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**Datasheet for the decision
of 20 July 2017**

Case Number: T 1472/12 - 3.2.05

Application Number: 04739196.6

Publication Number: 1629229

IPC: F16L15/06

Language of the proceedings: EN

Title of invention:

Threaded tubular connection with progressive axial thread interference

Patent Proprietors:

Vallourec Oil and Gas France
Nippon Steel & Sumitomo Metal Corporation

Opponent:

Hydril Company

Headword:

Relevant legal provisions:

EPC 1973 Art. 56, 100(c)
RPBA Art. 12(4)

Keyword:

Amendments - added subject-matter (no)
Late-filed evidence - admitted (yes)
Inventive step (yes)

Decisions cited:

G 0002/10

Catchword:



Beschwerdekammern
Boards of Appeal
Chambres de recours

European Patent Office
D-80298 MUNICH
GERMANY
Tel. +49 (0) 89 2399-0
Fax +49 (0) 89 2399-4465

Case Number: T 1472/12 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 20 July 2017

Appellants I: Vallourec Oil and Gas France
(Patent Proprietors) 54 rue Anatole France
59620 Aulnoye-Aymeries (FR)

Nippon Steel & Sumitomo Metal Corporation
6-1, Marunouchi 2-chome
Chiyoda-ku
Tokyo 100-8071 (JP)

Representative: Gabriel de Kernier
Cabinet Netter
Conseils en Propriété Industrielle
36, avenue Hoche
75008 Paris (FR)

Appellant II: Hydril Company
(Opponent) 2200 West Loop South, Suite 800
Houston, TX 77027 (US)

Representative: James Short
Boult Wade Tennant
Verulam Gardens
70 Gray's Inn Road
London WC1X 8BT (GB)

Decision under appeal: **Interlocutory decision of the Opposition**
Division of the European Patent Office posted on
3 May 2012 concerning maintenance of the
European Patent No. 1629229 in amended form.

Composition of the Board:

| | |
|-----------------|--------------|
| Chairman | M. Pooock |
| Members: | P. Lanz |
| | J. Geschwind |

Summary of Facts and Submissions

- I. The appeals by the joint patent proprietors and the opponent are against the interlocutory decision of the opposition division on the version in which European patent EP-B-1 629 229 met the requirements of the European Patent Convention.
- II. During the opposition proceedings, the opponent had raised the grounds for opposition according to Articles 100(a) (lack of novelty and lack of inventive step), 100(b) and 100(c) EPC 1973.
- III. Oral proceedings were held before the board of appeal on 20 July 2017.
- IV. Appellants I (patent proprietors) requested that the decision under appeal be set aside and the patent be maintained as granted or, alternatively, on the basis of the claims filed as auxiliary requests 1 to 10 with letter of 12 July 2017.

Appellants I also requested that, in case it would come to the assessment of the subject-matter of auxiliary request 3 with regard to inventive step, the case be remitted to the department of first instance for further prosecution.
- V. Appellant II (opponent) requested that the decision under appeal be set aside and that the patent be revoked. Appellant II also requested that auxiliary requests 8 to 10 be not admitted into the procedure and that the case be remitted to the department of first instance if any of the auxiliary requests 8 to 10 is admitted and is considered to meet the formal requirements of the EPC.

VI. The documents referred to during the appeal proceedings included the following:

D1: US Re 34,467;

D2: US 4,623,173 B;

D3: EP 0 254 552 A;

D4: US 2002/0027363 A1;

D5: US 4,671,544;

D7: DE 44 46 806 C;

D8: WO 01/34936 A;

D17: US 4,153,283;

D18: EP 1 301 738 B.

VII. Independent claim 1 as granted has the following wording:

"A threaded tubular connection comprising a male tubular element (1) comprising a male threading (3) and a female tubular element (2) comprising a female threading (4) which cooperates by makeup with said male threading (3), the axial width of the threads of said threadings and/or the intervals between said threads varying progressively along the axis of the connection over at least a portion of the axial length of the threadings, such that the threads of each threading are housed with an axial clearance in the intervals of the other threading at the start of makeup, said clearance

progressively decreasing until it becomes zero at the end of makeup in a final position of the threadings, characterised in that it comprises at least one contact zone (5, 6) axially separated from said threadings (3, 4) in which the male and female elements (1, 2) are in sealed contact by means of bearing surfaces respectively constituted by a cambered surface (11) and by a tapered surface (12) the tangent to the vertex half angle of the tapered surface (12) being in the range 0.025 to 0.075 the sealed metal-to-metal contact being effective in said final position of the threadings."

