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Datasheet for the decision of 6 October 2015

Case Number: T 1505/11 - 3.2.05

Application Number: 02710333.2

Publication Number: 1365183

IPC: F16L15/00

Language of the proceedings: EN

Title of invention:
Threaded joint for steel pipe with excellent seizure and corrosion resistances

Patent Proprietor:
Nippon Steel & Sumitomo Metal Corporation
Vallourec Oil and Gas France

Opponent:
Tenaris Connections Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC 1973 Art. 83, 56

Keyword:
Sufficiency of disclosure - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 1505/11 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 6 October 2015

Appellant: (Opponent)	Tenaris Connections Aktiengesellschaft Bahnhofstrasse 7 9494 Schaan (LI)
Representative:	Jens Hammer Grünecker Patent- und Rechtsanwälte PartG mbB Leopoldstraße 4 80802 München (DE)
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Respondent: (Patent proprietor 2)	Vallourec Oil and Gas France 54 rue Anatole France 59620 Aulnoye-Aymeries (FR)
Representative:	Amanda Simons J A Kemp 14 South Square Gray's Inn London WC1R 5JJ (GB)
Decision under appeal:	**Interlocutory decision of the opposition division of the European Patent Office posted on 20 April 2011 concerning maintenance of the European Patent No. 1365183 in amended form.**

Composition of the Board:

Chairman M. Poock
Members: H. Schram
D. Rogers

Summary of Facts and Submissions

I. On 21 June 2011 the appellant (opponent) lodged an appeal against the interlocutory decision of the opposition division posted 20 April 2011 concerning the maintenance of European patent No. 1 365 183 in amended form. The statement setting out the grounds of appeal was received on 29 August 2011.

The opposition division held that the grounds of opposition under Article 100(a) EPC (lack of inventive step, Article 56 EPC 1973) and Article 100(b) EPC (insufficiency of disclosure, Article 83 EPC 1973) did not prejudice the maintenance of the patent in amended form on the basis of the following claim:

"A threaded joint for steel pipes comprising a pin (1) and a box (2) capable of mating with each other, the pin (1) having an externally threaded portion (3A) and an unthreaded metal contact portion (4) as a mating surface, and the box (2) having an internally threaded portion (3B) and an unthreaded metal contact portion (4) as a mating surface, wherein the mating surface of at least one of the pin and the box is coated with a lower porous zinc or zinc alloy layer having a surface roughness of from 5 to 40 µm indicated by R_{max} and an upper lubricating coating which is a solid lubricating coating."

II. Oral proceedings were held before the board of appeal on 6 October 2015.

The appellant requested that the decision under appeal be set aside and that the patent in suit be revoked.

The respondent requested that the appeal be dismissed (main request) and hence the patent be maintained upon the basis decided upon by the opposition division, or alternatively that the decision under appeal be set aside and the patent be maintained upon the basis of either auxiliary request 1 or 2, both filed on 5 January 2012.

III. The following documents were inter alia referred to in the appeal proceedings:

E2 US 4,871,194;

E5 US 6,027,145.

IV. The arguments of the appellant, in writing and during the oral proceedings, can be summarized as follows:

Sufficiency of disclosure

The claims of the main request did not meet the requirements of Article 83 EPC 1973. In particular, none of the Examples 1 to 4 and 6 to 13 and comparative Examples 1 to 3 and 5 in Table 2 of the patent in suit disclosed the surface roughness of the lower layer, so that said examples did not sufficiently support the claimed subject-matter of the patent in suit. Due to the fact that the claim and specification failed to disclose any further information regarding the issue of porosity and the question of solid lubricant, any layer of zinc or zinc alloy being prepared by any of the methods disclosed in the patent in dispute was to be considered as being porous, and any lubricant material having a melting point was to be considered in principle as a solid lubricant.

Inventive step

Document E2 in combination with document E5

Document E2 represented the closest state of the art. This document disclosed an oil well pipe joint for steel pipes comprising a threaded portion and a pin and box capable of mating with each other, wherein the mating surface was coated with a blast-plated porous zinc layer having a surface roughness from 5 to 30 µm. A conventional grease based lubricant was applied on top of said layer. This document thus disclosed all features of claim 1 of the main request, except the feature that the upper lubricating coating was a solid coating. It was commonly known before the relevant time rank of the patent in suit that the disadvantages of compound grease were a low environmental compatibility and low pressure and temperature stability (see eg document E5, column 2, lines 48 to 57). Thus, the objective problem to be solved in view of document E2 was to provide a threaded joint for steel pipes, which eliminated the disadvantages of compound grease, in other words to provide a threaded joint having a good environmental compatibility and high pressure and temperature stability (taking into account that the applicability at repeated tightening and loosening was already solved by the lubricants of document E2).

