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Case Number: T 1272/22 - 3.2.07

Application Number: 15810657.5

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Title of invention:
THREADED CONNECTION

Patent Proprietors:
Vallourec Oil and Gas France
NIPPON STEEL CORPORATION

Opponent:
Hydril Company

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Catchword:

Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1272/22 - 3.2.07

D E C I S I O N
of Technical Board of Appeal 3.2.07
of 12 November 2024

Respondent: (Patent Proprietor 1)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted on 21 April 2022 concerning maintenance of the European Patent No. 3234298 in amended form.**

Composition of the Board:

Chairman	G. Patton
Members:	S. Watson
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. Appeals were filed by the patent proprietors and the opponent against the decision of the opposition division maintaining European patent No. 3 234 298 in amended form on the basis of auxiliary request 3.

II. In preparation for oral proceedings, the board gave its preliminary opinion in a communication pursuant to Article 15(1) RPBA, dated 18 September 2024, according to which the appeal of the patent proprietors was likely to be dismissed, but the appeal of the opponent was likely to be allowed.

III. The patent proprietors withdrew their appeal with letter of 7 October 2024.

IV. None of the parties responded in substance to the board's preliminary opinion.

V. Oral proceedings before the board took place on 12 November 2024. The patent proprietors did not attend the oral proceedings.

At the conclusion of the proceedings the decision was announced. Further details of the oral proceedings can be found in the minutes.

VI. The final requests of the parties are as follows.

The opponent ("appellant") requests
- that the decision under appeal be set aside and
- that the patent be revoked.

The patent proprietors ("respondents") request

- that the appeal be dismissed, or that the patent be maintained in amended form on the basis of one of the sets of claims of auxiliary requests 4 to 7 filed with the letter dated 31 August 2022.

VII. The following documents are referred to in this decision:

D2: US 6,543,816 B1
D3: WO 2011/060894 A2
D7: API (American Petroleum Institute) specification standard 5B: Specification for threading, gauging and thread inspection of casing, tubing and line pipe threads, 1 December 1996
D10: WO 2004/109173 A1.

VIII. Independent claim 1 of auxiliary request 3 reads as follows (feature labelling as used by the appellant in its statement of grounds of appeal):

1.1 "A threaded tubular connection (1) comprising a male threaded element (2) disposed at the end of a first tubular component (2) and a female threaded element (3) disposed at the end of a second tubular component (3),

1.2 the male threaded element (2a) comprising two male threadings, an outer (8) and an inner (10),

1.3 a first outer peripheral surface (14) disposed between the male threadings, a first male sealing surface (12) on said outer peripheral surface,

1.4 a second outer peripheral surface (26), a male axial abutment surface (20) disposed at the end of the male threaded element (2a), and a second male sealing surface (22) provided on the second outer peripheral surface of the male threaded element (2a) between the inner threading and the male axial abutment surface (20);

1.5 the female threaded element (3a) comprising two female threadings, an outer (9) and an inner (11),

1.6 an inner peripheral surface (15) disposed between the female threadings (9,11), at least one first female sealing surface (13) on said inner peripheral surface (15),

1.7 a female axial abutment surface (21), and a second female sealing surface (23) provided between the female axial abutment surface (21) and the inner female threading (11),

1.8 the threads of said outer male (8) and female (9) threadings being engaged in the coupled state, the threads of said inner male (10) and female (11) threadings being engaged in the coupled state;

1.9 the male axial abutment surface (20) and the female axial abutment surface (21) being abutted in the coupled state,

1.10 the first male sealing surface (12) and the first female sealing surface (13) being in sealing contact in the coupled state,

1.11 the second male sealing surface(22) and the second female sealing surface (23) being in sealing contact in the coupled state;

1.12 characterized in that the outer male threading (8) comprises a dovetail thread with an increasing width and the corresponding outer female threading (9) comprises a dovetail thread with an increasing width,

