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Datasheet for the decision of 20 November 2014

Case Number: T 1128/10 - 3.3.05

Application Number: 04732993.3

Publication Number: 1625279

IPC: E21B33/13, C04B28/00

Language of the proceedings: EN

Title of invention:
SELF ADAPTIVE CEMENT SYSTEMS

Applicant:
Services Petroliers Schlumberger
SCHLUMBERGER TECHNOLOGY B.V.
Schlumberger Holdings Limited
Prad Research And Development Ltd

Headword:
SELF ADAPTIVE CEMENT\SCHLUMBERGER PRAD

Relevant legal provisions:
EPC Art. 84, 123(2), 54, 56
RPBA Art. 13

Keyword:
Main request - admitted (clearly allowable)
inventive step (yes) -
no need to reformulate the technical problem

Decisions cited:
G 0002/88, G 0001/03, T 1079/08, T 1634/09

Catchword:

Europäisches Patentamt
European Patent Office
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Case Number: T 1128/10 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 20 November 2014

Appellant: (Applicant 1)	Services Petroliers Schlumberger 42, rue Saint-Dominique 75007 Paris (FR)
Appellant: (Applicant 2)	SCHLUMBERGER TECHNOLOGY B.V. Parkstraat 83-89 2514 JG Den Haag (NL)
Appellant: (Applicant 3)	Schlumberger Holdings Limited P.O. Box 71, Craigmuir Chambers Road Town, Tortola (VG)
Appellant: (Applicant 4)	Prad Research And Development Ltd P.O. Box 71 Craigmuir Chambers Road Town Tortola (VG)
Representative:	Regimbeau 20, rue de Chazelles 75847 Paris Cedex 17 (FR)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 November 2009 refusing European patent application No. 04732993.3 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Raths
Members:	G. Glod
	C. Vallet

Summary of Facts and Submissions

I. The present appeal lies from the decision of the examining division to refuse European patent application EP 04 732 993.

II. The following documents were cited in the decision:

D1: US 5 456 751
D2: WO-A-0020350
D3: US 3 487 038
D4: US 6 656 263 B2
D5: US 3 558 335

III. With the statement of grounds of appeal the applicant (hereinafter "the appellant") submitted a main request corresponding to auxiliary request 2 as rejected by the examining division on the ground of lack of novelty and two auxiliary requests.

IV. In its communication under Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), the board raised objections under Articles 84, 123(2), 54 and 56 EPC for all requests. In addition

D6: US 5 779 787

was introduced into the proceedings.

V. By letter dated 9 October 2014, the appellant submitted a new main request and auxiliary requests 1 and 2.

D7: NF EN 196-3

was cited.

VI. Oral proceedings took place on 20 November 2014. After discussion of the case, the appellant submitted a new main request.

Claim 1 of the request is as follows:

"*1. Use of a material that reacts and/or expands in contact with a liquid or gaseous hydrocarbon as an additive into a cement composition, comprising a pumpable slurry of cement and water, to cause expansion of the set cement when the said set cement is contacted with liquid or gaseous hydrocarbon and wherein the material that reacts and/or expands in contact with liquid or gaseous hydrocarbon is ground rubber obtained by recycling tires, wherein the material has a granular dimension of less than 850 µm and is present at a concentration up to 40% by weight of the solid content of the cement slurry.*"

VII. The appellant requests that the decision of the examining division be set aside and that a patent be granted on the basis of the main request submitted during the oral proceedings on 20 November 2014.

Reasons for the Decision

1. Admissibility of the new main request

Since the main request was filed after the grounds of appeal had been submitted and even after oral proceedings had been arranged, it constitutes an amendment to the party's case within the meaning of Article 13 RPBA.

Thus, its admission is at the board's discretion, to be exercised inter alia in view of the complexity of the

new subject-matter, the state of the proceedings and the need for procedural economy. According to an approach frequently adopted by the boards (see T 1634/09, Reasons 3.2), a request filed at a very late stage in the proceedings (after oral proceedings have been arranged and the board has already given a preliminary opinion) may be admitted and considered at the board's discretion

(i) if sound reasons exist for filing this request so far into the proceedings,
(ii) if the request does not extend the scope of discussion,
(iii) if the request is clearly or obviously allowable.

Conditions (i) to (iii) are met, since the request is a reaction to the objections raised in the communication under Article 15(1) RPBA and further discussed during oral proceedings.

The scope of discussion has not been extended, since the subject-matter of the claim has been considerably restricted.

This request is clearly allowable, since it is immediately apparent that the amendments made successfully address the issue raised without giving rise to new ones. Therefore, it is admitted into the proceedings.

2. Article 123(2) EPC

Claim 1 is based on page 2, lines 7 and 8, lines 10 to 13 and lines 17 to 20, from which it is unambiguously derivable that granular particles having a dimension of less than 850 µm (see also original claim 10) of a

material including ground rubber amongst others can be used as an additive in a cement composition to cause expansion of set cement. Now the material has been limited to ground rubber. Furthermore page 3, line 27, discloses that ground rubber is obtained by recycling tyres. The concentration (*up to 40% by weight of the solid content of the cement slurry*) is unambiguously derivable from original claim 13.