Document E5 provided a threaded joint for an oil well pipe which had an improved galling resistance on repeated tightening and loosening operations and which was coated with a solid lubricant containing a powder of molybdenum disulfide or tungsten disulfide and an organic binder such as an epoxy resin, furan resin and polyamide resin. This document also taught the presence of a lower phosphate chemical formation coating layer

(see claim 1), which enhanced the adhesion property of the solid lubricating coating layer (column 15, lines 40 and 41). In particular, the phosphate chemical formation coating layer was porous as it generated during crystallisation a large number of voids, wherein the solid lubricating coating layer was trapped so that a long term adhesion property was obtained and the corrosion of the manganese phosphate chemical formation coating layer was inhibited (column 15, line 63, to column 16, line 32). In column 2, line 6, of document E5 JP 62-258283 was cited, which corresponded to document E2.

Thus, a person skilled in the art would have combined document E2 with document E5 since both documents related to threaded joints for oil well pipes and also addressed the common problem of providing galling resistance at repeated tightening and loosening. Moreover, both documents clearly emphasized that the porosity of the lower layer was of great importance for the desired advantageous effects, ie they were related to a very similar concept (lower porous layer with an upper lubricating layer), which showed that these documents could be combined. Since document E5 explicitly addressed the object to provide galling resistance to a threaded joint without the negative environmental impact associated with the use of compound grease (column 2, lines 48 to 57), the person skilled in the art would have been motivated to substitute the compound grease of document E2 with the solid lubricant of document E5, resulting in the subject-matter of claim 1 of the main request. Thus, the subject-matter of claim 1 of the main request did not involve an inventive step in view of document E2 in combination with document E5. Lastly, it was emphasized that it was obvious for the average skilled person in

view of this combination to replace the undesired compound grease with a solid lubricating layer in order to achieve good galling resistance and improved environmental properties, and that any alleged further beneficial effects had to be considered as a bonus effect, which did not contribute to the issue of inventive step.

Document E5 in combination with document E2

Document E5 could also be regarded as closest prior art. As identified above, the subject-matter of claim 1 of the main request differed from the threaded joint known from document E5 in that it required a lower porous zinc or zinc alloy layer, instead of a lower porous phosphate chemical formation coating layer as in document E5. It was known in the art that chemically-formed coatings, such as zinc phosphate or manganese phosphate coatings, were not able to withstand high temperatures, see document E2, column 1, lines 40 to 45. The objective technical problem in view of the disclosure of document E5 was thus to provide a threaded joint which did not give rise to problems at higher temperatures. A person skilled in the art starting from document E5, when trying to improve the temperature stability of the coating, would therefore substitute the lower phosphate chemical formation coating layer of said document with the blast-plated zinc or zinc alloy layer known from of document E2 and would hence arrive at the subject-matter of claim 1 of the main request.

V. The arguments of the respondent, in writing and during the oral proceedings, can be summarized as follows:

Sufficiency of disclosure

That the surface roughness of the lower porous zinc or zinc alloy layer was not indicated in the examples section of the patent in suit, did, in itself, not render the specification insufficient. Rather, the question to be answered was whether the patent specification as a whole provided sufficient information for the skilled person to prepare a zinc or zinc alloy layer having the required surface roughness. In this regard, paragraph [0039] of the patent provided full details regarding the surface roughness required and the techniques which could be used to adjust surface roughness. Thus, for example, when the zinc or zinc alloy layer was formed by blast plating, the surface roughness could be controlled by the diameter or coating thickness of the particles to be blasted and the blasting velocity. Blast plating techniques such as impact plating were discussed at paragraph [0030] of the patent. The skilled person would accordingly have no difficulty in producing a zinc or zinc alloy layer having a surface roughness of from 5 to 40 µm as required by the present claims. The appellant had also commented on the interpretation of "porous layer" and "solid lubricating coating". However these submissions did not address any issue of lack of sufficiency.

Inventive step

The allegation of the appellant, that document E2 addressed the same problems as the present invention and represented the closest prior art, was contested. One of the major aims of the present invention was to avoid the need to use compound grease, in particular avoidance of the need to reapply compound grease on repeated make-up (fastening) and break-out (loosening) operations. Document E2 was not concerned with this

problem, on the contrary, this document explicitly taught that compound grease be used, and was therefore not to be considered as the closest prior art document.