VIII. The submissions by joint appellants I may be summarised as follows:

Added subject-matter

The claimed tangent value of the tapered surface on the one hand and the cambered surface on the other hand necessarily implied a progressive contact in the contact zone. Under these circumstances, the opposition division's assumption of a hypothetical embodiment with contact only at the end of the make-up was technically impossible. The application as originally filed stated that a progressive deformation occurred during the make-up, leading to a seal by radial interference in the final position (cf. page 6, lines 17 to 23). That a sealed metal-to-metal contact occurred already before the final position was neither mentioned nor excluded in the application as filed in general and in original claim 1 in particular. Thus, claim 1 as granted did not contain added subject-matter in that respect.

Furthermore, it had to be taken into account that the contested claim was directed to wedge-shaped threads.

While the relative positions of their male and female portions were difficult to determine due to plastic deformation during make-up, it was clear that their final (blocked) position was reached at the end of make-up. In fact, the claim was directed to a made-up threaded tubular connection. Consequently, the claim amendments did not introduce any additional information.

Admissibility of documents D17 and D18

Documents D17 and D18, which had been filed with appellant II's grounds of appeal, should not be admitted into the appeal proceedings because they were not *prima facie* relevant.

Inventive step

Appellant II's allegations that essential features were missing from the claim and that the problem was not solved were not convincing. It was the independent claim that defined the invention in general, while the description set out a specific and advantageous embodiment in more detail.

Regarding the objection based on a combination of documents D1 and D2, it had to be noted that document D1 was directed to draining off the lubricant in a wedge-shaped connection; the axial positioning of the threaded parts was not mentioned. Moreover, the system of document D1 was not gas-tight. No reason was apparent why the skilled person should consult document D2 if he wanted to improve the sealing of the connection, since document D2 concerned a conventional threading with a shoulder and a cambered surface. It aimed at avoiding stress corrosion cracking and at

maintaining the sealing quality in spite of repeated screwing and unscrewing. This was achieved by an abutment shoulder in combination with conditions (i) to (iv) listed in the introductory part of the description and in claim 1 of document D2. Since the types of threads and the problems explained in document D2 were different from those of the claimed invention and of document D1, the skilled person would neither combine documents D1 and D2 nor implement condition (ii) of document D2, taken in isolation, in the connection of document D1. The same conclusion was true when starting from documents D5 or D4, the latter proposing a torque-stop shoulder for controlling the final position of the wedge-shaped threads. Moreover, paragraph [0040] of document D4 contained a list of possible sealing mechanisms but not the one of document D2. The appellant's submissions were thus based on an *ex-post facto* analysis.

Lastly, the subject-matter was also inventive in view of common general knowledge. In particular, common general knowledge normally comprised technical handbooks and encyclopaedias. Patent documents could exceptionally be accepted as common general knowledge in technical areas with new technology where no handbooks and encyclopedias were available. This was obviously not the case in the field of the oil industry. Moreover, none of the cited patent documents related to wedge-shaped threadings.

For these reasons, the subject-matter of granted claim 1 involved an inventive step.

IX. Appellant II's submissions were essentially as follows:

Added subject-matter

According to the application as filed (cf. page 7, lines 3 to 36), a progressive contact required that the radius of the cambered surface was within a certain range, a feature which was not present in granted claim 1. Thus, the granted claim did not imply a progressive contact and thereby constituted an unallowable intermediate generalisation.

