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**Datasheet for the decision
of 18 April 2018**

Case Number: T 2387/13 - 3.2.05

Application Number: 07846449.2

Publication Number: 2092228

IPC: F16L11/12, F16L11/16

Language of the proceedings: EN

Title of invention:

A flexible pipe

Patent Proprietor:

National Oilwell Varco Denmark I/S

Opponent:

Technip France SA

Relevant legal provisions:

EPC Art. 54(1), 56

RPBA Art. 12(4)

Keyword:

Admissibility of auxiliary request 9 (yes)

Novelty (yes)

Inventive step (no; all requests)

Decisions cited:

G 0001/15

Catchword:

Partial priority for a "generic 'OR' claim" (see point 2.1.1)

No implicit disclosure of possible use (see point 2.1.2)



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Case Number: T 2387/13 - 3.2.05

D E C I S I O N
of Technical Board of Appeal 3.2.05
of 18 April 2018

Appellant: National Oilwell Varco Denmark I/S
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 28 October 2013
revoking European patent No. 2092228 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairman M. Poock
Members: O. Randl
G. Weiss

Summary of Facts and Submissions

I. The patent proprietor filed an appeal against the decision of the opposition division revoking European patent No. 2 092 228 (hereinafter referred to as "the patent").

II. The opposition division *inter alia* considered the following documents:

D1: WO 2008/077409 A1;

D2: US 4,364,418;

D3: WO 02/01104 A1;

D8: A. Felix-Henry et al, "Flexible Risers Technologies in Deepwater and Ultra Deepwater. The Integrated Production Bundle", Paper presented at the Global Offshore 2003 conference;

D9: A. Felix-Henry et al "Flexible Pipes In-Service Monitoring", Proceedings of OMAE 2004, 23rd International Conference on Offshore Mechanics and Arctic Engineering; 20-25 June 2004, Vancouver, Canada;

D11: M. Andersen et al., "Development of an Optical Monitoring System for Flexible Risers", Paper prepared for presentation at the 2001 Offshore Technology Conference held in Houston, Texas, 30 April - 3 May 2001;

D12: WO 02/088659 A2.

The division found claim 1 as granted not to be new over the disclosure of documents D1 and D2. According to the opposition division, claim 1 of auxiliary request 1 lacked novelty over document D1, whereas claim 1 of auxiliary requests 2 to 8 lacked novelty over document D2.

III. The oral proceedings before the board took place on 18 April 2018.

IV. The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (main request) or in amended form on the basis of auxiliary request 9, both requests submitted with the statement setting out the grounds of appeal.

Auxiliary requests 1 to 8 had been filed together with the statement of grounds of appeal but were withdrawn in the course of the oral proceedings before the board.

V. The respondent (opponent) requested that the appeal be dismissed.

VI. Claim 1 of the patent as granted (main request) reads as follows (the feature references proposed by the appellant are given in square brackets):

"1. [F0] A flexible pipe comprising [F1] a plurality of layers surrounding a longitudinal axis and [F2] an at least partly integrated sensor arrangement, [F3] said plurality of layers comprising an internal sheath and one or more armouring layers, [F4] at least one armouring layer comprising at least one folded metal strip helically wound around said longitudinal axis of the pipe, [F5] at least a part of said sensor arrangement being placed in a fold of said folded metal strip."

Claim 14 of the patent as granted reads:

"A flexible pipe as claimed in any one of the preceding claims, wherein at least a part of said sensor

arrangement is fixed in at least one fold of said folded metal strip, at least a part of said sensor arrangement preferably being fixed along the major part of the length of said folded metal strip and/or at least a part of said sensor arrangement being fixed at a plurality of fix points along the length of said folded metal strip, said sensor arrangement is for example fixed by clamping provided by said folded metal strip and/or by gluing."

Claim 1 of auxiliary request 9 differs from claim 1 of the main request by the addition of the feature "wherein said sensor arrangement comprises an optical fibre, said optical fibre being placed in a fold of said folded metal strip".