1.13 the thread of said outer male threading (8) comprising a load flank (8d) and a stabbing flank (8c), the stabbing flank (8c) being contact-free in the coupled state, the thread of said inner male threading (10) comprising a load flank and a stabbing flank, said stabbing flank being contact-free in the coupled state,

1.14 and in that the thickness of the female threaded element (3a) measured in a radial plane intersecting with the first female sealing surface (13) is in the range 20% to 50% of the nominal thickness of the male threaded element (2a),

1.15 the male threaded element (2a) comprising a lip with a thickness in the range 20% to 35% of the thickness of the regular section of the first tubular component (2),

1.16 said lip being disposed between the inner threading (10) and the male axial abutment surface (20)."

IX. Independent claim 1 of auxiliary request 4 differs from claim 1 of auxiliary request 3 in that feature 1.12 reads as follows:

"~~characterized in that~~ wherein the outer male threading (8) comprises a dovetail thread with an increasing width and the corresponding outer female threading (9) comprises a dovetail thread with an increasing width,"

and that features 1.15 and 1.16 are replaced by feature 1.17, which reads as follows:

"wherein the inner male threading (10) comprises a dovetail thread with an increasing width and the corresponding inner female threading (11) comprises a dovetail thread with an increasing width."

X. Independent claim 1 of auxiliary request 5 differs from claim 1 of auxiliary request 4 in that feature 1.2 reads as follows:

> "the male threaded element (2a) comprising two male threadings, an outer (8) and an inner (10), the two male threadings, inner and outer, of the male threaded element having two distinct generatrices with the same gradient or two generatrices with different gradients".

XI. Independent claim 1 of auxiliary request 6 differs from claim 1 of auxiliary request 4 in that feature 1.4 reads as follows:

> "a second outer peripheral surface (26), a male axial abutment surface (20) disposed at the end of the male threaded element (2a), the male axial abutment surface being disposed at the end of a lip located in the extension of the male inner threading, and a second male sealing surface (22) provided on the second outer peripheral surface of the male threaded element (2a) between the inner threading and the male axial abutment surface (20)".

XII. Independent claim 1 of auxiliary request 7 differs from claim 1 of auxiliary request 4 in that feature 1.17 is included in addition to, rather than replacing, features 1.15 and 1.16.

XIII. The arguments of the parties relevant for the decision are dealt with in detail in the reasons for the decision.

Reasons for the Decision

1. *Auxiliary request 3 - claim 1 - inventive step (Article 56 EPC)*

1.1 The opposition division found that document D2 was the closest prior art to claim 1 of auxiliary request 3 and disclosed all features of the claim with the exception of feature 1.12 and the newly introduced features (features 1.15 and 1.16).

The opposition division found that the subject-matter of claim 1 was inventive as there was synergy between feature 1.12 on the one hand and feature 1.15 on the other hand. According to the reasoning of the opposition division, the functional interaction of the features achieved a combined technical effect of increasing the connection efficiency, as feature 1.12 avoided jump-out which increased connection efficiency at the threaded part of the connection and feature 1.15 (the claimed thickness of the lip) increased the connection efficiency at the sealing point of the connection (see decision under appeal, point II.29.3).

1.2 *Distinguishing features with respect to the disclosure of document D2*

1.2.1 The respondents contested the opposition division's findings that features 1.2, 1.3, 1.5, 1.6, 1.13 and 1.14 were disclosed in document D2.

1.3 Features 1.2, 1.3, 1.5, 1.6

1.3.1 The respondents argued that document D2 refers repeatedly to a single threading.

1.3.2 However, the skilled person reading document D2 understands that the passages of that document cited by the appellant refer to the connectors having single threaded *zones*, in contrast to certain prior art connectors which were known to have two radially and axially offset independent threaded zones (see D2, column 3, lines 1 to 4; column 6, lines 52 to 58).

1.3.3 Features 1.2 and 1.5 require only that there are "inner" and "outer" (male or female) threadings. The skilled person understands this to refer only to the position of the threads on the element without further limitation.

