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[Continued on next page]

(54) Title: WELL REPAIR USING SWELLABLE MATERIAL IN A REMEDIAL MATRIX

(57) Abstract: A technique enables performance of remedial treatments to block unwanted fluid migration in a well. The remedial treatment involves formation of a slurry with a swellable material. The slurry, including the swellable material, is pumped downhole and is directed to a remediation site. When deposited at the remediation site, the slurry establishes a desired remediation treatment able to block unwanted migration of a downhole fluid.

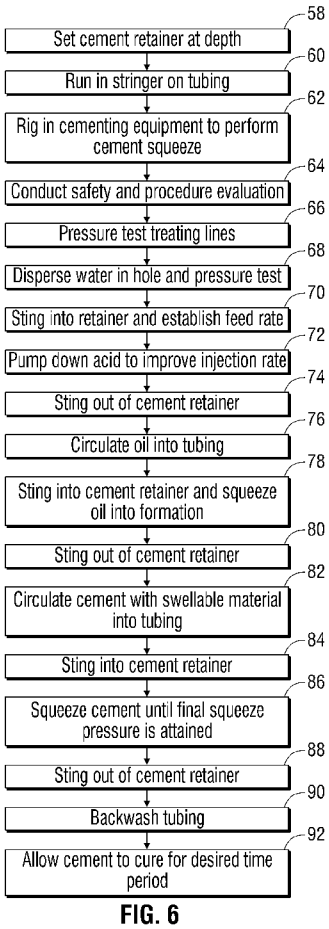

FIG. 6

WO 2009/138889 A1

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WELL REPAIR USING SWELLABLE MATERIAL IN A REMEDIAL MATRIX

BACKGROUND OF THE INVENTION

[0001] In many well-related applications, unwanted migration of fluids may be problematic. In some wells, fluids such as gas, oil, and/or water migrate along the annulus formed outside the well casing and through the formation proximate the wellbore. The migrating fluids can detrimentally affect production operations and other well-related operations.

[0002] For example, when gas migrates along a given well, the well may have a problem exhibited as a surface casing vent flow or gas migration. Remediation techniques are sometimes employed in an attempt to block the unwanted gas migration. Available techniques employ a variety of equipment and fluids that can be pumped downhole to remediate unwanted fluid flows. For example, cement squeezes have been used to limit unwanted fluid migration. However, available techniques often are limited in their ability to substantially block the fluid migration in many types of well applications and well environments.

BRIEF SUMMARY OF THE INVENTION

[0003] In general, the present invention provides a system and methodology for performing remedial treatments to block unwanted fluid migration in a well. A slurry is formed with a swellable material, and the slurry comprising the swellable material is pumped downhole. The slurry is directed to a remediation site and deposited in a manner that establishes a desired remediation treatment able to block unwanted migration of downhole fluid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Certain embodiments of the invention will hereafter be described with reference to the accompanying drawings, wherein like reference numerals denote like elements, and:

[0005] Figure 1 is a schematic view of a well system used to deploy a slurry containing swellable material at a remediation site along a wellbore, according to an embodiment of the present invention;

[0006] Figure 2 is a schematic view similar to that of Figure 1 but showing a reverse flow to remove unwanted material from the wellbore, according to an embodiment of the present invention;

[0007] Figure 3 is a schematic illustration of one sequence of treatment substances directed downhole to the remediation site, according to an embodiment of the present invention;

[0008] Figure 4 is a schematic illustration of another sequence of treatment substances directed downhole to the remediation site, according to an alternate embodiment of the present invention;

[0009] Figure 5 is a flowchart illustrating one example of a procedure for carrying out the remediation treatment, according to an embodiment of the present invention; and

[0010] Figure 6 is a flowchart illustrating another, more detailed, example of a procedure for carrying out the remediation treatment, according to an alternate embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] In the following description, numerous details are set forth to provide an understanding of the present invention. However, it will be understood by those of

ordinary skill in the art that the present invention may be practiced without these details and that numerous variations or modifications from the described embodiments may be possible.

[0012] The present invention generally relates to a system and methodology for carrying out a remediation treatment in a subterranean environment. The remediation treatment involves deploying slurry containing a swellable material to a specific remediation site or sites disposed along a wellbore. In one example, the slurry comprises a cement matrix having a swellable material and designed for remedial cementing. The swellable materials are deployed in the cement system to remediate a wellsite by enhancing the ability of the cement to shut off unwanted fluid migration, such as annular fluid migration. In some applications, the cement matrix, including the swellable materials, is used to shut off the unwanted annular flow of gas, such as shallow gas.

