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Datasheet for the decision of 6 August 2013

Case Number: T 0333/09 - 3.2.05

Application Number: 03744325.6

Publication Number: 1494845

IPC: B29C 47/02

Language of the proceedings: EN

Title of invention:
Process for the production of a polymer layer of a flexible offshore pipe

Patent Proprietor:
National Oilwell Varco Denmark I/S

Opponent:
Technip France

Headword:
-

Relevant legal provisions:
RPBA Art. 13(3)

Relevant legal provisions (EPC 1973):
EPC Art. 56

Keyword:
"Inventive step - no"
"Late filed request - not admitted"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0333/09 - 3.2.05

D E C I S I O N
of the technical board of appeal 3.2.05
of 6 August 2013

Appellant: (Opponent)
Technip France
6-8, Allée de l'Arche
Faubourg de l'Arche
ZAC Danton
F-92400 Courbevoie (FR)

Representative:
Didier Bertrand
S.A. Fedit-Loriot
38 Avenue Hoche
F-75008 Paris (FR)

Respondent: (Patent Proprietor)
National Oilwell Varco Denmark I/S
Priorparken 480
DK-2605 Brøndby (DK)

Representative:
Anette Hegner
Hegner & Partners A/S
Banemarksvej 50
DK-2605 Brøndby (DK)

Decision under appeal: **Decision of the opposition division of the European Patent Office posted 9 December 2008 rejecting the opposition filed against European patent No. 1494845 pursuant to Article 101(2) EPC.**

Composition of the board:

Chairman: M. Poock
Members: H. Schram
M. J. Vogel

Summary of Facts and Submissions

I. On 4 February 2009 the appellant (opponent) lodged an appeal against the decision of the opposition division posted on 9 December 2008, by which its opposition against European patent No. 1 494 845 was rejected. The appeal fee was paid at the same day and the statement of grounds was filed on 2 April 2009.

II. In a communication dated 19 April 2013 annexed to the summons to attend oral proceedings, the attention of the parties was drawn to Articles 12(2) and 13 of the Rules of Procedure of the Boards of Appeal (RPBA).

III. Oral proceedings were held before the board of appeal on 6 August 2013.

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

The respondent (patent proprietor) requested that the appeal be dismissed, or auxiliary that the decision under appeal be set aside and that the patent be maintained on the basis of claims 1 to 35 filed as auxiliary request during the oral proceedings.

V. The documents referred to in the appeal proceedings included the following:

A2 US 6,106,761;
A5 US 5,918,641;
A7 EP-A 0 087 344;
A11 WO 01/38060.

VI. Claim 1 of patent as granted reads as follows:

"1. A process for the production of a flexible unbonded offshore pipe comprising at least one polymer layer with a layer thickness of at least 4 mm, said process comprising the steps of shaping said polymer layer from a polymer material comprising a polyethylene by extrusion into or onto a supporting unit in an extrusion station and cross-linking said extruded polymer material, characterised in that said polymer material comprises a peroxide for providing a cross-linking of the polymer material, said peroxide having an activation temperature of at least 5 °C above the temperature of the polymer material during the extrusion thereof, said cross-linking of said extruded polymer material being carried out by exposing the extruded polymer material to electromagnetic waves, with a wavelength of between 0.5 μm to 0.5 m."

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

Claim 1 of the patent in suit related to "[A] process for the production of a flexible unbonded offshore pipe comprising at least one polymer layer". This was the only place in the claim where the final product, a flexible unbonded offshore pipe, was mentioned, the remaining process steps related to the polymer layer itself. The feature "with a layer thickness of at least 4 mm" was added during the examination proceedings, it was not a critical feature. The claim did not require that the cross-linking took place while the polymer material was in contact with a supported unit (that was only required during the extrusion step). The first

characterizing feature, viz. said polymer material comprises a peroxide for providing a cross-linking of the polymer material, encompassed not only the Engels process but also the silane process, since in both processes peroxide was present in the polymer material as an initiator of the cross-linking step. The second characterizing feature, viz said peroxide having an activation temperature of at least 5 °C above the temperature of the polymer material during the extrusion thereof, was obvious, since the activation temperature of the peroxide had to be above the extrusion temperature in order to avoid that it would be destroyed in the extruder. The last characterizing feature, viz. ... exposing the extruded polymer material to electromagnetic waves, with a wavelength of between 0.5 μm to 0.5 m", defined an extremely broad range of electromagnetic radiation.