The threaded tubular connection disclosed in D2 has a male and female threaded element, where there are two male and female threadings, respectively, namely an inner and an outer threading. This can be seen from figures 4 and 5 as well as column 7, lines 5 to 15. This passage of D2 describes how the threads 7, 8 (27, 28 in figure 4) are interrupted by a central sealing means 9 (29 in figure 4) comprising a male and a female bearing surface 10, 11 in a central zone of the male (and female) threaded zone. This divides the single threaded zone into inner and outer threadings with a sealing surface disposed in between as required by features 1.2, 1.3, 1.5 and 1.6 (see decision under appeal, point II.19.3).

1.4 Feature 1.13

1.4.1 The respondents also contested the finding of the opposition division that feature 1.13 was disclosed in document D2, in column 10, lines 17 to 24 and figure 5.

According to the respondents, it was not unambiguously disclosed that figures 4 and 5 of document D2 disclosed the same embodiment. Figure 5 was an enlarged view of figure 2, whereas figure 4 was said to be a variation of figure 2.

However, the board agrees with the appellant that the variation described with respect to figure 4 relates to the stop means and second sealing means, and not to the threadings.

1.4.2 Regarding the flank arrangement of feature 1.13, the passage in D2, column 10, lines 17 to 24, refers specifically to API buttress threading as a non-limiting example for the threading.

The respondents argued that it was not inevitable that the stabbing flanks of buttress threads are contact-free in the coupled state, even if the API buttress thread was used.

The appellant referred to figure 5 of D2 which shows stabbing flank surfaces with a gap in the coupled state. The appellant also referred to document D7 (figure 7) and to document D10 (figure 3 and page 2, lines 23 to 27) and argued that the skilled person was well aware that the stabbing flanks of the API buttress threading were contact-free in the coupled state.

In the board's view, document D2 discloses that the stabbing flanks are contact-free in the coupled state because there is a clear gap shown between the male and female stabbing flanks 36 and 37 of figure 5 of D2. This figure is an enlarged representation of a portion of the connector shown in figure 2 with the male and female threadings connected (see D2, column 5, lines 36 to 37 and lines 44 to 46, and column 10, lines 17 to 19).

The respondents argued that as figure 5 showed surfaces 10 and 11 in their geometry before make up, there was no unambiguous disclosure of the stabbing flanks being contact-free.

The board does not find this argument convincing as document D2 clearly describes that the surfaces 10 and 11 are shown before make up to demonstrate the interference which is then present after make up. D2 clearly describes that threadings 7 and 8 are shown connected in figure 5 (see D2, column 10, lines 17 to 19). The skilled person therefore understands that only the surfaces 10 and 11 are shown in their geometry prior to make up.

1.4.3 The board therefore agrees with the opposition division and the appellant that document D2 discloses feature 1.13, i.e. that the stabbing flanks are contact-free in the coupled state.

1.5 Feature 1.14

1.5.1 The respondents also contested that feature 1.14 was disclosed in D2. They argued that the thicknesses disclosed in D2 (D2, figure 4, column 9, line 64 to column 10, line 7 and column 4, line 61 to column 5, line 24) did not relate to the ratio of the thickness of the female threaded element to the nominal thickness of the male threaded element.

The opposition division reasoned that, even if the passage of D2 in column 9, line 64 to column 10, line 7 referred to the thickness of the female rather than the male threaded element, the nominal thickness of the female threaded element was in any case identical to the male element as the passage of column 5, lines 1 to 6 described differing wall thicknesses as optional (see decision under appeal, page 9).

1.5.2 The board can agree with the respondents' argument, that the passage in D2, column 9, line 64 to column 10, line 7 is understood by the skilled person to refer to the percentage thickness of the female threaded element at the first sealing surface compared to the nominal thickness of the pipe on which the female threaded portion is formed (pipe 4).

