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File Number: T 429/89 - 3.2.3

Application No.: 86 630 088.2

Publication No.: 0 202 190

Title of invention: Earth boring bit with improved rigid face seal assembly

Classification: E21B 10/22, F16J 15/34

D E C I S I O N
of 29 November 1991

Applicant: Hughes Tool Company

Headword:

EPC Article 56

Keyword: "Inventive step (yes)"

Headnote



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Boards of Appeal

Chambres de recours

Case Number : T 429/89 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 29 November 1991

Appellant : Hughes Tool Company
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Decision under appeal : Decision of Examining Division 2.3.03.114
European Patent Office dated 2 February 1989
refusing European patent application
No. 86 630 088.2 pursuant to Article 97(1) EPC

Composition of the Board :

Chairman : C.T. Wilson
Members : F. Brösamle
J. Van Moer

Summary of Facts and Submissions

- I. Appellant's European patent application No. 86 630 088.2 was refused by a decision of the Examining Division dated 2 February 1989. That decision was based on Claims 1 to 8 filed with letter of 6 June 1988, received on 13 June 1988.
- II. The reason given for the refusal was that the subject-matter of Claim 1 lacked an inventive step in the light of:
- (D1) EP-A-0 138 737 and
- (D2) US-A-3 656 764.
- III. On 22 March 1989, the Appellant (Applicant) filed a notice of appeal against that decision, paying the appeal fee in due time. The Statement of Grounds of Appeal was filed on 8 June 1989 (Telefax) and confirmed by letter of 8 June 1989, received on 13 June 1989, whereby new Claims 1 to 7 were submitted.
- IV. In a communication pursuant to Article 110(2) EPC dated 22 May 1991 the Board gave its provisional opinion in that Claim 1 does not meet the requirements of Rule 29(1)(a) and (b) EPC when considering (D1) and in that the description does not clearly express the technical problem to be solved by the invention when starting from (D1). Appellant's arguments for the existence of inventiveness of the subject-matter of a reworded Claim 1 were requested.

V. With letter of 31 July 1991 the Appellant filed new Claims 1 to 6 (6 only in part) which should be seen in combination with Claims 6 (remaining part) and 7 (page No. 17) filed with letter of 8 June 1989, received on 13 June 1989. These claims were accompanied by a revised page 2 of the description. As requested by the Board the Appellant submitted his arguments in respect of the requirements of Article 56 EPC, thereby introducing the documents

(D3) US-A-3 549 214 and

(D4) Smith Tool Company Catalog 1970-71.

VI. Claim 1 as now on file reads as follows:

"1. An earth boring bit with an improved pressure compensating face seal assembly (155) comprising:

a body (121);

a cantilevered bearing shaft (135) having a generally cylindrical journal bearing (175) positioned to extend obliquely inwardly and downwardly from the body with axial and radial play due to clearances; said generally cylindrical journal (175) bearing on the cantilevered bearing shaft (135) having a plain annular exterior bearing surface (175);

a cutter (147) having a generally cylindrical bearing (173) formed internally therein, secured for rotation about the journal bearing of the shaft; said generally cylindrical bearing (173) in the cutter (147) having a mating plain annular bearing surface (173);

a lubrication system (125) in the body, including a hydrostatic pressure compensator, to lubricate said bearings;

a cutter seal groove (161, 163) formed near the outermost region of the cylindrical bearing in the cutter

to have a circumferential, generally cylindrical wall (163);

a pair of rigid rings (169, 171) positioned in the seal groove (161, 163) to have opposed sealing faces; and

a pair of resilient energizer rings (165, 167) each of which sealingly engages a respective one of the rigid rings (169, 171) and one of the oppositely facing circumferential wall (175) of the cutter seal groove and the generally cylindrical journal bearing (163) to define the seal assembly (155);

characterized by

a shaft seal groove (157, 159) in the general cylindrical journal bearing (175) opposing the cutter seal groove, and having a circumferential, generally cylindrical wall (159), whereby one of said resilient energizer rings (165) engages said circumferential wall (159) of the shaft (135) and

the diameter of the journal bearing being intermediate the circumferential walls (163, 159) of the cutter and shaft seal grooves to decrease axial movement of said rigid rings (169; 171) with respect to axial cutter movement to a selected ratio during drilling."

