
**Members :** F.J. Pröls  
W. Moser

## Summary of Facts and Submissions

- I. European patent No. 0 125 718 was granted on 1 April 1987 on the basis of European patent application No. 84 200 617.3, filed on 2 May 1984.

Claim 1 of the patent has the following wording:

"Method of constructing an assembly of at least two metal parts in fitting contact with each other and capable of minimal movements relative to each other under an alternating load, in particular a rolling bearing assembly, so that no fretting corrosion will occur at the opposing surfaces of the parts, a layer of homogeneous elastic material being applied to one of the opposing surfaces in fixed connection therewith and contacting the other opposing surface, characterized in that the free surface of the said layer is made almost perfectly dense and smooth, so that it comes into complete intimate contact with the other opposing surface, with so high a coefficient of friction that no relative sliding oscillatory motion can take place between the free surface of said layer and said other opposing surface."

- II. The patent was opposed by the Respondents, who requested that the patent be revoked in its entirety. The opposition was based on the grounds of Article 100(a) (lack of inventive step) and 100(b) (insufficiency of disclosure) EPC. With respect to the ground of Article 100(a) the Respondents cited the following state of the art documents:

D1 = DE-A-1 605 082

D2 = DE-B-1 061 565

D3 = DE-A-2 401 544.

III. The Opposition Division revoked the patent by its decision dated 24 November 1988 on the opposition ground of Article 100(b) EPC (insufficiency of disclosure).

IV. The Appellants (Patentees) appealed against this decision on 28 January 1989, paying the due fee at the same time. The statement of grounds was submitted on 25 March 1989.

V. On 15 December 1989, the Board issued a communication pursuant to Article 110(2) EPC wherein the prior art documents

D4 = "Kunststoffe", 1969/1, pp. 45-50

D5 = "Kunststoff - Taschenbuch", F. Pabst,  
München/Wien 1979, 21st edition,  
pp. 52, 53 and pp. 270-273, 276, 277

were cited and wherein the provisional opinion was given that the contested patent does not appear to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

VI. The Appellants requested that the decision under appeal be set aside and that the patent be maintained as granted.

In support of their submission they referred (with letter received 6 February 1990) to the following prior art documents as mentioned in the description of the patent in suit:

D6 = DE-A-2 336 947

D7 = US-A-3 533 667

D8 = GB-A-760 145.

The arguments in support of their request can be summarised as follows:

The disclosure of the patent as concerns (a) the surface quality and (b) the level of the contact pressure forces is sufficient, since the description of the patent defines in which way the required surface quality can be obtained. In particular, the description discloses that a porefree and smooth surface is achieved by sintering and fine-grinding operations. The provision of an intimate contact between the surfaces and its consequences such as a high coefficient of friction are well known to the man skilled in the art as apparently also recognised by the Opposition Division according to their statements on page 5, second paragraph of the decision under appeal.

The prior art documents D6 to D8 as cited in the description of the patent further show that the prior art sometimes mentions the pressure forces (as D8) and often not (as D6 and D7) and demonstrates in this way that the mentioning of the pressure forces is not decisive for practicing the claimed method. In consideration of the description of the patent in suit and the knowledge of the skilled man it can be concluded that the provisional opinion of the Board and the view of the Respondents is based upon the underestimation of the skilled person's knowledge and ability in this field of technology and within the context of the state of the art.

VI. The Respondents requested the dismissal of the appeal. An auxiliary request for oral proceedings was made.

In support of their request they put forward the following arguments:

The Appellants' interpretation of page 5, paragraph 2 of the decision under appeal is wrong, since the Opposition Division has simply given there a relative evaluation of

the deficient disclosures of the characterising features (a) (surface quality) and (b) (coefficient of friction) and has furthermore argued that these deficient disclosures compound each other, particularly since the surface finish will have an effect on the coefficient of friction. In a friction pairing the friction forces would be dependent from the contact pressure and the properties of both contacting surfaces. The original documents of the alleged invention, however, say nothing about the property of the second surface and the contact pressure. The arguments put forward by the Appellants do not overcome the objections forwarded in the opposition and appeal proceedings.

#### Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rules 1(1) and 64 EPC; it is admissible.
2. The disputed patent relates to "a method of constructing an assembly of at least two metal parts in fitting contact with each other" and is concerned with the problem of fretting corrosion which, in the original and in the granted description, is defined as a phenomenon of wear that occurs between two surfaces subject to a relative vibratory motion of comparatively small amplitude. Such fretting corrosion generally can occur in rolling bearings, in particular between the inner ring and the shaft or between the outer ring and the housing. The vibratory motion between these parts is a result of the alternating stresses set up in the races as the rolling elements move along them and elastically deform the rings. Some proposals for dealing with this problem, such as disclosed in D6 and D7, are discussed in the preamble of the description of the contested patent. Generally press

fits have been used in an attempt to reduce the amount of movement between the components. This is not always successful in preventing fretting corrosion and in any case press fits are not always practicable.

Thus, it has also been proposed in D7, which is equivalent to D1, to separate the outer bearing ring and the housing by a thin intermediate layer of metallic or synthetic plastics material applied to one of the opposing surfaces thereof.

Starting from this latter prior art, which corresponds to what is stated in the preamble of Claim 1, the characterising clause of Claim 1 specifies the following measures as being instrumental in avoiding the occurrence of fretting corrosion even under extremely high dynamic stresses and without the need to provide a press fit between the parts of the assembly:

- (a) the free surface of the layer is made almost perfectly dense and smooth, so that it comes into complete intimate contact with the opposing surface, whereby
- (b) the coefficient of friction between the free surface of the layer and the opposing surface is so high that no relative sliding oscillatory motion can take place between them.

3. This appeal is concerned with the question of whether the disclosure of the disputed patent is sufficient to enable the skilled person to put the claimed invention into practice.

3.1 The above cited characterising measures (a) and (b) of Claim 1, which distinguish the claimed method from that known from D7 (or D1), require that

- (i) any relative sliding oscillatory motion between the opposing surfaces shall be avoided by
- (ii) firstly, realising an intimate contact between the opposing surfaces by making the layer surface "almost perfectly dense and smooth" and
- (iii) secondly, making the coefficient of friction between the opposing surfaces high enough that the desired result (no oscillatory motion) is reached.

Thus, the teaching of Claim 1 of the contested patent and, in particular, the feature in its last lines (as above defined under (b) or (iii)) defines much more the desired technical effect rather than giving a complete teaching how this result can be achieved in practice.

3.2 Therefore, in the Board's judgment, in order that the disclosure could be considered to be sufficient, it is necessary that either the measures applied in order to provide an almost perfectly dense and smooth layer surface causing an intimate contact with the opposing surface and to achieve a high coefficient of friction so that any oscillatory motion is prevented are fully described or shown in the patent (and supported by the original disclosure) or that these measures are apparent to the skilled person so that, in the light of his common general knowledge, a detailed description is unnecessary.

3.3 In the present case, in accordance with the original disclosure, the patent specification specifically discloses an example of the material used for the layer, viz. polyamide 11. The opposing metal surface can safely assumed to be of steel as is generally used for rolling bearings, their shafts and their housings. The layer

surface is further defined as being perfectly dense and smooth which, according to the original disclosure, can be obtained by a polyamide sintering process. Sintering processes for the manufacture of pore-free layers of plastics, such as polyamide, are generally known, see e.g. D5, pages 52, 53 (whirl sintering) and pages 276, 277. According to the description, the smooth layer surface is obtained by a fine grinding operation which, as generally known, provides a surface roughness between 2,5 and 1  $\mu\text{m}$ .

- 3.4 The patent specification and the corresponding original disclosure, however, contain no information as regards the surface quality of the opposing surface, i.e. the surface adjacent the free layer surface, and the level and even the existence of any contact pressure force. These properties or values are of essential importance for the friction force which is active between two friction surfaces to prevent undesired motion.