However, the board is of the view that the passage referred to by the opposition division does disclose that the pipes have the same thickness. It is stated in column 5, lines 1 to 2 of document D2 that "[d]epending on the configuration and thickness of the pipes...", the end of the female element may be expanded and the end of the male element may be thickened. The use of the singular term "thickness of the pipes" leads the skilled person to understand that the pipes by default have the same thickness, but that the ends may optionally be expanded (female element) or thickened (male element).

Hence, feature 1.14 is disclosed in D2.

1.6 Feature 1.16

1.6.1 The board agrees with the appellant's argument that feature 1.16 is disclosed in figure 4 of document D2, which shows the lip disposed between the inner threading and male axial abutment surface 32. The respondents did not dispute this point, arguing only that feature 1.16 should be regarded as part of feature 1.15.

1.7 In light of the above, the board is of the view that the opposition division was correct in finding that only features 1.12 and 1.15 were not disclosed in document D2.

1.8 *Partial problem approach*

1.8.1 The appellant argued that even if it were considered that the distinguishing features 1.12 and 1.15 broadly served the same purpose by contributing to the overall performance of the connection, there was no synergistic effect between the features, i.e. the features together did not achieve an effect which was more than the sum of their parts.

1.8.2 The respondents argued that features 1.12 and 1.15 were functionally dependent as each one could not be altered without having an effect on the remainder of the connection. According to the respondents, as the lip section thickness was reduced, the critical section became higher and the connection was more efficient. However, if the lip was too thin, it would be radially displaced and the seal would be lost. The dovetail shape of the outer threading ensured that the threads were in close contact and therefore the sealing surfaces remained against one another. This allowed the lip to be thinner whilst still maintaining the seal.

1.8.3 According to established case law, a proprietor may rely on a technical effect if the skilled person, having the common general knowledge in mind, and based on the application as originally filed, would derive said effect as being encompassed by the technical teaching and embodied by the same originally disclosed invention (G 2/21, Headnote II.).

The board cannot see that the skilled person would have derived the synergetic technical effect referred to by the respondents between features 1.12 and 1.15 when considering the application as originally filed.

There is no explicit mention of any relationship between the two features or that the dovetail threads allow for a thinner lip, which gives better connection efficiency. The position of the critical section for the efficiency of the connection is not defined in the contested patent.

The contested patent refers to the dovetail threads reducing the risk of jump out (see paragraph [0015]) and to the claimed lip thickness leading to a generatrix with a high gradient and high connection efficiency being obtained (paragraph [0032] of the contested patent).

However, there is no indication in the contested patent that avoiding jump out increases the connection efficiency.

The respondents referred to the graphs of figure 7 and paragraph [0084] of the contested patent as showing that the claimed connection, as a whole, has improved connection efficiency.

The experimental evidence in the contested patent is, however, not shown in relation to a connection as disclosed in document D2. According to the contested patent (see paragraph [0081]), the principal difference between the reference connection shown in the graphs and the connection of the claimed invention, is that the reference connection does not have a central sealing surface between two threadings but has only one threaded portion and the sealing surface is close to the outer surface of the connection. No mention is made of the thread type or of the lip thickness of this reference connection.

1.8.4 Therefore the alleged synergy referred to by the respondents does not appear to be derivable by the skilled person from the application as originally filed and the partial problem approach used by the appellant is justified.

1.9 *Feature 1.12 - objective technical problem to be solved*

1.9.1 The respondents argued that the objective technical problem posed by the opposition division for feature 1.12 of reducing jump-out was incorrect and instead the problem should be regarded as how to optimise the function of the central seal as mentioned in paragraph [0011] of the contested patent.

1.9.2 The board agrees with the opposition division and the appellant that the objective technical problem should be considered as to reduce the risk of jump-out. Paragraph [0015] of the contested patent explicitly and directly links dovetail threading with increasing width with reduction of jump-out risk.