The problem to be solved with respect to the cited prior art could be summarized in one sentence, namely, how to cross-link the polymer material in the best possible way. A suitable starting point was document A2. This document related to a process for cross-linking of polymer material that was fast, see column 3, lines 9 to 26. It disclosed a process for the production of a pipe from polymer material comprising a peroxide for providing a cross-linking of the polymer material, which included the step of shaping of the material in/onto a supporting unit in an extruder and cross-linking the extruded pipe by exposing it to infrared radiation, preferably with a wave length of 1.2 μm (see column 6, lines 17 to 19, and claim 13), the same value as disclosed in a preferred embodiment in the patent in suit (see column 8, line 32). It was

obvious to the person skilled in the art to apply the process known from document A2 for producing a flexible unbonded offshore pipe comprising at least one polymer layer with a layer thickness of at least 4 mm (cf document A5) and to choose a peroxide having an activation temperature of at least 5 °C above the extrusion temperature (cf. documents A7 and A11) and thus to arrive at the invention. Another suitable starting point was document A11 which related to the silane process. This document, just like document A2, did not mention flexible unbonded offshore pipe as a possible application of the process described therein. The heating step for cross-linking the polymer was performed by means of infrared irradiation. As a suitable wavelength 1.2 μm was mentioned (see page 6, line 5), as in document A2. Document A5 could also be taken as a starting point. The subject-matter of claim 1 as granted was also obvious with respect to document A5 taken alone, or in combination with either document A2 or A11.

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

The problem of the invention was to provide a process for the production of a flexible unbonded offshore pipe comprising a polymer layer of polyethylene, which resulted in a high degree of cross-linking for tubes having a relatively thick wall, ie having a thickness of at least 4 mm. This problem was solved by the subject-matter of claim 1, in particular by using peroxide for providing a cross-linking of the polymer material and exposing the extruded polymer material to

heat in the form of electromagnetic waves, with a wavelength of between 0.5 μm to 0.5 m.

Document A5 was directed to the same purpose of the invention, namely a process of providing a polymer layer of cross-linked polyethylene for an unbonded offshore pipe, and represented the closest state of the art. The person skilled in the art received a clear teaching from this document that a process for producing large diameter tubes by chemical cross-linking using peroxides and heat as proposed by European patent application EP-A 0 087 344 (document A7) did not result in a workable process for producing offshore pipes, since that method required large quantities of heat, see the passage in column 2, lines 28 to 37, of document A5. According to said passage the chemical cross-linking method "has never been able to be implemented on an industrial scale for producing tubes made of polyethylene for high-performance flexible structures insofar as the increase in temperatures required for obtaining the cross-linking does not enable the tubes to support their own weight". Indeed, document A7 taught (see page 8, lines 1 to 6) very high cross-linking temperatures as compared to process known from document A5 (see column 6, lines 53 to 58). The person skilled in the art starting from the silane process of document A5 would therefore not consider a document relating to a chemical cross-linking process such as document A7 or A2. Document A2 related to the production of small water pipes with a good surface finish. The process known from this document was not suitable to produce a flexible unbonded offshore pipe with a thickness of at least 4 mm, since it required that the extruded

material was fully unsupported during contactless heating for providing a good surface finish (see column 3, lines 9 to 15, lines 21 to 26, and column 6, lines 25 to 30). That manner of heating was not possible for producing an offshore pipe. The person skilled in the art knew that the larger the diameter of the pipe and the thicker the wall, the larger was the risk of deforming the pipe. Document A11 related to the production of cables (see the examples on page 7, line 21ff), it did not disclose a process for the production of a flexible unbonded offshore pipe. For that reason it was not a suitable starting point for assessing inventive step. Since this document disclosed a silane cross-linking process (see title and claim 1) it also failed to disclose, as document A5, the first characterizing feature of claim 1 as granted. It followed from the above that the subject-matter of claim 1 as granted involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Ground for opposition under Article 100 a) EPÜ 1973 in combination with Article 56 EPÜ 1973*

2.1 The objects of the invention are described in paragraphs [0016] to [0018] of the patent in suit and include to provide a process for the production of a polymer layer of a flexible unbonded offshore pipe by extrusion of a polyethylene based polymer followed by cross-linking, which method is faster and less space demanding than known processes, cf. paragraph [0018].