[0013] In another embodiment, the present system and methodology comprise squeezing an activating agent, such as an oil-based spacer fluid, ahead of the slurry containing the swellable material. In this example, the swellable material is selected to swell upon contact with a hydrocarbon activating agent, such as oil. In some environments, a preparatory fluid, such as an acid, may also be squeezed into the formation initially to enhance the penetration of the remedial cement system. One preparatory fluid comprises hydrochloric acid and is sometimes referred to as a mud acid.

[0014] By injecting the activating fluid, e.g. an oil-based fluid, into the matrix ahead of the cement slurry, the activating agent is able to enhance the swelling of the swellable materials contained in the self-healing cement upon placement of the cement slurry at a well remediation site. Placement of the activating agent enhances the self-healing/swelling capabilities of the cement. Consequently, the cement has an improved functionality in the presence of migrating fluids, such as gas. In a variety of applications, for example, the swellable materials help block the unwanted migration of pure methane, nearly pure methane, and other gases that do not necessarily induce swelling of the swellable material. The activating agent injected prior to the cement may comprise a

variety of materials, including diesel fuel, crude oil, mineral oil, condensate, and/or other oils. The activating agent also may comprise other materials, such as liquid natural gas, ethane, propane, butane, other gases, and other materials.

[0015] Referring generally to the schematic example of Figure 1, one embodiment of a well system 20 is illustrated as deployed in a wellbore 22. The well system 20 may comprise a variety of components for use in many types of wells and well environments. The well system 20 also can be used in cooperation with many types of completion equipment, casings, liners, and other components used in various well applications. To facilitate explanation, however, well system 20 is illustrated as comprising a treatment tubing 24 deployed downhole within a surrounding tubing, such as a well casing 26. A plurality of perforations 28 may extend through well casing 26, through a surrounding annulus 30, and into a surrounding formation 32.

[0016] Treatment fluids are delivered down through treatment tubing 24, as represented by arrows 34. The treatment fluids comprise a swellable material 36 which is delivered downhole to a desired remediation site 38 for use in a remediation process to limit the unwanted flow of well fluids along specific areas. As described above, for example, the swellable material 36 can be used in a cement slurry for remedial cementing along surrounding annulus 30 to prevent the undesired migration of gas and/or other fluids along well casing 26. Unused portions of the treatment fluids can be reverse circulated out of wellbore 22 by a reverse fluid flow, as represented by arrows 40 in Figure 2. In this particular example, the reverse fluid flow 40 is initially delivered into an annulus 42 between treatment tubing 24 and the surrounding tubing 26, e.g. well casing. The reverse fluid flow 40 is routed down along annulus 42, proximate remediation site 38, and up through treatment tubing 24 to remove excess treatment fluids.

[0017] The treatment fluids 34 may be delivered in stages, as illustrated in the example of Figure 3. By way of example, the fluid stages may be delivered immediately sequentially or with gaps between the sequential fluid stages. In the embodiment illustrated in Figure 3, an activating agent 44 is initially delivered downhole to

remediation site 38. As described above, the activating agent may be delivered through an appropriate tubing, such as treatment tubing 24. In some applications, treatment tubing 24 may comprise coiled tubing conveyed downhole within a surrounding casing, completion, or other downhole component.

[0018] Following activating agent 44, a slurry 46 containing swellable material 36 is delivered downhole to remediation site 38. In the embodiment illustrated, slurry 46 comprises a cement slurry for use in remedial cementing. The slurry 46 contains swellable material 36 which may be in the form of swellable particles 48 dispersed throughout the slurry. The activating agent 44 is selected to cause swelling of the swellable material 36, e.g. swellable particles 48, upon deposit of the slurry 46 at remediation site 38.

[0019] The particular type of activating agent 44 chosen for a given remediation procedure depends on the swellable material 36 used in slurry 46. By way of example, the swellable material, e.g. swellable particles 48, can be formed from a material that swells in the presence of a hydrocarbon based fluid, such as oil. Examples of oils that can serve as activating agent 44 include diesel fuel, crude oil, mineral oil, or condensate. The activating agent also may comprise other hydrocarbon fluids, including liquid natural gas. Other types of activating gases can also be used in the activating agent 44. In still other applications, the swellable material 36 can be selected to swell in the presence of water and/or in the presence of a specific chemical or chemicals.

[0020] The swellable material 36 may be formed from one or more materials that swell in the presence of a suitable activating agent. A few specific examples of swellable materials comprise swelling elastomers and nitrile mixed with salt or hydrogel. Additionally, a material available from Schlumberger Technology Corporation of Sugar Land, Texas, USA and sold under the trade name FUTUR also comprises a swellable material that can be pumped downhole as slurry 46. In many of these applications, the swellable material 36 is used as part of a cement matrix to facilitate remedial cementing at remediation site 38.