Paragraph [0011] of the contest patent does not specify which features of the outer threading are responsible for allowing the optimum function of the central seat. The previous paragraph mentions both features 1.12 and 1.13, so that this paragraph would not be understood by the skilled person as providing a connection between feature 1.12 and optimising the function of the central seal.

1.10 *Feature 1.12 - obviousness*

1.10.1 The respondents argue that the skilled person has no pointer in document D2 to select the type of threading specified in feature 1.12.

1.10.2 It is however established case law that there does not need to be a pointer in the closest prior art itself to a certain feature or combination, the question is rather what the skilled person would do dependent on the state of the art in the relevant technical field (see Case Law of the Boards of Appeal, 10th edition 2022 ("CLB" hereinafter), I.D.5, fifth paragraph).

1.10.3 In the present case, the pointer is found in document D3 (page 4, line 22 to page 5, line 3), where it is set out that a particular tooth form greatly reduces the risk of jump-out (as reasoned by the opposition division in the decision under appeal, page 10, second to fourth paragraphs).

1.10.4 The respondents do not contest that document D3 shows feature 1.12 but they argue that document D3 does not teach that the relevant features can be extracted from the further features of the connector of D3 and applied to D2.

1.10.5 The board however agrees with the arguments of the appellant that the skilled person would take the thread of D3 as a whole and apply it to the connector of D2, in particular in light of the passage of D2 which states that the threadings may be of any type (D2, column 4, lines 47 to 48).

1.10.6 The subject-matter of claim 1 including feature 1.12 is therefore obvious over a combination of the teachings of documents D2 and D3.

1.11 *Feature 1.15 - objective technical problem to be solved*

1.11.1 Regarding feature 1.15, the board follows the arguments of the appellant, that it has not been shown that the claimed lip thickness values improve the connection efficiency in all cases. It appears from paragraph [0032] of the contested patent that the thickness values claimed could lead to high connection efficiency in conjunction with particular gradients. The connections in claim 1 are not however limited to tapered connections and no values of gradient are given in the claim. Therefore the objective technical problem to be solved is regarded as being to find an alternative lip thickness.

1.12 *Feature 1.15 - obviousness*

1.12.1 Document D10 discloses that a lip thickness of at least 25% is suitable to maintain compressive strength, this value falls within the claimed range (D10, page 11, lines 7 to 11).

The respondents argued that the skilled person would not consider document D10 as the nose of the pin in the connection of D10 did not contact the box, unlike in the connections shown in documents D2 and D3. Therefore the skilled person would not consider the teaching of D10 to be useful in improving the sealing of the connection in D2 and no pointers to such a combination were present.

1.12.2 As the board is of the view that the objective technical problem is to provide an alternative, there is no requirement for a pointer (CLB, I.D.4.5). The skilled person would consider the teaching of D10 and apply it to the connection of D2, irrespective of the different construction, as both documents relate to threaded tubular connections for use in the oil and gas industry (D10, page 1, first paragraph and D2, column 1, lines 5 to 10).

1.13 The board therefore finds that the subject-matter of claim 1 of auxiliary request 3 including feature 1.15 is not inventive in view of document D2 with document D10.

1.14 The subject-matter of claim 1 is therefore not inventive in view of the combination of the teaching of documents D2, D3 and D10 (Article 56 EPC). As auxiliary request 3 is not allowable, the decision must be set aside.

2. *Auxiliary request 4 - claim 1 - inventive step (Article 56 EPC)*

2.1 In claim 1 of auxiliary request 4, features 1.15 and 1.16 have been replaced by feature 1.17 (see point IX. above). This feature relates to the dovetail thread and is equivalent to feature 1.12, but for the inner threading rather than the outer threading.

2.2 The distinguishing features with respect to D2 are regarded as being features 1.12 and 1.17.

2.3 The respondents regarded the objective technical problem to be solved as improving the central behaviour and avoiding jump-out.