Moreover, during the examination proceedings the definition of the final position of the threadings as the position when the axial clearance of the threadings became zero had been introduced into the claim 1. This was allegedly based on page 5, lines 29 to 32 of the original application. However, according to the application as filed the clearance became zero already during the make-up prior to the progression of axial interference that led to the final position (cf. page 1, first paragraph: "[...] said clearance progressively decreasing until it becomes zero during makeup" and page 5, lines 29 to 32: "The threadings 3, 4 are of a known type with a progressive variation in the axial thread width and/or the intervals between threads so that a progressive axial interference occurs during makeup until a final blocked position"). This modified the definition of the final position, while the aspect of the axial interference was missing from granted claim 1. Also the essential features of achieving the sealed metal-to-metal contact by progressive radial interference (cf. title of the patent application, page 1, lines 23 to 30, page 6, lines 17 to 19) and two contact zones (cf. page 5, line

35), of the length of overlap, of the orientation of the cambered and tapered surfaces (cf. page 6, lines 7 and 8) and of the omission of a torque shoulder (cf. page 7, lines 35 and 36) were not mentioned in the claim. That gave rise to a further unallowable intermediate generalisation in view of the embodiment in the original application.

Admissibility of documents D17 and D18

The filing of documents D17 and D18 together with the statement setting out the grounds of appeal was a legitimate reaction to the findings in the contested decision. These documents should therefore be admitted into the proceedings.

Inventive step

In view of the prior art in the form of documents D1, D4 or D5, the patent in suit aimed at ensuring a gas-tight sealing when the connection was subjected to high internal pressure after being subjected to high external pressure (cf. paragraph [0022] of the patent). According to paragraphs [0024] and [0025] of the patent, a solution to this problem required that the radius of the cambered surface was between 30 and 80 mm. Since this essential feature was not contained in claim 1, the technical problem was not solved. Consequently, no inventive merit could be attributed to the subject-matter claimed.

Alternatively, inventive step was lacking in view of document D1, which was acknowledged in paragraph [0003] of the contested patent and which disclosed a tubular connection with wedge-shaped threads. It was known that with such threads the correct axial positioning of the

tubes during make-up was difficult to control. The problem to be solved was to ensure a proper sealing in view of gases and fluids in the presence of these axial tolerances. As to the obviousness of the claimed solution, it was noted that in document D1 the sealing was already an issue (cf. column 2, lines 37 to 42 and column 5, lines 13 to 24). Moreover, the tapering angle now proposed in the contested claim was described in document D2, column 1, line 36 to column 2, line 14, in combination with further conditions (cf. also claim 1 of D2, items (i) to (iv)) as ensuring excellent sealing. In that respect, the provision of a shoulder was of no relevance. In view of the statement in document D2, column 3, lines 63 ff on the discrepancy in position, it would be obvious to the skilled person that applying the suggested tapering angle to the tubular connection of document D1 would compensate for the axial discrepancies of the wedge-shaped thread and improve the sealing. Moreover, document D1 even invited the skilled person to look for different sealing arrangements by stating that other types of seal were possible (cf. D1, column 6, lines 4 to 7). The same was true for documents D4, paragraphs [0040] and [0044], or D5, which could equally be used as starting points for assessing inventive step. Finally, it was noted that both wedge-shaped and conventional threads belonged to the same technical field and that the skilled person was familiar with both types (cf. for example document D6, paragraph [0023]).

Additionally, the subject-matter claimed was not inventive over common general knowledge. According to EPO case law, common general knowledge did not normally include patent literature and scientific articles. By way of exception, however, patent specifications and scientific publications could be considered to be

common general knowledge, in particular when a series of patent specifications provided a consistent picture that a particular technical procedure was generally known and belonged to the common general knowledge in the art at the relevant date. Moreover, the skilled person had unwritten "mental furniture", which related to routine design skills and guided the skilled person when solving the problem, rather than facts in the form of technical teachings (cf. T 939/92, Reasons 2.3).

For the present case it was relevant that not only document D2, but also documents D3 (column 6, lines 32 to 45), D7 (column 6, lines 10 to 40), D8 (page 6, lines 26 to 31), D17 (column 3, line 20 to column 4, line 65) and D18 (column 5, line 58 to column 6, line 54) disclosed tapered to cambered sealing surfaces. Patent documents D2, D3, D7, D8, D17, D18 thus provided a consistent picture of the common general knowledge at the priority date of the opposed patent, i.e. showed that it was commonly known in the field of threaded tubular connections, in particular in the field of oil and gas wells, to use tapered surface to cambered surface metal-to-metal contact to provide removable seals. All those documents taught that the sealing of the male and female parts of a threaded tubular connection was improved by the contested feature compared to taper-to-taper surfaces. Furthermore, several of these documents disclosed that the tangent to the vertex half angle of the tapered surface was in the range of about 0.025 to 0.075.