VII. The appellant (patent proprietor) argued as follows:

(a) Main request

(i) Claim interpretation

"Sensor arrangement" should be interpreted according to paragraph [0006] of the patent as encompassing a sensor and possibly transmission lines. If transmission lines as such were meant to be sensor arrangements, paragraph [0006] would have been drafted differently ("or" instead of "and"). The definition of "sensor" given by the Oxford English Dictionary appears to be fully satisfactory. The sensor arrangement needs to be at least partly integrated (see paragraph [0055]); full integration is not mandatory. Paragraph [0035] ("... may be arranged ...") only discloses a preferred way of arranging the sensor.

If the interpretation of the respondent were to be adopted, virtually any object (e.g. a sheet of paper that tears when a certain stress is applied) would qualify as a sensor.

(ii) Novelty

Claim 1 is new over the cited prior art.

The subject-matter of claim 1 is new over document **D1** because the priority is valid for the parts that are common to claim 1 and document D1.

The subject-matter of claim 1 also differs from document **D2**, on two counts:

- There is no sensing in the device of document D2. The electric line is a transmission line (col. 2, line 13) required for flexodrilling and does not qualify as a sensor (see Abstract). A strain gauge measures the strain where it is fixed; the electric line of document D2, however, is not fixed to the layer. The fact that a line does not conduct electricity when it is broken does not make it a sensor.
- The casing shaped wire that receives the electrical line is arranged between wires and does not form part of the armouring layer (see col. 1, lines 46-51). A wire that is not fixed to the end of the pipe and which only lies passively within the sheathing layers 7 and 8 of the tube (see Fig. 2) cannot be said to be part of the armouring layer.

The subject-matter of claim 1 also differs from document **D3**:

- The optical fibres and the electrical cable mentioned in the last paragraph of document D3 are said to transport a signal, supply an underwater installation or heat something; there is no disclosure of any sensing.
- As can be seen from Fig. 8 of document D3, the fibre or line is not part of the armouring layers but is lying freely therein.

(iii) Inventive step

The skilled person starting from document D12 and seeking an alternative solution would consider documents related to sensors. He would refrain from consulting documents using different technologies. Any objection built on such documents is necessarily built on hindsight. Documents D2 and D3 are not about sensing and should, therefore, not be considered. The sensor arrangement is already well protected in the embodiment according to document D12; there is no reason to go to document D2.

(b) Auxiliary request 9

(i) Admissibility

The appellant filed auxiliary request 9 together with its statement of grounds of appeal and asked the board to maintain the patent on the basis of this request. The board understands this to be an implicit request for admission of auxiliary request 9. The appellant did not provide any

reasons why the request was not filed during the first instance proceedings.

(ii) Inventive step

Claim 1 of auxiliary request 9, which comprises the additional feature of granted claim 2, involves an inventive step. Document D2 is silent on optical sensors or fibres. Therefore, the skilled person starting from document D12 would not consider document D2.

Document D3 deals with a different way of reinforcing pipes. The skilled person would not be guided by its very last paragraph. So the skilled person would neither consider this document nor find an appropriate solution in it, all the more as the optical sensor is not integrated in the device disclosed in document D3, but merely lies therein.

Contrary to the assertion of the respondent, document D12 does not disclose the additional feature.

VIII. The respondent (opponent) argued as follows:

(a) Main request

(i) Claim interpretation

The definition of "sensor" given by the Oxford English Dictionary does not express the technical reality of the patent or the relevant state of the art.

According to paragraph [0006] of the patent, the expression "sensor arrangement" encompasses both sensors and transmission lines. Consequently, an optical fibre or an electric line as such constitutes a optical sensor. According to paragraph [0031], a sensor arrangement can be incorporated into the armouring layer (see paragraph [0043]), whereas the instrumentation is situated outside the flexible pipe. Paragraph [0035] presents the connection to a read-out element as a mere possibility ("... may be arranged ..."). Therefore, a sensor does not have to be part of a detection device in order to form a sensor arrangement.

This understanding also corresponds to the disclosure of the relevant state of the art, such as document D11.

(ii) Novelty

Claim 1 lacks novelty over documents D1, D2, and D3.