VII. The Appellant requests to set aside the impugned decision and to grant a patent on the basis of Claims 1 to 7 as set out above under V. in combination with a revised description, i.e. pages 4 to 10 and 13 as originally filed, pages 1, 3, 11, 12 and 14 filed with letter of 8 June 1989, received on 13 June 1989, and page 2 filed with letter of 31 July 1991, received on 3 August 1991, and with figure sheets "1/7" to "7/7" as originally filed.

VIII. As an alternative the Appellant requested to remit the case to the Examining Division for further examination.

By way of an auxiliary petition oral proceedings were requested if the case could not be allowed in written proceedings.

Reasons for the Decision

1. The appeal complies with the requirements of Articles 106 to 108 and Rule 64 EPC and is, admissible.
2. Amendments (Article 123(2) EPC) :
 - 2.1 Claim 1 is a combination of the features of originally filed Claims 1 and 4 in combination with the disclosure of the originally filed Figure 9 and page 12, lines 18 to 20.
 - 2.2 Claims 2 to 5 correspond to originally filed Claims 2, 3, 5 and 6.
Claim 6 is derived from originally filed Figure 9 and Claim 7, whereas Claim 7 is derived from originally filed Claim 10.
 - 2.3 As a result of the foregoing, Claims 1 to 7 are not open to objection under Article 123(2) EPC.
3. The nearest prior art document is (D1). Claim 1 is now correctly delimited over this piece of prior art, Rule 29(1)(a) and (b) EPC.

From the foregoing follows already novelty of the subject-matter of Claim 1, which was not contested by the Examining Division in its decision, so that no further argument is necessary in this respect, Article 54 EPC, since in (D1) the features of the characterising clause of Claim 1

- (a) an additional seal groove is provided in the shaft and
- (b) the diameter of the journal bearing is intermediate the circumferential walls of the cutter and shaft seal groove are missing.

4. Starting from an earth boring bit according to (D1) it is the object of the present invention, see first paragraph of the revised page 2 of the description, to improve the earth boring bit according to the preamble of Claim 1 such as to decrease the axial movement of the rigid ring of its seal assembly with respect to the axial movement of its cutter to a selected ratio during drilling.

4.1 In the known earth boring bit according to (D1) an additional seal groove in the shaft is not provided and the diameter of the journal bearing is not intermediate the circumferential walls of the cutter and the shaft seal groove, so that problems arise with the axial movement of the rigid rings of the seal assembly. These axial and radial movements of the seal assembly lead to axial and radial cutter movements which cause rapid pressure variations in the lubricant - or more accurately - volume changes in the vicinity of each seal.

4.2 To overcome these drawbacks of the known earth boring bit is the gist of the above object of the invention i.e. the distance along which the rigid seals move axially should be less than in the known earth boring bit in relation to the axial cutter movement.

4.3 The object of the present invention is derived from the behaviour of the known earth boring bit in its use.

The posing of this object cannot be seen as an inventive endeavour in the meaning of Article 56 EPC, since it is normal practice to improve known boring bits.

5. It has therefore to be decided whether or not the solution to the above object is based on an inventive step when seen in the light of the prior art to be considered.

5.1 In this respect the Examining Division has pointed to (D2) and followed therefrom that the subject-matter of Claim 1 would be obvious.

5.2 Feature (a) according to 3. above appears to lie in the design freedom of an average engineer and no specific effect can be seen in this arrangement of seal surfaces. In addition, feature (a) is known from document (D2) also dealing with a drill bit assembly in general and in particular with its sealing arrangements, since from (D2), see Figures 1 and 7 in combination with column 2, lines 7/8, lines 12 to 14 and lines 26 to 29 and column 5, lines 21 to 72, it is known to provide two grooves for a seal assembly, one in the journal (reference signs 33, 34 in Figure 1 or 133, 155 in Figure 7) and one in the cutter (reference signs 36, 37 in Figure 1 and 136, 137 in Figure 7). Feature (a) already forms, therefore, part of the prior art in the technical field of seal assemblies of earth boring bits and as a consequence thereof cannot as such render inventive the earth boring bit according to the preamble of Claim 1.