For these reasons, the subject-matter of granted claim 1 did not involve an inventive step.

Reasons for the Decision

1. Added subject-matter

1.1 Regarding the feature "the sealed metal-to-metal contact being effective in said final position of the threadings"

The board first notes that claim 1 as originally filed is directed to:

"A threaded tubular connection [...] characterized in that it comprises at least one contact zone (5, 6) [...] in which the male and female elements (1, 2) are in sealed contact by means of bearing surfaces respectively constituted by a cambered surface (11) and by a tapered surface (12)."

During the examination proceedings, the contested feature was added:

"the sealed metal-to-metal contact being effective in said final position of the threadings."

In the judgement of the board, this amendment does not add subject-matter. Original claim 1 generally defines that the male and female elements of the made-up connection are in sealed contact, which, for a skilled reader, necessarily implies that the sealed contact is effective in the final position of the threadings. Moreover, the explicit wording of both the original claim and the amended claim is silent on whether the sealing develops progressively before the end of the make-up or happens (only) at the end of the make-up.

Hence, it is not apparent that the amended claim now covers a (hypothetical) embodiment which was not covered by the claims as originally filed. In view of the above, it is also not evident that the additional feature alters the technical teaching of the original application in such a way as to present the skilled reader with new technical information. Rather, the amendment is within the limits of what a skilled person would derive directly and unambiguously, using his common general knowledge, from the whole of the application as filed (cf. G 2/10, OJ EPO 2012, 376).

- 1.2 Regarding the feature *"said clearance progressively decreasing until it becomes zero at the end of makeup in a final position of the threadings"*

In original claim 1 the disputed feature reads:

"said clearance progressively decreasing until it becomes zero at the end of makeup",

while the amended wording is:

"said clearance progressively decreasing until it becomes zero at the end of makeup in a final position of the threadings".

Thus, the contested amendment essentially consists in stating that the end of the make-up is reached in a final position of the threadings. Since the end of make-up effectively defines the final position of the threadings, these expressions are considered synonymous in the context of present claim 1. In view of the fact that the amendment in question does not restrict the claimed subject-matter, appellant II's objection of an unallowable intermediate generalisation, i.e. of an

undisclosed combination of selected features lying between the originally broad disclosure and a more detailed specific disclosure, must equally fail.

- 1.3 The above conclusions are reached on the basis of the wording of the contested claim, which has a clear meaning. Under these circumstances, it would not be appropriate to use the description for interpreting the claim in a different way and to assess the issue of added subject-matter on that basis. Rather, the unambiguous claim language must be construed as it would be understood by the person skilled in the art.

For the above reasons, the subject-matter of the contested patent does not extend beyond the content of the application as filed, Article 100(c) EPC 1973.

2. *Admissibility of documents D17 and D18*

Appellant II submitted documents D17 and D18 together with the statement setting out its grounds of appeal. As to their admissibility, it is observed that under Article 12(1) and (4) RPBA the board has to take into account everything presented by the parties, *inter alia* in the notice of appeal, the statement of grounds of appeal and any written reply of the other party or parties, if and to the extent that it relates to the case under appeal and meets the requirements set out in Article 12(2) RPBA. The board, however, has the power to hold inadmissible facts, evidence or requests which could have been presented or were not admitted in the first-instance proceedings.

In the present case, no reasons are apparent as to why appellant II should have filed documents D17 and D18 during the first-instance proceedings; nor has this

been argued. Rather, it submitted them as an attempt to react to the contested decision and to fill gaps in its previous arguments. Moreover, these documents are not unrelated to the case under appeal and meet the requirements set out in Article 12(2) RPBA.

In view of that, the board decided not to hold the filing of documents D17 and D18 inadmissible under Article 12(4) RPBA.