2.4 As set out above in relation to feature 1.12 of claim 1 of auxiliary request 3, the board views the objective technical problem to be solved as to reduce the risk of jump-out, which was expressly indicated in the contested patent as arising from the specific tooth form (see point 1.9 of this decision).

2.5 The board agrees with the appellant that the skilled person would modify both the outer and the inner threadings of the connection of D2 in accordance with the teaching of document D3, for the same reasons as given for feature 1.12 of auxiliary request 3 (see point 1.10 of this decision).

2.6 The respondents argued that the skilled person would not consider document D3 as it does not have a central seal. However, in view of the objective technical problem considered by the board, it is not relevant whether the connection of D3 has a central seal or not.

2.7 The subject-matter of claim 1 of auxiliary request 4 is therefore not inventive in view of documents D2 and D3 (Article 56 EPC).

3. *Auxiliary request 5 - claim 1 - inventive step (Article 56 EPC)*

3.1 Claim 1 of auxiliary request 5 comprises the amendments to feature 1.2 found in auxiliary request 1 of the decision under appeal, which the opposition division found not to meet the requirements of Article 56 EPC as amended feature 1.2 was disclosed in document D2 (see decision under appeal, point II.23.3).

In addition, claim 1 of auxiliary request 5 contains the same amendment as in claim 1 of auxiliary request 4, namely the replacement of feature 1.15 and 1.16 with feature 1.17.

3.2 The respondents argued that in D2 the inner and outer male threadings had the same generatrix. According to the respondents, the passage referred to by the opposition division related to the male and female threadings rather than the two male threadings as required by the newly introduced feature.

3.3 The board however follows the arguments of the appellant that figure 4 of document D2 shows two male threadings, divided by the central sealing area and therefore discloses the male threadings having two distinct generatrices with the same gradient.

3.4 Therefore the distinguishing features of claim 1 of auxiliary request 5 are the same as for claim 1 of auxiliary request 4 and the subject-matter of claim 1 of auxiliary request 5 is not inventive for the same reasons as set out above for auxiliary request 4 (see point 2. above).

4. *Auxiliary request 6 - claim 1 - inventive step (Article 56 EPC)*

4.1 Regarding auxiliary request 6, this request is based on auxiliary request 2 of the decision under appeal and includes the feature, "the male axial abutment element surface being disposed at the end of a lip located in the extension of the male inner threading".

4.2 The opposition division found that this feature was disclosed in document D2 (see decision under appeal, point II.27.2 to II.27.3).

4.3 The respondents did not contest this point at the oral proceedings before the opposition division, nor in their submissions in appeal.

4.4 The board therefore confirms the opposition division's findings and follows the arguments of the appellant that this feature is disclosed in document D2 (D2, figure 4 and column 9, lines 24 to 26), so that the distinguishing features remain the same as for auxiliary request 4.

4.5 Therefore, the subject-matter of claim 1 of auxiliary request 6 is also not considered to be inventive in view of documents D2 and D3 for the same reasons as for auxiliary request 4 (Article 56 EPC).

5. *Auxiliary request 7 - claim 1 - inventive step (Article 56 EPC)*

5.1 The subject-matter of claim 1 of auxiliary request 7 corresponds to a combination of claim 1 of auxiliary request 3 with the addition of feature 1.17.

5.2 The respondents did not make any arguments relating specifically to this combination of features but relied on their submissions for the then main request and auxiliary request 3.

5.3 The subject-matter of claim 1 of auxiliary request 7 is therefore not considered to be inventive for the reasons given for auxiliary request 3 (see points 1.8

to 1.14 of this decision) and auxiliary request 4 (see points 2.3 to 2.6 of this decision).

6. In light of the above findings, it was not necessary to consider the appellant's request not to admit auxiliary requests 4 to 7 into the appeal proceedings (Article 12(6) RPBA).

7. *Conclusion*

As none of the requests fulfils the requirements of Article 56 EPC, the patent must be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

G. Nachtigall G. Patton

Decision electronically authenticated