In paragraphs [0010] to [0013] of the patent in suit a process known from European patent application EP 487 691 is described. In paragraph [0012] of the patent in suit is stated that the cross-linking step in known processes is often very cumbersome and time and space demanding. The preamble of claim 1 of the patent in suit is based on said European patent application.

2.2 The invention is based on a chemical cross-linking technology using peroxide as an initiator to generate free radicals, which in turn leads to cross-linking. In chemical cross-linking by the peroxide (Engel) method, the cross-linking takes place through direct carbon-to-carbon bonds. In contrast, the process known from the European patent application mentioned above is based on grafting a vinylsilane onto the polymer chain with small amounts of peroxide used as initiator, followed by hydrolysis to effect cross-linking (cf), and results in a different type of cross-linking of the polymer material, namely through -Si-O-Si- cross-links. The cross-linking and curing mechanisms of the peroxide and silane methods are totally different. The curing temperature for the peroxide method is high and the curing time short. For the silane process it is the other way around: the curing temperature is low and the curing time is long. In the judgment of the board, the person skilled in the art would interpret the first characterizing feature of claim 1 as granted, viz "said polymer material comprises a peroxide for providing a cross-linking of the polymer material", in the light of the patent specification as referring to the peroxide method. Said feature is therefore not considered to be known from said European patent application, and that

also applies to the remaining characterizing features of claim 1 as granted.

2.3 A process for the production of a flexible unbonded offshore pipe with all the features of the preamble of claim 1 as granted is known from document A5. This document, which is a family member of the European patent application mentioned in point 2.1 above, discloses a flexible pipe for transporting offshore live crude oil, which pipe has an extruded internal liner of cross-linked polyethylene. This liner is produced by a process involving peroxide-activated grafting a silane onto the polyethylene chain and cross-linking by hydrolysis (see column 3, line 45 to 65, and column 4, line 48 to column 5, line 37, and claim 1). In the examples of document A5, the duration of the cross-linking operation and/or of the operation at constant temperature is 48 hrs, 72 hrs, 96 hrs, 120 hrs and 240 hrs, and the thickness of the liner is between 5 and 10 mm, see column 20, line 15, to column 21, line 67.

2.4 The respondent has argued that document A5 should be considered as representing the closest prior art.

The subject-matter of claim 1 as granted differs from the process known from document A5 in that:

(i) said polymer material comprises a peroxide for providing a cross-linking of the polymer material,

(ii) said peroxide having an activation temperature of at least 5 °C above the

temperature of the polymer material during the extrusion thereof,

(iii) said cross-linking of said extruded polymer material being carried out by exposing the extruded polymer material to electromagnetic waves, with a wavelength of between 0.5 μm to 0.5 m.

2.5 The person skilled in the art, who starts from the process for producing a flexible unbonded offshore pipe known from document A5, would readily realize that the duration of the cross-linking process involving peroxide-activated grafting a silane onto the polyethylene chain and cross-linking by hydrolysis is prohibitively long.

When looking for a faster cross-linking process, he or she would consider document A2, which relates to a method for the uniform and fast heating of polymers or mixtures of polymers, inter alia to a method for cross-linking polymers, which are cross-linkable by means of heat, by means of infrared radiation, particularly to a method for the contactless cross-linking of mouldings of a cross-linkable polymer material in connection with the manufacture of the mouldings, especially in the manufacture of extruded tubes of polyethylene, see column 1, lines 6 to 15, and column 3, lines 9 to 22.

More particularly, this document discloses (see column 4, lines 6 to 48, column 6, lines 17 to 19, and claims 1, 8, 9 and 13) a process for the production of a pipe ("tube 4") made of polyethylene comprising a peroxide for providing a cross-linking of the polymer

material, with the steps of shaping of the material in/onto a supporting unit ("angled head 5") in an extruder 1 and cross-linking the extruded pipe by exposing it to infrared radiation with a wave length of eg 1,2 µm. It follows that features (i) and (iii) are known from document A2.