3. *Inventive step*

3.1 Objection that the technical problem is not solved

From a general point of view, a technical problem set out in a patent is considered to be credibly solved by a claimed invention if there are no reasons to assume the contrary. Under such circumstances, the burden is normally on the opponent to prove the opposite or at least provide evidence casting doubt on the alleged solution of the problem (cf. Case Law of the Boards of Appeal of the European Patent Office, 8th edition 2016, III.G.5.1.1).

Applying this principle to the present case, the patent in suit presents the problem to be solved and the proposed solution in paragraphs [0009] to [00012] as follows:

"[0009] The invention aims to eliminate all of the drawbacks mentioned above [i.e. in particular poor and not reproducible sealing; board's comment] and to maximize the axial effective contact length under load (internal or external pressure, axial tension or compression) of the sealing surfaces.

[0010] *The invention also aims to provide a threaded connection that resists cyclic mechanical loads (fatigue).*

[0011] *To this end, the invention provides a threaded connection of the type defined in the introduction, comprising at least one contact zone axially separated from said threadings, in which the male and female elements are in sealed contact by means of bearing surfaces respectively constituted by a cambered surface and by a tapered surface. The tangent to the vertex half angle of the tapered surface is in the range 0.025 to 0.075, corresponding to a taper in the range 5% to 15%.*

[0012] *It has been shown that such a contact zone, which is known per se, allows a substantial variation in the axial position of the contact zone and thus in the relative position of the elements without losing the gas-tight seal, the effective length of the contact zone or the integral of the contact pressure along the contact zone being high (contact stability)."*

Based on this information, there are no objective reasons for assuming that the measures proposed in the claimed invention do not improve the sealing by maximising the axial effective contact length under load of the sealing surfaces. Moreover, appellant II as opponent, which under such circumstances has to bear the burden of proof, has not provided any objective evidence (for example in the form of comparative tests or simulations) demonstrating the contrary (or at least giving rise to reasonable doubt) in order to support its allegations.

Appellant II cited paragraphs [0024] and [0025] of the contested patent in support of its argument that the technical problem was not solved. However, these passages explicitly refer to a preferred embodiment of ensuring a seal when the connection is subjected to high internal pressure after being subjected to high external pressure (cf. paragraph [0022] of the patent), which goes beyond the general aim of the invention as explained in paragraphs [0009] and [0010].

For the above reasons, appellant II's assertions that the technical problem has not been solved are not such as to render obvious the subject-matter of claim 1 as granted.

3.2 In view of the prior art

3.2.1 Alternatively, appellant II objects that inventive step is lacking in view of a combination of any of documents D4, D5 or D1 with document D2.

These documents all relate to tubular connections with wedge-shaped threads and disclose subject-matter conceived for the same purpose as the subject-matter claimed. Each of these documents differs from the subject-matter of claim 1 as granted at least in the features of

(a) bearing surfaces respectively constituted by a cambered surface and by a tapered surface; and

(b) the tangent to the vertex half angle of the tapered surface being in the range 0.025 to 0.075.

3.2.2 In view of the technical effect of these differences (cf. paragraph [0012] of the patent), the objective

technical problem to be solved is to improve the sealing tightness of the metal-to-metal seal.

- 3.2.3 Regarding the claimed solution, appellant II refers to document D2. It is uncontested that this document discloses, albeit in the context of conventional threads, sealing surfaces respectively constituted by a cambered surface and by a tapered surface, wherein the latter has a tapering angle of 1.0 to 4.7°, preferably 1.0 to 2.0° (cf. D2, column 1, line 67 to column 2, line 3 and Figure 2). This element of disclosure, as such, anticipates the wording of the differing features (a) and (b). Consequently, the issue of inventive step primarily hinges on whether or not the skilled person would consider combining the sealing arrangement of document D2 with the wedge-shaped threads of documents D1, D4 or D5 in order to arrive at the claimed invention.
- 3.2.4 In that respect, it is noted that document D2 is aimed at avoiding stress corrosion cracking at the root of the torque shoulder while still providing excellent strength and sealing properties (D2, column 1, lines 21 to 39). Hence, the primary focus of the teaching of document D2 is not fully in line with the objective technical problem of the contested invention. Turning to the proposed solution, it is observed that in document D2 the contested claim features (a) and (b) are disclosed in the context of conventional threads having a torque shoulder. In fact, they form one part (condition (ii)) of a comprehensive solution consisting of a combination of four conditions (i) to (iv) (cf. D2, column 1, line 53 to column 2, line 14):