The electric line disclosed in document **D2** (col. 1, lines 35-37) can be used as a sensor via the electrical resistance of the wire. Paragraph [0005] of the patent mentions strain gauges in which "the electrical resistance in a conductor is changed by a mechanical impact". Also, the fact that the conduit is sectioned can be detected by monitoring the resistance of the electric line. According to the definition of a sensor arrangement in paragraph [0006] of the patent, an electric line qualifies as a sensor arrangement.

It is not correct that document D2 only deals with flexodrilling; flow lines are explicitly envisaged (col. 1, line 10).

When asked by the board what the disclosed use of the lines of document D2 was, the respondent mentioned electrical transmission (col. 2, line 13), but pointed out that the lines had the same structure as the strain gauges mentioned in the patent.

Document D2 clearly discloses that the casing-shaped wires are part of the sheathing layers 7 and 8 of Fig. 2 (see col.2, lines 33-35).

The optical fibre disclosed in document **D3** constitutes a sensor arrangement. Even an ordinary optical fibre can be used to detect temperature and stress differences. In this context, the respondent referred to paragraph 4.3 of document D8, which discusses optical fibre temperature monitoring (DTS), and the last paragraph of the right-hand column on page 2 of document D9. Sensing by means of optical fibres corresponds to one of the embodiments disclosed in the patent (see the reference to Rayleigh, Raman and Brillouin scattering in column 5, lines 23-26 of the patent). As soon as light is introduced into an optical fibre, there is backscattering, which may be used to obtain information on the physical condition of the guide and its surroundings. This is precisely how an optical sensor (mentioned in the patent: col.5, line 30 and col. 6, line 36) works. Moreover, the optical guide can also be used for detecting whether the conduit has been sectioned.

(iii) Inventive step

Document D12 is the closest prior art. The objective technical problem is to provide an alternative device offering good protection to the sensor arrangement. The skilled person starting from document D12 and faced with the objective technical problem would have considered documents D2 and D3. He would be aware that the sensor can comprise transmission lines, for both powering the sensor and transmitting the sensor signal. When seeking alternatives, the skilled person would not limit his search to sensors, but would also consider related systems, and in particular transmission lines. Thus he would become aware of document D2, which deals with electrical transmission lines (see col. 2, line 13). He would realise that he could protect the sensor arrangement by following the teaching of document D2. If the sensor is located inside the casing-shaped wires, it is protected in a very efficient way.

The same holds true for optical sensors. The skilled person seeking an efficient way of protecting the optical fibre used to transmit the signal would be aware of document D3, which discloses that the fibre may be inserted in the corrugated parts of the strap. This arrangement has the advantage of simplicity of manufacture.

Thus the skilled person starting from document D12 and implementing the solution proposed by documents D2 and D3 would reach the claimed solution in an obvious way.

(b) Auxiliary request 9

(i) Admissibility

The board should not admit this document because the appellant could and should have filed it during the first instance proceedings.

(ii) Inventive step

Document D12 already discloses the use of an optical fibre (see page 21, lines 25-29 and Fig. 4). Therefore, the subject-matter of claim 1 differs from document D12 by the same features as claim 1 of the main request. It should be held to be obvious for the same reasons as apply to claim 1 of the main request. It lacks inventive step over documents D12 and D2 (or D3, which explicitly considers optical fibres) in combination.

Reasons for the Decision

1. Claim interpretation

1.1 "Sensor"

There is no proper definition of the term "sensor" in the patent. Therefore, the general meaning of the term, especially in the field of the patent, has to be considered.

The Oxford English Dictionary defines a sensor as "a device which detects or measures physical properties or changes and provides a corresponding output or measurement in response".

A similar definition is given by the Merriam-Webster Dictionary, which defines this term as "a device that responds to a physical stimulus (such as heat, light, sound, pressure, magnetism, or a particular motion) and transmits a resulting impulse (as for measurement or operating a control)".

Having considered these different attempts to define the concept of "sensor" and the common understanding of the word in the field of physical measurements, the board has concluded that the skilled person would understand a sensor to be a device that responds to a physical stimulus and provides some corresponding output.