If, in the present case, any oscillatory motion is to be prevented between the free surface of the layer and the opposing metal surface, then a sufficient static friction force  $F = \mu \times N$  (wherein  $\mu$  = friction coefficient and  $N$  = contact pressure force) must be active between the contacting surfaces.

- 3.5 In this context it is well known that in a friction pairing between synthetic material and metal (steel) the friction coefficient  $\mu$  is essentially dependent upon:

- (I) the contacting materials themselves,
- (II) the roughness of their sliding surfaces, and
- (III) the contact pressure,

see in document D4, page 45, paragraph 3 of the report on "Reibung und Verschleiß...." in connection

- (I) with table 1 of page 47 showing the dependence of the friction coefficient from the chosen synthetic material,
- (II) with the figure "Abb. 3" showing the dependence of this coefficient from the roughness of the opposing steel surface and
- (III) with the figure "Abb. 9" on page 49 showing the dependence of the friction coefficient from the contact pressure.

Finally, in the last sentence on page 50 of D4 it is mentioned that instructions as to the friction coefficient are not useful without detailed information as to all conditions.

The afore-cited figures "Abb. 3 and 9" concern the sliding friction coefficient whereas in the present case apparently the static friction coefficient is concerned. In this respect, however, D4 also teaches (page 50, left column, paragraph 5) that the static friction coefficient is about 20% larger than the sliding friction coefficient.

- 3.6 The Board, referring to point 3.4 above, considers that the disclosure of the patent specification and the originally filed documents is silent in respect at least of two important conditions namely condition (II), i.e. the roughness of the opposing surface contacting the free layer surface, and in particular condition (III), i.e. the contact pressure force needed.

Thus, the Board is of the opinion that the patent specification and the corresponding original disclosure do not disclose sufficient specific details how the desired technical effect (b) or (iii) (see points 2 and 3.1 above) as set out in the last lines of Claim 1 of the disputed patent can be achieved in practice.

3.7 Therefore, with respect to sufficiency of disclosure, it remains to be examined whether, in the absence of these specific details, the skilled person would be in a position to carry out the claimed method without any instruction concerning the surface quality of the opposing surface and the level and even the existence of any contact pressure force.

3.7.1 An expert trying to reach the claimed result would be confronted not only with a great number of experiments, each experiment itself apparently lasting a long time in order to determine whether fretting corrosion occurs or not (which is considered to be the way to check whether oscillatory motion is present or not) but also with the basic question how to obtain the contacting force. The description of the contested patent on the one hand excludes the generally used means for producing a contact pressure force between the opposing surfaces, i.e. a press fit, but on the other hand does not suggest any alternative means for producing this pressure force.

Therefore, since the contested patent is completely silent on this point and the skilled person's common general knowledge would be of no assistance to him in finding measures suitable for carrying out the method of Claim 1 in practice to achieve the desired result.

3.8 Moreover, the Board is of the opinion, that the documents D6 to D8 as cited by the Appellants and their reasoning on

that point cannot support the Appellants' view that the definition of the pressure force adopted to avoid any oscillatory motion is of no importance for practicing the claimed method, since none of these documents is concerned with the question how to avoid oscillatory motion between two friction surfaces.

4. For the above reasons the Board comes to the conclusion that the opposed patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a skilled person in the art (Article 83 EPC) and therefore cannot be maintained (Articles 102(1) and 100(b) in conjunction with Rule 66(1) EPC).
5. Consequently the appeal is to be dismissed and the further ground of opposition according to Article 100(a) EPC advanced by the Respondents need not be considered.

#### Order

For these reasons, it is decided that:

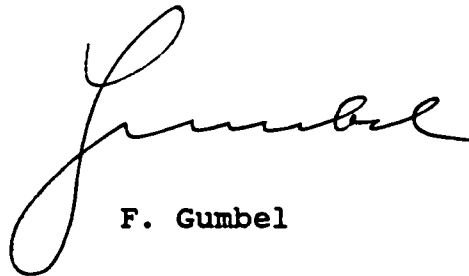
The appeal is dismissed.

The Registrar



N. Maslin

The Chairman



F. Gumbel

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*Prof. W. Nober*