The respondent has argued that the person skilled in the art starting from the silane process known document A5, would not consider a document relating to a process for producing a pipe using the chemical cross-linking method (such as document A2), in view of the statement in document A5 that such a method required large quantities of heat and high temperatures, which did not enable the tubes to support their own weight (see the passage in column 2, lines 28 to 37, citing document A7).

However, the notional person skilled in the art referred to in Article 56 EPC 1973 is assumed to be aware of the totality of the prior art pertinent to the relevant area of technology and in particular of everything made available to the public within the meaning of Article 54(2) EPC 1973. Therefore, it is assumed that the person skilled in the art starting from document A5 is aware of documents A7 and A2 and is free to consider these documents using his own judgment.

The passage in column 2, lines 28 to 37, of document A5 reads as follows:

It is known from .. [A7] .. to improve the mechanical behaviour of polyethylenes, for large diameter tubes,

by chemical crosslinking using peroxides. The chemical crosslinking method requires large quantities of heat. It has never been able to be implemented on an industrial scale for producing tubes made of polyethylene for high-performance flexible structures insofar as the increase in temperatures required for obtaining the crosslinking does not enable the tubes to support their own weight.

Whilst document A7 is silent about the way the polymer to be cross-linked is heated, document A2 specifically concerns a method for heating and/or cross-linking of polymers by infrared radiation (cf claims 1 and 16). The smooth and uniform heating is used for cross-linking of extruded tubes and minimizes the risk that the tube is deformed, see column 6, lines 25 to 36. Document A2 is thus prima facie a relevant document that the person skilled in the art will not disregard solely on the basis of the above passage in document A5.

2.6 Choosing a peroxide with a decomposition temperature that is higher than the temperature of the polymer material in the extruder (cf feature (ii)) is self-evident to the person skilled in the art, since cross-linking should not start in the extruder (see for example document A7, page 8, lines 4 to 6, where it is stated that the cross-linking temperature is in general 20 to 100 °C higher than the highest extrusion temperature) and the peroxide should not degrade in the extruder (see for example document A11, page 6, lines 35 and 36).

2.7 Thus, in the judgment of the board, the person skilled in the art, starting from the process for producing a flexible unbonded offshore pipe known from document A5 and seeking to provide a faster cross-linking process, would have taken into account the teaching of document A2 and the general technical knowledge with a view to preventing a premature cross-linking in the extruder and would thus have arrived at the invention.

2.8 It follows that the subject-matter of claim 1 as granted is obvious to the person skilled in the art, and therefore does not involve an inventive step, Article 56 EPC 1973.

3. *Admissibility of the auxiliary request*

The auxiliary request was filed by the respondent during the oral proceedings after the chairman had announced that claim 1 as granted did not involve an inventive step. Up to that point in time the respondent had defended its patent solely only in its granted version throughout the opposition and appeal proceedings.

According to Article 13(3) RPBA, amendments sought to be made after oral proceedings have been arranged shall not be admitted if they raise issues which the board or the other party or parties cannot reasonably be expected to deal with without adjournment of the oral proceedings. The power of the board given to it according to Article 13(1) RPBA to exercise its discretion to allow amendments to a party's case after it has filed its grounds of appeal does not apply to the situation described in Article 13(3) RPBA.

Claim 1 of the auxiliary request is a combination of claims 1 and 2 as granted. This request shifts the focus to facts not previously discussed in the appeal proceedings. Moreover, the additional feature of claim 2 as granted, viz "[wherein] said extruded polymer material is exposed to electromagnetic waves for a sufficient time to thereby raise the temperature of the extruded polymer material at least to the activation temperature of the peroxide", appears already to be known from document A2. Consequently, the auxiliary request raises issues which the board and the appellant cannot reasonably be expected to deal with without adjournment of the oral proceedings.

Therefore the auxiliary request could not be admitted into the appeal proceedings.

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:

D. Meyfarth M. Poock