[0021] In the embodiment illustrated in Figure 4, a preparatory fluid 50 is initially delivered downhole to remediation site 38. By way of example, preparatory fluid 50 may be squeezed into the formation at remediation site 38 to enhance penetration of the remedial slurry 46 containing swellable material 36. As described above, preparatory fluid 50 may comprise a suitable acid, such as a mud acid, delivered downhole through tubing 24 or along another appropriate delivery route.

[0022] After delivering preparatory fluid 50 to remediation site 38, activating agent 44 also may be delivered downhole to the remediation site. In some applications, activating agent 44 may be delivered immediately following preparatory fluid 50. As described above, the activating agent also may be delivered through tubing 24 or via another suitable route.

[0023] In this embodiment, the slurry 46 containing swellable material 36 is subsequently delivered downhole to remediation site 38. Again, the slurry comprises swellable material 36 which may be in the form of swellable particles 48 or in other forms dispersed throughout the slurry. The activating agent 44 serves to cause swelling of the swellable material 36 upon deposit of the slurry 46 at remediation site 38.

[0024] The procedure for performing a remedial application at remediation site 38 may vary according to the remediation site size and location, the equipment deployed downhole, the wellbore environment, and other factors. However, a general procedure for carrying out a remedial operation can be described with reference to the flowchart in Figure 5. In this example, a remedial cementing operation is carried out by initially injecting an acid downhole to a remediation site, as indicated by block 52. The acid may comprise a variety of acids, such as hydrochloric acid, a combination of hydrochloric acid and hydrofloric acid (e.g. 12:3 mud acid), or organic acid (e.g. citric acid).

[0025] Subsequently, an oil is injected downhole to the remediation site 38 to serve as the activating agent, as indicated by block 54. By way of example, the oil may

comprise diesel fuel, synthetic oil, or mineral oil that is deposited at the remediation site 38 to enable or at least facilitate expansion of swellable material 36. Following injection of the oil, the slurry 46 is delivered downhole. In this embodiment, a self-healing cement is injected downhole to remediation site 38, as indicated by block 56. Self-healing cement comprises swellable material 36 which may be in the form of swellable particles 48 dispersed throughout the cement slurry. Furthermore, the various treatment fluids may be injected downhole through an appropriate tool deployed on tubing, such as coiled tubing.

[0026] The treatment fluid amounts, rates, spacing, and other injection parameters may vary depending on the remediation site, the equipment downhole, and the well environment. In some applications, for example, roughly equal amounts of acid, oil, and the self-healing cement may be directed downhole to the remediation site. By way of specific example, approximately 1 cubic meter of each treatment fluid may be pumped downhole to the remediation site 38. Of course, these amounts can vary depending on the size and nature of the remedial cementing required for a given operation.

[0027] Referring generally to the flowchart of Figure 6, another example is provided for a treatment procedure used to perform a remedial treatment able to limit the unwanted migration of downhole fluids at a remediation site. It should be noted that in some applications, the remediation site may extend a substantial distance along the wellbore. Furthermore, the procedure described in reference to Figure 6 is one specific example of a remedial treatment procedure, however, the order, length, content, and materials used to carry out the procedure can be changed and adjusted to accommodate the needs of particular remedial operations.

[0028] In the example illustrated, a cement retainer is initially set at depth within wellbore 22, as indicated by block 58. A stinger is then run on tubing to a desired downhole location, as indicated by block 60. The operator can then rig in cementing equipment for performing a cement squeeze, as indicated by block 62. A safety and

procedure evaluation may be conducted prior to initiation of pressure testing, as indicated by block 64.

[0029] Once this initial equipment is in place, the treating lines, e.g. tubing 24, can be pressure tested, as indicated by block 66. Furthermore, water may be dispersed downhole and further pressure testing may be conducted by, for example, moving the stinger to a blank spot in the cement retainer, as indicated by block 68. Following the pressure testing, the operator is able to sting into the cement retainer and establish a suitable feed rate, as indicated by block 70.

[0030] In some applications, it may not be necessary to inject a preparatory fluid 50. However, in the example provided in Figure 6 a preparatory fluid 50, e.g. an acid, is pumped downhole to the remediation site 38 to improve the injection of slurry 46 with swellable material 36, as indicated by block 72. After injecting the preparatory fluid, the operator can sting out of the cement retainer, as indicated by block 74, and an activating agent 44, e.g. oil, is circulated into the tubing, as indicated by block 76. By way of example, the activating agent 44 may be delivered downhole via treatment tubing 24.

[0031] The operator then again stings into the cement retainer and squeezes activating agent, e.g. oil, into the surrounding formation, as indicated by block 78. Upon completion of the activating agent squeeze, the operator can sting out of the retainer, as indicated by block 80. Subsequently, the slurry 46, which may comprise self-healing cement containing swellable material 36, is circulated into the tubing, as indicated by block 82.