1.2 "Sensor arrangement"

Paragraph [0006] of the patent states: "Sensors and possible transmission lines of sensors will hereinafter be referred to as sensor arrangements" (underlining added by the board).

The respondent appears to have understood this sentence to mean that both sensors and transmission lines of sensors constitute sensor arrangements within the meaning of the patent.

The board finds it difficult to endorse an interpretation that would lead to the conclusion that a sensor arrangement does not have to comprise a sensor, but that transmission lines as such also constitute a sensor arrangement.

The board rather understands the expression "sensors and possible transmission lines of sensors" as being

equivalent to "sensors, possibly in combination with transmission lines". In other words, a "sensor arrangement" within the meaning of the patent necessarily comprises a sensor, but it may also comprise transmission lines needed for powering the sensor and/or collecting its output.

The board does, however, agree with the respondent that a "sensor arrangement" within the meaning of the patent does not have to comprise instrumentation allowing the sensor output to be transformed into meaningful physical values.

2. Main request

2.1 Novelty

2.1.1 Novelty over document D1

International patent application D1 was filed on the same day as the international application on which the opposed patent is based and which is hereafter referred to as D0. Both applications claim the priority of Danish application D1a of 22 December 2006, the content of which is identical to the content of document D1. Application D0 also claims the priority of a second Danish application, D0a, of 23 August 2007, the content of which is identical to the content of D0.

Under these circumstances, regardless of the precise contents of the various applications under consideration, document D1 cannot destroy the novelty of claim 1, for the following reasons:

Generally speaking, claim 1 may encompass both subject-matter that is disclosed in document D1a (and,

therefore, also in document D1) and subject-matter that is not. Subject-matter covered by claim 1 that is disclosed in document D1a will be referred to as part "A", and subject-matter covered by claim 1 that is not disclosed in document D1a will be referred to as part "B". Depending on the actual contents of claim 1 and document D1a, either part A or part B may be empty, but the present argument is valid irrespective of those contents. In any case, the sum of parts A and B forms the subject-matter of claim 1 of the patent. Claim 1 could therefore be rewritten as "A or B".

As the alternative is not explicit, claim 1 may be understood to constitute a "generic 'OR' claim" within the meaning of the decision G 1/15 of the Enlarged Board of Appeal (published in OJ EPO 2017, A82), i.e. "a claim encompassing alternative subject-matter by virtue of one or more generic expressions or otherwise".

According to decision G 1/15, part A cannot be refused the partial priority offered by priority document D1a. As a consequence, document D1 is not part of the state of the art within the meaning of Article 54(3) EPC for part A. Part B only benefits from the priority of application D0a. Consequently, document D1 is state of the art within the meaning of Article 54(3) EPC for part B. As a consequence, document D1 can only be used for the assessment of novelty, and cannot be considered when deciding whether there has been an inventive step within the meaning of Article 56 EPC. As document D1 does not disclose the subject-matter of part B (by definition; otherwise this subject-matter would be part of part A and not of part B), document D1 cannot destroy the novelty of claim 1.

2.1.2 Novelty over document D2

The parties disagreed on whether document D2 disclosed a device comprising a sensor arrangement.

It is undisputed that document D2 discloses a flexible tubular conduit comprising an electrical transmission line. There is no doubt that such a line could, under certain circumstances, be used as a sensor, i.e. a device that responds to a physical stimulus and provides some corresponding output (see point 1.1 above). If, for instance, the conduit is cut through, this would lead to a sharp increase in the resistance of the electric line. Thus, in response to the physical stimulus of disruption, the line provides the output of a strongly increased resistance, which can then be transformed into a disruption alert. In other terms, if the resistance of the line were monitored, the line could be said to constitute a "disruption sensor".

However, the mere fact that the disclosed line could be used as a sensor does not mean that a sensor is being disclosed. In order for such a use to be possible, there would have to be further installations, such as a unit for monitoring the electrical resistance of the line. Such installations are, however, not disclosed. As a consequence, the tubular conduit of document D2 as it stands cannot be said to comprise a sensor arrangement. It only comprises an electric line that could be used as part of a sensor arrangement. Document D2, however, does not suggest, let alone disclose such a use.

