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File Number: T 753/89 - 3.2.1

Application No.: 83 301 505.0

Publication No.: 0 090 557

Title of invention: Improvements in tapered roller bearings

Classification: F16C 33/66, F16C 33/36, F16C 19/52

D E C I S I O N
of 28 April 1992

Proprietor of the patent: The Timken Company

Opponent: SKF GmbH

Headword:

EPC Article 56

Keyword: "Inventive step (yes)"

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 753/89 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 28 April 1992

Appellant :
(Opponent)

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Respondent :
(Proprietor of the patent)

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Representative :

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Decision under appeal :

Interlocutory decision of Opposition Division of
the European Patent Office dated
28 September 1989 concerning maintenance of
European patent No. 0 090 557 in amended form.

Composition of the Board :

Chairman : F. Gumbel
Members : M. Ceyte
F. Benussi

Summary of Facts and Submissions

- I. The Respondent is the Proprietor of the European patent No. 0 090 557 (patent application No. 83 301 505.0) which was granted on 4 March 1987.

- II. The patent was opposed by the Appellant on the grounds that its subject-matter does not involve an inventive step. In support of his request, he submitted the following prior art documents:

 - (D1) DE-A-1 952 450
 - (D2) DE-A-2 838 330
 - (D3) DD-C-31913
 - (D4) US-A-3 675 978
 - (D5) US-A-3 582 164
 - (D6) DE-A-2 352 578
 - (D7) US-A-1 840 607

- III. By its interlocutory decision dated 28 September 1989, the Opposition Division maintained the patent in amended form on the basis of the documents specified in a communication pursuant to Rule 58(4) EPC dated 5 June 1989.

- IV. The Appellant (Opponent) appealed against the decision on 27 November 1989 paying the appropriate fee and filing the grounds for the appeal the same day.

- V. At the oral proceedings held before the Board on 28 April 1992, the Respondent requested that the patent be maintained on the basis of Claims 1 to 6 and description as filed during the oral proceedings and drawings as granted.

The Appellant requested cancellation of the decision under appeal and revocation of the European patent in its entirety.

VI. The Appellant argued essentially that it would be obvious for the skilled person to combine the teaching of document D7 which represents the closest prior art with that of document D2 to arrive at the subject-matter of Claim 1, particularly since document D7 seeks to solve the problem of reducing the elevated friction generated on the part of the roller bearing which serves as a lateral guide for the rollers and proposes the provision of a rib ring made from a sintered porous metal impregnated with a lubricant.

He conceded that the state of the art does not teach the specific selection of the sintered porous steels stated in the characterising part of Claim 1. The selected steels were nevertheless considered to be well known per se. If the skilled person working on the development of bearings did not possess the technical knowledge in advance; he could at least be expected to test the available sintered porous metals in order to select those which are best suited to meet the requirements concerning anti-friction or emergency lubrication.

VII. The Respondent contested this view and submitted particularly that there is in the prior art no disclosure or suggestion of this specific selection. He pointed out that the use of a selected sintered porous steel is necessary to achieve an emergency lubrication without any failure for at least 30 minutes, which is an adequate period of time to recognise the loss of supply of lubricant and to shut down the machinery without damaging it.

VIII. Claim 1 reads as follows:

"1. A tapered roller bearing comprising an inner race (2) having an outwardly presented raceway (12) that is tapered, an outer race (4) having an inwardly presented raceway (18) that is tapered and surrounds the raceway of the inner race, tapered rollers (6) arranged in a row between the tapered raceways of the two races and contacting those raceways along their bodies, a cage (8) for the rollers and a rib ring (10) which is normally mounted in a fixed position with respect to one of the races and projects generally radially beyond the large end of the raceway for that race, such that the large ends of the tapered rollers bear against said rib ring, characterised in that the abutment face (30) of the rib ring engaged by the large ends of the rollers is conically inclined, in that an end of the cage (8) extending axially beyond the large ends of the rollers is located in close proximity to another surface (32) of the rib ring (10), and in that the rib ring is formed from compact and sintered powdered metal the pores of which are charged with a liquid lubricant and the pores (20) of which are open at least on said abutment face and said other surface (32), whereby the rib ring is capable of releasing the absorbed lubricant to lubricate the larger end faces of the rollers and the end of the cage if the bearing loses its normal supply of lubricant, the rib ring (10) being derived from M2 powdered metal or from 46 100 powdered metal or from CBS 1000 M (trade mark) powdered metal".

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is admissible.

2. Allowability of the Amendments

There are no formal objections under Article 123(2) EPC to the present claims since they are adequately supported by the original disclosure.

The features of present Claim 1 are in essence disclosed in original Claims 1, 2, 5 to 7 and 10. Present Claims 2 and 6 correspond to Claims 3, 4, 9, 11 and 12 as filed.

Present Claim 1 contains all the features of the granted Claim 1, so that the requirements of Article 123(3) are also met.

3. Novelty

After examination of the available prior art the Board is satisfied that the subject-matter of Claim 1 is novel. Since this has never been disputed, there is no need for further detailed substantiation of this matter.

4. Inventive step

The Appellant submitted document D7 well after the opposition period has expired without adducing sound reasons; this document is thus to be regarded as belatedly filed. Nevertheless the Board in the exercise of its discretion under Article 114(2) EPC decided to admit it to the appeal proceedings, since its subject-matter is closer in some respect than the other prior art, and therefore has a significant bearing on the reasons set out below.

According to the patent in suit, radial loads on the rollers create, due to their tapered configuration, an axial force component which tends to expel the rollers from the annular space between the two races, that is, from between the cup and the cone. This expulsion force is resisted by means of a thrust rib on one of the races, usually the inner raceway or cone.

In the known tapered roller bearing of document D7, the thrust rib has an abutment face against which the large diameter end faces of the tapered rollers are in rolling and sliding contact as well as an external cylindrical face which acts as a guide for the large diameter end of the cage. The thrust rib is made integral with the inner race.

According to the patent in suit unless a film of lubricant is maintained between the roller end faces and the thrust rib, the bearing will overheat and sustain damage. Additionally, without adequate lubrication there is a risk that the cage will weld to the thrust rib (column 4, lines 50 to 52 of the patent in suit).

In some machinery it is important to have safety reserves which will enable the machinery to operate even though its lubricating system is disabled. This is particularly true for helicopters.

According to the examples and the results given in the patent in suit, bearings of the invention subjected to a very high dynamic load may remain operable for at least 30 minutes after interruption of the normal supply of lubricant (see e.g. column 7, lines 7 to 12).

- 4.1 In the light of the closest prior art document D7, the technical problem underlying the patent in suit may still

be seen in providing a tapered roller bearing that will remain operable for at least 30 minutes after the loss of normal lubrication, and to do this while being operated at high angular velocities and carrying heavy dynamic loads, as defined in the specification of the patent in suit.

4.2 This problem is in essence solved by the following features stated in Claim 1:

- (a) the rib is formed as a separate ring fixed to one of the races;
- (b) the rib ring is formed from a sintered porous metal charged with a liquid lubricant;
- (c) the sintered porous metal is selected in the group consisting of M2, 46 100 or CBS 1000 M (trade mark) powdered metals.

In view of the examples and the test results given in the disputed patent, the Board is satisfied that the above technical problem is effectively solved.

4.3 There is no disclosure or suggestion in any of the cited prior art documents of a bearing comprising a rib ring made from the claimed specific selection of sintered porous steel alloys impregnated with a lubricant which according to the Respondent's submission were the only ones passing the test for operability of at least 30 minutes without lubrication supply.

4.3.1 Document D2 discloses in the embodiment of Figure 3 a rib ring which acts as a lateral guide for the rollers of the roller bearing. In order to reduce the elevated friction between the rollers and the rib ring, this document teaches the adoption of a rib ring made of a sintered porous metal impregnated with a lubricant.

The purpose of the rib ring disclosed in document D2 is the reduction of excessive friction while that of the claimed rib ring is to ensure emergency lubrication after interruption of the normal supply of lubricant; there is no explicit suggestion in document D2 that the same rib ring could be used to provide emergency lubrication. Even if despite of this difference it could be regarded as obvious for the skilled person to apply the teaching of document D2 in the present case, there would be no lead in this document to the specific selection of alloys claimed.

- 4.3.2 Document D3 relates to a method for opening the pores of a sintered metal compact for impregnation with a lubricant and document D4 teaches the application of a composite dry lubricant insert between a thrust rib integral with the inner roller bearing and rollers. Document D6 suggests forming the races in their entirety of sintered metal.
- 4.3.3 Document D5 proposes for guiding the rolling elements of an anti-friction bearing a cage which is made from a sintered porous metal impregnated with a lubricant. It is true that the problem solved in the disputed patent is expressis verbis stated in this prior art document (cf. column 2 lines 29 to 33). However, as has been set out above in respect of document D2, even if the skilled person had thought in view of the teaching of document D5 to provide the bearing of the closest prior art document D7 with a rib ring made from a sintered porous metal impregnated with a lubricant, he would not have arrived at the teaching of Claim 1, since neither document D5 nor any other available prior art document give a suggestion to the claimed specific selection of sintered porous steels which are necessary to obtain the desired effect and thus to solve the technical problem with which the patent in suit is concerned.

4.3.4 The Appellant has argued that it would have been obvious for a skilled practitioner acting routinely to test the available sintered porous materials for determining the period of time the bearing may run without any lubrication and thus to arrive at the claimed selection. The Board cannot accept such a purely speculative argumentation: no indication is given in the prior art documents about the influence of the sintered material upon the duration of the emergency lubrication and it is only with the benefit of hindsight that the skilled person could have selected the claimed sintered steels from the enormous number of existing sintered porous metal alloys suitable for use in a thrust ring.

Additionally, such an argumentation pre-supposes that the problem to be solved was reduced to the selection of a sintered porous material for a thrust ring apt to extend greatly the time a bearing may run without any lubricant. This approach is not acceptable, since such a statement of the problem would already contain parts of the claimed solution, that is the provision of a separate rib ring made from sintered porous material and charged with a lubricant. The closest prior art document D7, does not teach the use of a separate rib ring, let alone a rib ring made from a sintered porous material.

Document D1 indeed shows such a separate rib ring but there is also no disclosure or suggestion of the above mentioned features (b) and (c). Moreover, there is no guiding surface between the rib ring and the respective end of the cage. Thus this document cannot lead in any way to the claimed teaching.

Therefore in the Board's judgement, the subject-matter of Claim 1 involves an inventive step in the sense of Article 56 EPC and the patent may be maintained on the basis of this claim.

5. Dependent Claims 2 to 6 which concern particular embodiments of the invention are likewise allowable.
6. The description as amended and the drawings take account of the requirements of the EPC.
7. The opposition grounds thus do not prejudice the maintenance of the patent in amended form.

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 with the documents specified in point V above.

The Registrar:



M. Kiehl

The Chairman:



F. Gumbel

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