Document E2 in combination with document E5

Document E2 described an oil well pipe joint which comprised threaded and metal sealing portions, in which a metal sealing portion had a plating layer, which was a blast-plated layer of zinc or a zinc alloy (claim 1), and which could optionally include a lubricant impregnated therein (claim 12). The lubricant as disclosed in this document was a conventional compound grease (see, for example, column 4, lines 36 to 44), ie a liquid lubricant. The threaded joint of document E2 differed from the present invention in that it did not disclose a coating composition in which the upper layer was a solid lubricating coating. The effect of the solid lubricating coating was to provide good galling resistance and rust-preventing properties, whilst avoiding the need to use a compound grease, which had adverse environmental impact. In particular, Table 5 of the patent showed that the coatings of the present invention could withstand at least seventeen make-up and break-out operations without the need to reapply compound grease. The problem of avoidance of the need to reapply compound grease on repeated make-up and break-out was, contrary to the allegation of the appellant, not solved by document E2, since good galling resistance and corrosion protection could only be achieved with the re-application of compound grease prior to each make-up operation. Thus the problem to be solved over document E2 was to avoid the need to use compound grease, including the avoidance of repeated application, whilst maintaining galling resistance and

rust-preventing properties even without such reapplication.

It would not have been obvious on the basis of the teaching of document E5 to combine the lower zinc or zinc alloy layer of document E2 with an upper layer of solid lubricant in order to solve this problem. According to document E5, the surface conditions onto which the lubricating coating was applied had a significant effect on the final behaviour of the coating. This was clear from the background art section of this document as well as the discussion at column 7, lines 55 to 67, and at column 9, line 57, to column 10, line 18. The inventors found that providing a phosphate chemical formation layer as a surface pre-treatment under the solid lubricant coating provided maximum lubricity. The entire disclosure made clear that the surface treatment underlying the solid lubricant coating was of primary importance in determining the ultimate behaviour of the lubricant. It was not obvious to the person skilled in the art that the combination of a solid lubricant with a different lower layer than the phosphate chemical formation layer taught in document E5 could provide satisfactory results. Hence it was only with hindsight that it was possible to see that a solid lubricant as taught in document E5 could be used on top of a porous zinc or zinc alloy lower layer as taught in document E2. The person skilled in the art would not have made that combination, since document E5 taught away from such combination. Even if the person skilled in the art starting from document E2 would have considered document E5 he would have adopted not only the solid lubricant coating layer known from document E5, but also the pre-treatment method taught in connection with that solid coating, since the whole

teaching of document E5 strongly discouraged use of a solid coating with any other pre-treatment.

The appellant submitted that both document E2 and document E5 relied on the porosity of the lower layers, and therefore could be combined. However, the structure of a blast-plated zinc layer was different from that of a manganese phosphate layer. The porous zinc layers of document E2 were created by blasting particles of zinc at the surface to be coated, which were partially melted by the action of the heat generated at the time of impingement of the particles to the substrate (column 5, lines 18 to 37, page 6, lines 13 to 19, and Figure 4). The resulting structure was a porous plated layer of zinc particles. In contrast, the surface preparation manganese phosphate layers of document E5 were created by crystalline growth of a phosphate, an inorganic salt. The resulting crystals were typically acicular in form, or in massive or plate-like form. Thus the surface structure of a phosphate layer had an irregular crystalline surface with voids within the crystal structure.

Document E5 in combination with document E2

The difference between the present invention and the disclosure of document E5 was the use of a lower porous zinc or zinc alloy layer as the lower layer to be provided under the solid lubricating coating, instead of the manganese phosphate layer of document E5. The present invention solved the problem stated in paragraph [0015] of the patent. It was clear from Table 5 and paragraph [0113] of the patent, that galling resistance and rust prevention of a threaded joint according to the invention were markedly better than the threaded joint of comparative Example 1, which

had a lower manganese phosphate layer such as the one in document E5. The problem to be solved over document E5 could be defined as the provision of a lubricating system having improved resistance to galling in repeated make-up and break-out operations, without the application of lubricant prior to each make-up operation. As explained above, the whole teaching of document E5 strongly discouraged use of any other pre-treatment than a manganese phosphate coating. Thus, in the light of this teaching, it would not be obvious to the skilled person that the use of a lower zinc or zinc alloy layer known from document E2 instead of the manganese phosphate layer of document E5 would provide even a comparable galling resistance, let alone an improvement. There was no suggestion in document E2 that the effectiveness of the blast-plated porous zinc or zinc alloy layer in combination with a liquid lubricant with respect to galling reduction could also be achieved using a solid lubricant. Thus the subject-matter of the present claims was not obvious in view of document E5 in combination with document E2, and did involve an inventive step.