Thus document D2 does not directly and unambiguously disclose a tubular conduit comprising a sensor

arrangement. It follows that the subject-matter of claim 1 is new over the disclosure of document D2.

In view of this finding, there is no need for the board to determine whether there are further features that distinguish claim 1 from the disclosure of document D2.

2.1.3 Novelty over document D3

Document D3 does not disclose a "sensor arrangement" within the meaning of claim 1 either.

The board reaches this conclusion for the same reasons that have led it to conclude that document D2 does not disclose a sensor arrangement.

There is no doubt that document D3 teaches that secondary conductors such as an optical fibre or an electrical cable can be provided in the corrugated armouring structure (see page 6, lines 20-23). These elements could in principle be used as sensors, but in order for them to be used in that way, the conduit of document D3 would have to be adapted. The disclosed conduit as such is not equipped for sensing, and such a use is neither disclosed nor suggested.

Thus, document D3 does not directly and unambiguously disclose a tubular conduit comprising a sensor arrangement. It follows that the subject-matter of claim 1 is new over the disclosure of document D2.

In view of this finding, there is no need for the board to determine whether there are further features that distinguish claim 1 from the disclosure of document D3.

2.1.4 Conclusion

The subject-matter of claim 1 is new over the disclosure of the prior art cited by the respondent.

2.2 Inventive step

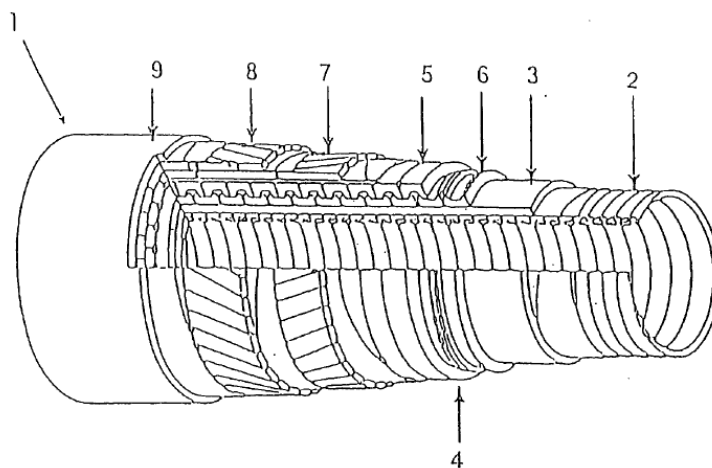
The board uses the problem/solution approach when assessing whether the subject-matter of claim 1 involves an inventive step.

2.2.1 Closest prior art

The respondent considered document D12 to be the most promising starting point. The board is satisfied that this document is indeed a reasonable starting point for the assessment of inventive step.

2.2.2 Differences

Document D12 discloses a tubular pipe comprising helically wound tensile reinforcement layers 7 and 8.



A sensor arrangement 16a such as an optical fibre or an electrical conductor that is connected to a strain gauge (page 21, lines 20-31 and page 22, lines 21-23) is provided in a groove of the tensile reinforcement profile (see Fig. 2).

In its communication pursuant to Article 15(1) RPBA, the board set forth its provisional opinion that claim 1 differs from the disclosure of document D12 in that:

- the armouring layer comprises a folded strip (rather than a wire); and
- the sensor is arranged in a fold of this strip (rather than in a groove).

This was not contested by the parties.

2.2.3 Objective technical problem

In paragraph [0010] of the patent, which follows the paragraph mentioning the U.S. patent based on document D12, the object of the invention is stated to be "to provide an alternative flexible pipe with integrated sensor arrangement". This appears to be a suitable technical problem. It is also a realistic problem, because the skilled person may need to "work around" a patented solution.