Claim 2 is based on original claim 12.

Claims 3 and 4 are based on original claims 17 and 18.

Claim 5 is based on claim 20.

The requirements of Article 123(2) EPC are met.

3. Article 84 EPC

3.1 Claim 1 is now formulated as a use claim in accordance with G 2/88 ("use of a material [...] to cause expansion of the set cement when the said set cement is contacted with hydrocarbon[...]). In this respect the feature "to cause expansion of the set cement when the said set cement is contacted with hydrocarbon" is a functional technical feature of the claim (G 2/88, Reasons 10.3).

3.2 The expression "granular dimension of less than 850 µm" is deemed clear in the present context to a person skilled in the field of cement. The expression relates to ground rubber obtained by recycling tyres that are put in cement. The skilled person knows that in the field of cement and in the field of rubber tyres a sieve with a certain mesh size is used in determining the particle size distribution of a granular material.

This is also in accordance with example 1 of the application (page 6, line 3), D1 (D1: column 2, lines 37 to 55), example 1 of D2 (D2: page 4, line 32) and D6 (D6: column 3, lines 40 to 42).

The requirements of Article 84 EPC are met.

4. Article 54 EPC

4.1 As indicated above (point 3.1), "*to cause expansion of the set cement when the said set cement is contacted with hydrocarbon*" is a functional technical feature of the claim. Therefore it is to be taken into consideration when evaluating novelty for the subject-matter of claim 1.

4.2 D1 discloses compositions comprising cement and particulate rubber from recycled automobile tyres (column 2, lines 3 to 9). The inclusion of the rubber in the concrete mixture provides for a finished concrete composite having a lower density. It also provides a more ductile composite than conventional concrete. The rubber-containing concrete can also be utilised as a composite for noise barrier applications and also in applications requiring improved heat insulation, vibration dampening, toughness and impact resistance (D1: column 5, lines 16 to 28). **D1 does not disclose** that the rubber is used to cause expansion of the set cement when the set cement is contacted with hydrocarbon.

4.3 D2 relates to cementing slurry compositions for an oil well comprising rubber particles (D2: claim 1). The aim is to provide lighter oilwell cements reinforced with recycled rubber. The ground rubber particles reduce the density of the slurry and thus, secondarily, affect the

flexibility of the system (D2: page 2, lines 28 to 30). A slurry containing rubber particles has advantageous expansion properties in the presence of water during setting (D2: example 8, page 19, lines 15 to 22, and page 20, lines 4 and 5). **D2 is silent** about expansion in contact with hydrocarbons.

4.4 D3 relates to elastomeric sealants consisting essentially of a mixture of (A) a thixotropic mixture of (i) an elastomer emulsion of about 50-70 parts by weight of finely divided synthetic rubber solids dispersed in about 30-50 parts by weight of water, and (ii) about 5-70 parts by weight of liquid alpha-methylstyrene polymer per 100 parts by weight of (i); and (B) from about 1 to about 3 parts by weight of hydraulic cement per part by weight of water in (A) (D3: claim 1). They are suitable for use as caulks, sealants or expansion joint materials (D3: column 1, lines 15 and 16). **D3 is silent** about expansion in contact with hydrocarbons.

4.5 The aim of the invention according to D4 is to cement the annular space defined between the outside of the casing pipe and the wellbore (D4: column 1, lines 9 and 10). Therefore, a resin obtained by crosslinking substituted vinyl acrylate copolymers is associated with cement particles (D4: column 1, lines 46 to 51). **D4 discloses neither** expansion in contact with hydrocarbons **nor** ground rubber particles.

4.6 D5 relates to improved cement compositions for use in well cementing operations (D5: column 1, lines 38 to 41). The cement is used to form an impermeable sheath (D5: column 1, lines 64 and 65). The composition comprises 0.5 to 10 percent by weight of silica or diatomaceous earth particles to have the desired low

plastic viscosity and the desired low but positive yield point without causing undue settling of the solids (D5: column 5, lines 67 to 69). **D5 does not disclose** that the diatomaceous earth particles are used to cause expansion of the set cement when the set cement is contacted with hydrocarbon. In addition, rubber particles are not mentioned.

4.7 D6 discloses a method for cementing a subterranean zone (D6: column 4, lines 8 to 23). The cement compositions used comprise rubber particles in the 10/20 to 20/30 mesh range (595 to 2000 µm) (D6: column 3, lines 40 to 42). The compositions shown in the tables of D6 comprise up to 40% rubber by weight of cement. These compositions have excellent expansion properties, compressive strength, shear bond, elasticity and ductility (D6: column 6, lines 50 to 53). The expansion properties relate to cement cured in the presence of water (D6: Tables 1 to 6). **D6 does not disclose** that the rubber is used to cause expansion of the set cement when the set cement is contacted with hydrocarbon.

4.8 Novelty is acknowledged in view of the feature "*to cause expansion of the set cement when the said set cement is contacted with hydrocarbon*".

The requirements of Article 54 EPC are met.