Reasons for the Decision

1. The appeal is admissible.

MAIN REQUEST

2. *Sufficiency of disclosure*

The last part of claim 1 of the main request reads "wherein the mating surface of at least one of the pin and the box is coated with a lower porous zinc or zinc alloy layer having a surface roughness of from 5 to 40

µm indicated by R_{max} and an upper lubricating coating which is a solid lubricating coating".

Methods and apparatus for forming a lower porous zinc or zinc alloy layer on the mating surface of a threaded joint are described in paragraphs [0030] and [0031] of the patent as amended, eg an impact or blast plating method in which particles are blasted by use of compressed air or a rotating blade. Particles suitable for use in blast plating are described in paragraphs [0032] to [0034] of the patent as amended. The surface roughness of said layer may be controlled by the diameter or coating thickness of the particles to be blasted and the blasting velocity, cf paragraph [0039] of the patent as amended. Methods for forming a solid lubricating coating on the lower porous zinc or zinc alloy layer are described in paragraph [0040] of the patent as amended. Suitable solid lubricating coatings are described in paragraphs [0041] to [0053] of the patent as amended. It may be noticed that the technical terms "porous zinc or zinc alloy layer" and "solid lubricating coating" are well-known in the art, see for example the abstracts of documents E2 and E5, respectively.

It follows that the claimed invention is disclosed in the patent in suit in a manner sufficiently clear und complete for it to be carried out by a person skilled in the art, Articles 100(b) and 83 EPC 1973.

3. *Ground for opposition under Article 100(a) EPC 1973 in combination with Article 56 EPC 1973*

3.1 The invention relates to threaded joints for steel pipes and particularly for oil well pipes which have improved galling resistance, rust-preventing properties

and gas tightness, after having been subjected to repeated make-up and break-out operations, and which can be used in a high temperature environment without the need to apply a liquid lubricating grease containing a heavy metal powder such as a compound grease, cf paragraphs [0001], [0015] and [0016] of the patent as amended. The problem as set out in paragraphs [0015] and [0016] of the patent as amended is solved by the subject-matter of claim 1 of the main request.

In particular, the patent proposes a threaded joint for steel pipes, wherein a mating surface is coated with a lower porous zinc or zinc alloy layer having a surface roughness in the claimed range and an upper solid lubricating coating.

It is clear from the description of the patent that a surface treatment consisting of coating a mating surface with a lower porous zinc or zinc alloy layer was known in the art of threaded joints for oil well pipes (see paragraph [0008] of the patent, citing document E2) and that the provision of an upper solid lubricating coating was also known in the art (see paragraphs [0012] and [0013] of the patent). The combination of the claimed features is however new.

3.2 Document E2

Document E2 relates to an oil well threaded pipe joint having improved resistance to galling, adequate sealing at high temperatures and corrosion resistance, after being repeatedly subjected to connection and disconnection of the joint. This document discloses particularly a pipe joint suitable for steel pipes (column 7, line 3) comprising a blast-plated layer of soft metal particles at least on the surface of a metal

sealing portion (column 1, lines 7 to 13). The pin-box type joint shown in Figure 1 has an externally threaded portion 10 and an unthreaded sealing portion 12. In the preferred embodiment described in column 4, lines 23 to 39, the blast-plated layer of soft metal particles is porous and the blasting particles having an iron or an iron-alloy core covered with zinc or a zinc alloy, with an iron-zinc alloy layer intervening therebetween (henceforth referred to as blast-plated zinc or zinc-alloy layer), see eg claims 1, 4 to 7, and claim 10, column 4, lines 36 to 39, Figure 2, and column 4, lines 53 to column 5, line 3. The surface roughness of the blast-plated layer by means of an air blasting device or a mechanical blasting device lies in the range of 3 to 30 µm or 5 to 30 µm, respectively (see Table 4).

In the description of the preferred embodiment (see above, column 4, lines 39 to 43) it is stated that "a conventional lubricant, e.g., a grease-based thread compound containing powders such as graphite, lead, zinc, and copper powders (API BUL 5A2, for example) are impregnated into the porous layer."

Document E2 discloses therefore all the features of claim 1 of the main request with the exception of the last half-sentence of said claim, viz "[is coated with ...] and an upper lubricating coating which is a solid lubricating coating".