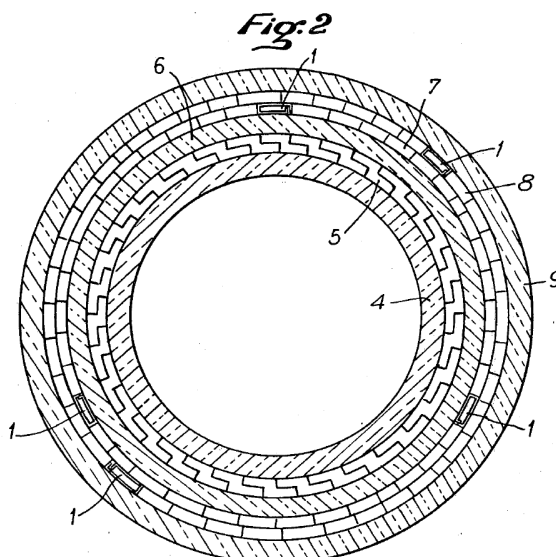
The appellant added that the alternative flexible pipe should have an armouring layer that is not weakened with respect to the one of document D12. The board accepts that the skilled person would aim at maintaining the strength of the known flexible pipe.

2.2.4 Obviousness

The skilled person considering the pipe of document D12 and seeking to define an alternative embodiment is aware of the flexible tubular conduits of the state of the art, such as the one disclosed in document D2.

The appellant argued that the skilled person would not consider document D2, because it does not disclose the use of sensor arrangements. This argument is unpersuasive, because the skilled person looking for alternatives would consider the whole technical field. He would only disregard flexible pipes the structure of which would make the use of integrated sensor arrangements impossible.

The conduit of document D2 has an armouring layer (formed by sheathing layers 7 and 8) that is structurally very similar to the tensile reinforcement layers 7 and 8 of the pipe of document D12:



Document D2 teaches the skilled person to provide caisson-shaped wires 1 in the sheathing layers (col. 1,

lines 46-51), so that they can accommodate electrical transmission lines (col. 2, lines 11-17).

The skilled person would understand this teaching to be applicable without major difficulty to the device of document D12. He would realise that the electrical lines or optical guides of the sensor arrangement of document D12 could be enclosed in caisson-shaped wires provided in the armouring layers 7 and 8 in the same way as in document D2.

When implementing the teaching of document D2 into the device of document D12, the skilled person would, therefore, obtain a flexible pipe having all the features of claim 1 of the patent.

As a consequence, the subject-matter of claim 1 cannot be said to involve an inventive step, and the board cannot grant the appellant's main request.

3. Auxiliary request 9

3.1 Admissibility

Auxiliary request 9 was filed for the first time together with the statement of grounds of appeal. In application of Article 12(4) RPBA, the board has the power to hold inadmissible requests which could (and should) have been presented in the first instance proceedings.

The board has decided not to make use of its power under Article 12(4) RPBA, because claim 1 of the auxiliary request only differs from claim 1 of the main request by the addition of the feature of claim 2 as granted, which the respondent had already attacked in

its notice of opposition. The amendment does not create a completely new case. Moreover, the request was filed at the very beginning of the appeal, so that the respondent had sufficient time to consider the request and develop appropriate attacks.

As a consequence, auxiliary request 9 is admitted.

3.2 Remittal to the department of first instance

On page 19 of its response to the statement of grounds of appeal, the respondent asked the board to remit the case to the department of first instance should it admit auxiliary request 9. This request was not reiterated at the oral proceedings before the board. Considering the duration of the opposition and appeal proceedings (the notice of opposition was filed in November 2011) and for the sake of procedural efficiency, the board has decided not to remit the case and to proceed with the examination of inventive step involved in claim 1 of auxiliary request 9.

3.3 Inventive step

3.3.1 Closest prior art

Document D12 is considered to be the closest prior art for claim 1. This was not contested by the parties.

3.3.2 Differences

Document D12 also discloses a sensor arrangement comprising an optical fibre as an alternative to an electrical conductor.

As a consequence, claim 1 of auxiliary request 9 differs from the teaching of document D12 by the same features as claim 1 of the main request.

3.3.3 Obviousness

Claim 1 of auxiliary request does not, therefore, involve an inventive step over the disclosure of documents D12 and D2 in combination, for the same reasons as apply to claim 1 of the main request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



D. Meyfarth

M. Poock

Decision electronically authenticated