5.3 The Appellant has pointed to the fact, see letter of 8 June 1989, page 2, that in (D2) the bearing is constituted by segments instead of a ring as in Claim 1 and that in (D2) the problem of differential pressures and lubricant pressure variations cannot exist, since in this

case the lubricant could pass through the bearing segments.

5.4 With letter of 31 June 1991 the Appellant has extended the above argument by incorporating documents (D3) and (D4). The Board agrees with these arguments, since at least from (D3) and (D4) it is absolutely clear that the known bearing is constituted by segments and not as claimed in present Claim 1 by a ring. This is, however, a fundamental difference as far as the flow of lubricant is concerned, since in the case of (D2) the lubricant can flow between the ends of the segments and along surfaces "31" or "32", see for instance Fig. 1 of (D2). (Similarly, see reference signs "26, 44" in Fig. 2 and 4 of (D3) or see (D4) second page picture at the bottom headed "Cutaway showing ... exclusive segment sealed bearings".)

5.5 The possibility offered for the lubricant to flow in (D2), (D3) and (D4) is clearly contrary to the teaching of Claim 1, which requires that the journal bearing surface "175" and engaged cone bearing surface "173", see Fig. 9 of the application, must reside intermediate the seal assembly. The feature that the surfaces "173, 175" lie intermediate between the surfaces "159" and "163" of the cutter and bearing shaft, see Fig. 9 of the application, is the essential feature to achieve the object of the invention in decreasing axial movement of the seal assembly in relation to movement of the cutter as it moves back and forth or wobbles during cutting.

5.6 Without considering the segments of (D2) one could come to the conclusion that from Fig. 7 of (D2) feature (b) according to above 3. is known, since the bearing diameter (between reference signs "113" and "129") appears to be between the diameter of the bearing rings "138, 139". To

conclude therefrom any hint or teaching in the direction of the subject-matter of Claim 1 is, however, clearly wrong, since the situation for the flow of lubricant is completely different from that claimed, due to the existence of segments i.e. possibilities to offer a path for the lubricant to flow, see (D3) and (D4) in particular, which clearly show spaces between adjoining ends so that lubricant can flow between these spaces towards the inner or outer cylindrical surfaces of the segments.

5.7 Even if (D2) were combined with (D1) the object of the invention would therefore not be achieved. It must therefore follow that Claim 1 is based on an inventive step within the meaning of Article 56 EPC, (see also advantages of the invention as set out on page 14 of the description lines 22 to 32). The further documents of the Search Report i.e. GB-A-2 012 375 and US-A-28 625 are by far less relevant than (D1) to (D4). In GB-A-2 012 375, see Fig. 1/2, a seal assembly in the form of a simple seal unit "11" is disclosed (i.e. integrally formed elastomeric ring, see page 2 lines 96 to 100) which cannot be compared with the seal construction of Claim 1 consisting of pairs of rigid rings and of energiser rings which are specifically designed and arranged in the boring bit.

US-A-28 625 discloses a very similar sealing construction (see reference sign "86" in Fig. 4), to that in GB-A-2 012 375, so that this document is also not particularly relevant.

Even if GB-A-2 012 375 and US-A-28 625 were combined with (D1) to (D4) there would not result the earth boring bit according to Claim 1 so that this claim is clearly allowable.

- 5.8 Claim 1 being allowable dependent Claims 2 to 7, which relate to further embodiments of the invention, are allowable likewise.
- 5.9 The description as present on file meets the requirements of the EPC and can therefore form the basis for printing the patent specification.
- 6. Since the request to grant a patent is acceptable to the Board the alternative requests to remit the case to the first instance for further prosecution and for oral proceedings are superfluous under these circumstances.

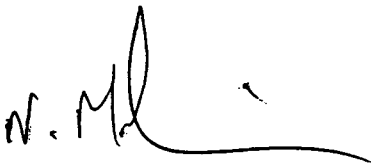
Order

For these reasons, it is decided that:

- 1. The impugned decision is set aside.
- 2. The case is remitted to the first instance with the order to grant a patent on the basis of the documents set out under above VII.

The Registrar

The Chairman



N. Maslin



C.T. Wilson