3.3 Document E5

Document E5 relates to a joint for steel pipe having high galling resistance, good sealing performance without using liquid lubricant such as compound grease, and corrosion resistance, even after the joint has been repeatedly fastened and unfastened, and to a surface

treatment thereof (column 1, lines 6 to 18, and column 3, lines 51 to 62). The surface treatment consists of (see eg Abstract, column 4, lines 34 to 52) providing a manganese phosphate chemical formation coating layer of 5 to 30 µm thickness on a thread portion and a metallic sealing portion of the joint of steel pipe, or alternatively providing a nitriding layer of 1 to 20 µm thickness in combination with a manganese phosphate chemical formation coating layer of 5 to 30 µm thickness coated thereon (both options are henceforth referred to as a "chemical formation coating"), and a coating of a solid lubricant containing powder of molybdenum disulfide or tungsten disulfide and also containing an epoxy, furan or polyamideimide resin.

The disadvantages of using compound grease as a lubricant mentioned in document E5 include (see column 2, lines 48 to 64) environmental problems caused by heavy metal contained in compound grease and a deterioration of the performance of compound grease after repeated fastening and loosening of a threaded joint.

Document E5 discloses therefore all the features of claim 1 of the main request with the exception of the penultimate half-sentence of said claim, viz "wherein the mating surface of at least one of the pin and the box is coated with a lower porous zinc or zinc alloy layer having a surface roughness of from 5 to 40 µm indicated by R_{max}". It may be noticed that the surface roughness R_M of the manganese phosphate chemical formation coating layer lies in the range of 3 to 30 µm, ie within the claimed range for the lower porous zinc or zinc alloy layer of the invention (column 13, lines 37 and 38).

3.4 Would the person skilled in the art have combined the teachings of documents E2 and E5?

Each of the documents E2 and E5 provide a different solution to the problem of providing a threaded joint for steel oil well pipes having good galling resistance, good sealing performance and good corrosion resistance, after being repeatedly subjected to make-up and break-out of the joint. Both solutions have in common that the mating surface of the threaded joint is first coated with a corrosion inhibiting layer ("lower layer"), which layer is then coated with a lubricant (a conventional lubricant such as a compound grease in document E2 and a solid lubricant in document E5). In both documents the lower layer is capable of retaining the lubricant layer, and the surface roughness lies in the same range of 3 to 30 µm. More particularly, in document E2 it is stated (see column 3, lines 1 to 3): "The blast plating has a porous structure with improved ability to retain a lubricant, so that the resistance to galling is markedly improved" and in document E5 it is mentioned that a large number of voids are generated on the chemical formation layer which entrap a large amount of the solid lubricant coating layer (column 16, lines 61 to 66).

The teaching of document E2 is very specific: use a blast-plated zinc or zinc-alloy coating with a conventional lubricant. The coating obtained by the mechanical plating ("MP") process known from document E2 (see column 4, line 65, to column 5, line 6), which is referred to as MP film, is shown in Figure 4, and described in column 6, lines 13 to 19, as follows: "Minute pieces 40 of an iron-zinc alloy are piled one over another on the surface of a steel member 42. The MP film is generally porous, and a lubricant (not

shown) may be retained in such porous portions of the film when used". The teaching of document E5 is also very specific: use a chemical formation coating with a solid lubricant. While both the blast-plated zinc or zinc-alloy coating of document E2 and the chemical formation coating of document E5 are capable of retaining the lubricant layer, there is a qualitative difference between the porosity of blast-plated coating of document E2 and the voids of the chemical formation coating of document E5, which underlines the statement above, that the teachings of documents E2 and E5, notwithstanding certain similarities, are different.

A person skilled in the art starting from document E2, will be aware of document E5 and the remarks therein about the disadvantages of using compound grease. However, the teaching of document E5 is not merely to provide a coating of a solid lubricant to the metal surface of the threaded joint that has been treated with any surface treatment, the use of solid lubricant is solely disclosed in combination with a manganese phosphate chemical formation coating layer, preferably with a nitriding layer as a first layer, on the metal surface of the threaded joint.

Conversely, a person skilled in the art starting from document E5, will be aware of document E2 and its proposal to provide a blast-plated zinc or zinc-alloy layer on the metal sealing portion of a threaded joint in combination with a compound grease. He or she will not adopt the teaching of document E2 to use a blast-plated zinc or zinc-alloy layer, since that would go against the teaching of document E5, namely using a manganese phosphate chemical formation coating layer.

The argument of the appellant that the person skilled in the art would consider to replace the compound grease taught by document E2 by the solid lubricant known from document E5, is therefore, in the judgment of the board, based on hindsight with knowledge of the invention.

It follows that a person skilled in the art starting from document E2 or E5 would not arrive at the invention claimed in claim 1 of the main request.

The subject-matter of claim 1 of the main request is therefore not obvious to the person skilled in the art and therefore involves an inventive step. The same conclusion applies to the remaining claims of the main request, all of which depend on claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Meyfarth M. Poock

Decision electronically authenticated