5. Article 56 EPC

5.1 Invention

The present invention relates to cement systems which can adapt to compensate for changes or faults in the physical structure of the cement in the cementing of

oil, gas, water or geothermal wells (page 1, lines 5 to 8).

5.2 Closest prior art

D6 is the closest prior art, since it relates to the cementing of oil and gas wells. It discloses highly resilient well cement compositions having improved mechanical properties, including elasticity and ductility. A preferred well cement composition is comprised of a hydraulic cement, rubber particles present in an amount sufficient to increase the expansion properties of the composition, and sufficient water to form a pumpable slurry (D6: column 2, lines 50 to 58).

5.3 Problem

The problem underlying the application is to provide a **cement sheath** that can **adapt** its structure in the event of physical failure or damage (page 2, lines 4 and 5, and page 1, lines 16 to 18).

5.4 Solution

As a solution to the problem the application proposes the use according to claim 1, characterised in that ground rubber causes expansion of the **set cement** when the **set cement** is contacted with liquid or gaseous hydrocarbon.

5.5 Success of the solution

It needs to be determined whether the problem is solved over the whole range claimed.

Claim 1 requires the ground rubber obtained by recycling tyres "*to cause expansion of the set cement when the said set cement is contacted with hydrocarbon*". It is accepted that this effect can be achieved by the skilled person, since example 1 shows that a set cement composition expands in the presence of hydrocarbons. In addition, the patent application indicates that the concentration is an important factor (page 4, lines 1 to 3). The skilled person would therefore adapt the concentration such that the effect is achieved.

If there was a lack of reproducibility of that effect, there would be a lack of sufficient disclosure (G 1/03, Reasons 2.5.2; T 1079/08, Reasons 4). However, this is not the case, since the teaching of the application with respect to ground rubber enables the skilled person to obtain the effect.

The effect does not contain any indication of what degree of expansion needs to be obtained. Micro-cracks can form in the cement matrix and micro-annuli at the interface between the cement and the casing (page 2 of the application, lines 21 to 25). Such micro-faults in the structure can already be repaired when the set cement expands only to a small degree. Therefore, even a small expansion of the set cement caused by the ground rubber is encompassed by claim 1. Even in such cases it can be accepted that the problem (to provide a cement sheath that can adapt its structure in the event of physical failure or damage) is solved.

5.6 Obviousness

D6 teaches that there are several stress conditions associated with cement sheath failures. For example,

one such condition is the result of relatively high fluid pressures and/or temperatures inside a pipe cemented in the well bore during testing, perforating, fluid injection or fluid production. The high internal pipe pressure and/or temperature results in expansion of the pipe, both radially and longitudinally, which places stresses on the cement sheath causing it to crack, or the bond between the outside surface of the pipe and the cement sheath to fail in the form of loss of hydraulic seal. Another condition results from exceedingly high pressures which occur inside the annular cement sheath due to the thermal expansion of fluids trapped within the cement sheath (D6: column 1, lines 43 to 55).

When such stresses are exerted on the set cement in the well bore, the set cement can fail in the form of radial or circumferential cracking of the cement as well as in the breakdown of the bonds between the cement and pipe or between the cement and the formation (D6: column 1, line 66, to column 2, line 3).
D6 relates to cement compositions that are highly resilient and can withstand such stress conditions (see column 2, lines 39 to 42). The **goal of D6 is thus to prevent the failure of the set cement**. The expansion evaluated in D6 relates to the expansion of cement following setting in water and is part of the determination of the quality of the cement, which is known in the art (D7: chapter 7).

The **goal of the present invention is different**, in that it is accepted that the set cement can fail to some extent under the stress conditions present during oil recovery (page 1, lines 16 to 18). This failure can be repaired when the oil/gas that is pumped to the surface comes into contact with the cement containing the

ground rubber, since due to the hydrocarbons the rubber expands upon that contact and leads to expansion of the cement.

As mentioned in the section on novelty, this effect is not disclosed in the prior art. It is also not obvious, since in the present case the rubber is used to repair an already impacted set cement when the oil/gas is pumped to the surface, whereas all the prior-art documents teach the use of rubber to prevent failure of the set cement.

The expansion of ground rubber in the presence of hydrocarbon is known to the skilled person. Yet it is not taught in the prior art that this property can be advantageously used in cement compositions.

Furthermore, it appears from the application as filed that not all polymers or elastomers that can swell in contact with hydrocarbons are suitable for use in cement compositions to cause expansion of the cement (application: page 4, lines 11 to 12). This is also in line with the results of some examples (Table 7: composition A31 in combination with oil O3; Table 8: composition A34 in combination with oil O3; Table 11: composition A27 (should probably be A23) in combination with oil O2), where no expansion could be observed.

Therefore, the use of ground rubber obtained by recycling tyres "*to cause expansion of the set cement when the said set cement is contacted with hydrocarbon*" cannot be considered obvious.

To conclude, the prior art does not render the solution to the problem posed obvious.

6. The claims fulfill the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent on the basis of the main request (claims 1 to 5) filed at the oral proceedings and a description to be adapted.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated