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D E C I S I O N
of 2 September 1997

Case Number: T 0918/96 - 3.2.1

Application Number: 92201819.7

Publication Number: 0520567

IPC: F16K 25/00, E21B 34/02

Language of the proceedings: EN

Title of invention:
Erosion resistant valve

Applicant:
Norsk Hydro ASA

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step - no"
"Prejudices in the art - no"

Decisions cited:
T 0062/82, T 0119/82, T 0410/87, T 0500/88

Catchword:
-

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Case Number: T 0918/96 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 2 September 1997

Appellant: Norsk Hydro ASA
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Decision under appeal: Decision of the Examining Division of the European Patent Office posted 7 June 1996 refusing European patent application No. 92 201 819.7 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: F. A. Gumbel
Members: F. J. Pröls
G. Davies

Summary of Facts and Submissions

I. European patent application No. 92 201 819.7 was refused by a decision of the Examining Division dated 7 June 1996.

II. This decision was based on claims 1 to 7 filed on 13 January 1995 of which claim 1 reads as follows:

"An erosion resistant pressure reduction valve or choke comprising a valve housing (1) with an inlet (2), a valve chamber (4) and an outlet (3), a valve seat of polycrystalline diamond arranged in the valve chamber, a closure (5) for the valve housing, and a plug (11) axially displaceable by means of a spindle (12) or the like arranged in the closure, wherein the plug (11) is adapted to be displaced from an upper position where the valve is open to a lower position where the valve is shut and the lower end of the plug abuts the valve seat,
c h a r a c t e r i z e d i n t h a t
the valve seat is a casing (8) produced in one piece of polycrystalline diamond."

Dependent claims 2 to 7 relate to preferred features of the valve according to claim 1.

III. The ground for the decision was that in view of the prior art documents

D1: US-A-4 732 364
D2: DE-A-3 728 946
D3: US-A-3 831 428

the subject-matter of claim 1 did not involve an inventive step.

IV. On 6 August 1996 a Notice of Appeal was filed and the appeal fee was paid at the same time. The Statement of Grounds of Appeal was submitted on 4 October 1996.

The Appellants requested that the decision under appeal be set aside and that a patent be granted on the basis of the following documents:

Claims 1 to 7 filed on 13 January 1995 and the description and drawings as originally filed.

They argued that the closest prior art document D1 disclosing a valve seat covered by a layer of individual tiles of polycrystalline diamond was first filed in December 1984, although on that date the production of one single piece of polycrystalline diamond in a shape comparable to that of a valve seat was already known. In this respect reference was made to Industrial Diamond Review 2/83, pages 75 to 80 (D4), article "Syndie Wire Drawing Die Blanks", in particular to pages 79 and 80 thereof, wherein the fabrication of synthetic one-piece polycrystalline diamonds and their use for wire drawing dies producing wire diameters up to 8 mm is described. The drawing dies for such wire diameters apparently have an outer diameter overlapping the diameter range of 17 to 34 mm necessary for the valve seats concerned. Nevertheless the inventor to D1 representing an important manufacturer for erosion resistant pressure reduction valves had chosen the less advantageous solution with a diamond tile cladding. This behaviour proves that something like a prejudice against the use of one piece polycrystalline diamonds for valve seats must have existed on the filing date of the application in suit.

Reasons for the Decision

1. The appeal complies with Article 106 to 108 and Rules 1(1) and 64 and is admissible.

2. *Formal admissibility of the claims*

The present claims 1 to 7 are those forming the basis for the decision under appeal. Claim 1 corresponds to the originally filed claim 1 except that the words "of polycrystalline diamond" have been additionally introduced after the word "valve seat" in the pre-characterising part of the claim. This amendment was made to delimitate claim 1 over the prior art according to document D1, which already revealed a valve seat covered with a cladding of polycrystalline diamond tiles. Dependent claims 2 to 7 correspond to the original claims 2 to 7.

Therefore, the present claims satisfy the requirements of Article 123(2) EPC.

3. *Novelty*

The valve defined in claim 1 is distinguished from the closest prior art valve disclosed in document D1 by the features of the characterising clause of the claim, i.e. that the valve seat is a casing (8) produced in one piece of polycrystalline diamond.

Document D2 shows an apparatus comprising a valve seat (22) consisting of a one piece of polycrystalline diamond (PCD) which is formed as a flat disc and so does not represent a casing as defined in claim 1 of the application.

The further documents D3 and D4 do not deal with valves but with wire drawing dies.

Thus, the subject-matter of claim 1 is novel.

4. *Inventive step*

4.1 Document D1, which relates to erosion resistant pressure reduction valves, discloses in Figures 1 to 5 a seat assembly (14) with a valve plug (52) and a valve seat casing (19). In the description of D1 the substantive need for such a valve having a longer useful life is emphasised and it is stated (column 2, lines 60 to 62) that it would be desirable to form erosion and wear resistant articles out of diamond, since it is the hardest known material. After confirming that techniques were known for making polycrystalline diamond products by subjecting a mass containing diamond crystals to high temperatures at sufficient high pressure (see column 2 last two lines and column 3) the description of D1 continues as follows (starting from column 3, line 15):

"The size of parts that can be made with polycrystalline diamond is limited by the need for maintaining extremely high pressures when forming PCD. This has necessarily limited the size of presses capable of reaching such high pressures. Pieces about thirty millimetres across are among the largest made to date. Further, in the presses employed in the techniques described in the above-mentioned patents, isostatic pressure is not obtained and complex shapes do not appear to be feasible ... . Thus, it is desirable to form valve parts and other surfaces subject to wear and erosion out of diamond but techniques for doing so are not readily available."

Consequently, document D1 suggests to provide the surfaces of parts of the seat assembly with a cladding of a plurality of tiles each made e.g. from a single piece of polycrystalline diamond (PCD).

4.2 According to the Appellants' comments and to a calculation starting from the measures given in column 6, lines 14 to 17 and column 7, lines 55 to 57, of D1 the valve seat diameters of the erosion resistant valves according to D1 (and so also according to the present valve) are between 17 and 34 mm.

The Appellants' basis for their argumentation started from the finding that it was already known to produce one piece polycrystalline diamonds having the desired dimensions even for valve seats at the time when D1 was filed.

This finding, obviously contradicting the above-cited statements in the description of D1, was supported, according to the Appellants, by the disclosure of document D4 (particularly pages 79, 80) published February 1983, i.e. before the first priority date of D1 (December 1984).

4.3 D4 describes the fabrication of synthetic diamond composite material resulting in a one-piece polycrystalline diamond (PCD) used for wire drawing dies up to 8 mm wire diameter at maximum. No further information is given in the text of D4 concerning the outer diameter of the PCD wire drawing dies used to draw 8 mm wires, except that Figure 4 of D4 shows a wire drawing die blank, which has an outer diameter of about twice the drawing orifice diameter, i.e. about 16 mm outer diameter for a die blank with an orifice diameter of 8 mm. Thus, the diameters of the PCD wire

drawing dies as disclosed in D4 do not overlap with the diameter range from 17 to 34 mm required for the valve seat casings according to the application and D1 and D4 does not prove that PCD pieces having the diameters as required for valve seats were in principle available before the priority date of the present application.

Notwithstanding this result obtained from D4, the above-cited description in column 3 of D1 already stated that PCD pieces up to 30 millimetres could be manufactured, but that techniques for forming complex shapes were not yet available. The latter restriction apparently refers to the form of the valve seat casings, since D1 teaches that the suggested valve seat is covered by a multiple-tile diamond cladding and is not made from a single PCD piece.

Therefore, neither prior art document D1 nor D4 provide any proof that on the priority date of D1 single-piece PCD materials were readily available for the manufacture of valve seat casings for erosion resistant valves. On the contrary document D1 denies it.

4.4 The Appellants assert there existed a prejudice, which would have deterred the skilled person from conceiving the claimed invention, and the onus is on them to demonstrate the existence of such a prejudice (see the Appeal Board Decision T 119/82, EPO 1984, 217). However, in the present case, the Appellants did not present any material in support of this argument. As mentioned above D4 does not concern the use of PCD for valve seats and D1 expressly recommends forming valve parts and other surfaces subject to wear and erosion out of diamond, if techniques for doing so were available.

Hence, according to the existing case law of the Boards of Appeal (see e.g. the non-published decisions T 500/88, points 4.1.7 and 4.1.8, T 62/82 point 5.6, T 410/87, point 3.5) the alleged prejudice cannot be considered valid.

4.5 Since the skilled person obtains a clear hint in the description of D1 that the wear resistant diamond cladding for valve seats according to D1 could be replaced by a valve seat made of a single piece of polycrystalline diamond, the claimed teaching of the present application must be considered as an obvious alternative.

4.6 Accordingly the Board comes to the conclusion that the subject-matter of claim 1 does not involve an inventive step.

5. Since the Board is bound by the request of the Appellants, it is unnecessary in the present case, in which claim 1 does not satisfy the requirements of the EPC, to consider the merits of dependent claims 2 to 7. These claims must therefore fall with claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Fabiani F. Gumbel