"For accomplishing the above mentioned objects, the invention adopts such a structure for a joint coupling

where a main sealing portion is provided with a sealing portion (outer circumference) which is formed axially in convex at an end of the male screw, and with a sealing portion (inner circumference) which is formed in taper at an inner side of a female screw, and provided by butting the end point of the male screw and the end part of the stopper formed at the inner part of the female screw; and comprising parts of the joint coupling constructed under the following conditions

- (i) a screw portion is provided with a shrinkage allowance $\Delta d (=d_1-d_2)$, and a load flank angle (α) of the screw portion is selected to be 0 to 1.1° ;
- (ii) a convex (arc face) in an axial direction of the sealing portion of the male screw is formed with a radius of curvature of more than 100 mm, and the tapering angle (θ) of the sealing portion of the female screw is 1.0 to 4.7° , preferably 1.0 to 2.0° ;
- (iii) an outer diameter D_1 of the sealing portion of the male screw and an inner diameter D_2 of the sealing portion of the female screw are made $D_1 > D_2$, and a shrinkage allowance $\Delta D (=D_1-D_2)$ of the seal part is provided where the sealing shrinkage allowance is formed such that pressure P of the sealing part is (inner pressure applied to the screw coupling) $< P <$ (yield strength of composing member of the screw joint coupling); and
- (iv) relation between the seal shrinking margin ΔD and the screw shrinking margin Δd is set $\Delta D \geq \Delta d$."

Given that documents D1 and D2 relate to different thread types and that the primary aim of document D2 does not fully match the objective technical problem of the present invention, it is not evident, from an objective point of view, that the skilled person would consider document D2 when looking for a solution to improve the sealing tightness of the metal-to-metal

seal in the wedge-shaped threaded connection of document D1. Even if document D2 were taken into consideration, it teaches that conditions (i) to (iv) are to be implemented in combination. This does not correspond to, and even speaks against, the solution now proposed in claim 1, which is directed to condition (ii) only.

In summary, the technical contexts of documents D1 and D2, the objective technical problems addressed in document D2 and the patent in suit, and the solutions proposed therein, do not completely coincide. It has therefore not been established that documents D1 and D2 would render obvious the subject-matter of granted claim 1 of the contested patent. The same reasoning applies if documents D4 or D5 are used as starting points for assessing inventive step in combination with document D2, notably since document D4 in general and its paragraph [0040] in particular do not disclose, let alone suggest, tapered to cambered sealing surfaces.

3.3 In view of common general knowledge

According to established case law (cf. Case Law of the Boards of Appeal of the European Patent Office, 8th edition 2016, I.C.2.8.1), common general knowledge is to be found in basic handbooks, monographs, encyclopaedias, textbooks and reference books. This is knowledge that an experienced person in the field in question is expected to have, or at least to be aware of, to the extent that he knows he could look it up in a book if he needed it. Even if, by way of exception in particular technical areas and under particular circumstances, patent documents could be considered to be common general knowledge, it is not apparent why this exception should apply to the field of oil and gas

pipes, where handbooks, monographs, encyclopaedias, textbooks, reference books and industry standards are widely available. As to the substance, it can be added that the cited patent documents D2, D3, D7, D8, D17 and D18 do not provide a consistent picture indicating that the subject-matter presently claimed, in particular a combination of the wedge-shaped threadings, the bearing surfaces respectively constituted by a cambered surface and by a tapered surface, and the tapering angle, was generally known and part of common general knowledge at the relevant date. Consequently, this additional line of attack is likewise not such as to render obvious the subject-matter of claim 1.

- 3.4 For these reasons, the subject-matter of claim 1 as granted involves an inventive step, Article 56 EPC 1973.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.
3. The appeal of appellant II is dismissed.

The Registrar:

The Chairman:



D. Meyfarth

M. Poock

Decision electronically authenticated