[0032] The operator again stings into the cement retainer, as indicated by block 84. This enables a squeeze of the self-healing cement until a final squeeze pressure is attained, as indicated by block 86. Subsequently, the operator is able to sting out of the cement retainer, as indicated by block 88, and the tubing may be backwashed, as indicated by block 90. The backwashing can be conducted by establishing a reverse fluid flow 40, as described above.

[0033] Depending on the material used to prepare slurry 46, e.g. the type of cement used to prepare the slurry, the slurry is allowed to cure over a desired time period, as indicated by block 92. For example, a 24-hour period may be provided to allow the cement to sufficiently cure. Upon deposit of the slurry, the swellable material 36 within the slurry is acted on by the activating agent 44 which causes the swellable material 36 to swell and expand. The swelling better enables the cement to block unwanted migration of fluids, e.g. gases, past remediation site 38.

[0034] It should be noted that the well remediation technique may be adjusted to suit a variety of wells, environments, and types of equipment. Furthermore, the swellable material can be deployed in a variety of slurries and with a variety of supporting treatment fluids. In some applications, well repair is accomplished using swellable material in a cement matrix. Additionally, well system 20 may be formed with many types of components for use with many types of well systems. Similarly, various stingers and tubings or other passages may be used for injecting fluids. The remediation technique also may be carried out in cooperation with many configurations of existing downhole equipment. Some applications benefit from a preparatory fluid, while other remediation operations can be conducted without the preparatory fluid. Additionally, a variety of activating agents and slurry materials may be employed. Similarly, the type, size, disbursement, concentration, shape, and other factors related to the swellable material may be adjusted as desired for a given application.

[0035] Accordingly, although only a few embodiments of the present invention have been described in detail above, those of ordinary skill in the art will readily appreciate that many modifications are possible without materially departing from the teachings of this invention. Such modifications are intended to be included within the scope of this invention as defined in the claims.

CLAIMS

What is claimed is:

1. A method, comprising:
forming a cement slurry with swellable particles;
pumping the cement slurry downhole into a wellbore; and
using the cement slurry in performing a remedial cementing to limit unwanted migration of a downhole fluid.

2. The method as recited in claim 1, further comprising initially injecting an oil into the wellbore.

3. The method as recited in claim 1, further comprising initially injecting an acid into the wellbore, followed by injection of an oil, before pumping the cement slurry downhole.

4. The method as recited in claim 1, wherein using the cement slurry in performing a remedial cementing comprises shutting off unwanted annular fluid migration.

5. The method as recited in claim 1, wherein using the cement slurry in performing a remedial cementing comprises shutting off unwanted migration of a gas.

6. The method as recited in claim 1, further comprising activating the swellable particles.

7. The method as recited in claim 1, further comprising activating the swellable particles with a hydrocarbon-based fluid.

8. A method, comprising:

forming a cement slurry that contains a swellable material;

squeezing an activating agent ahead of the cement slurry in a wellbore to perform a remediation treatment; and

activating the swellable material to limit unwanted migration of a downhole fluid at a remediation site.

9. The method as recited in claim 8, further comprising delivering an acid downhole into the wellbore ahead of the activating agent.

10. The method as recited in claim 8, wherein squeezing the activating agent comprises moving an oil ahead of the cement slurry.

11. The method as recited in claim 8, wherein forming the cement slurry comprises forming the cement slurry with swellable particles.

12. The method as recited in claim 8, wherein activating the swellable material comprises activating the swellable material with a hydrocarbon-based fluid.

13. The method as recited in claim 8, wherein activating the swellable material comprises activating the swellable material at a location selected to prevent unwanted annular fluid migration.

14. The method as recited in claim 8, wherein activating the swellable material comprises activating the swellable material at a location selected to prevent unwanted migration of a gas.

15. A system for remedial cementing, comprising:

a cement slurry containing a swellable material; and

an activating agent deployed ahead of the cement slurry in a wellbore at a remedial site.

16. The system as recited in claim 15, further comprising an acid deployed ahead of the activating agent.

17. The system as recited in claim 15, wherein the swellable material comprises swellable particles.

18. The system as recited in claim 15, wherein the activating agent comprises oil.

19. A method, comprising:

positioning an activating agent at a remedial site in a wellbore; and

delivering a swellable material to the remedial site such that the swellable material swells upon interaction with the activating agent.

20. The method as recited in claim 19, further comprising initially preparing the remedial site with a preparatory fluid.

21. The method as recited in claim 19, further comprising initially preparing the remedial site with a mud acid.

22. The method as recited in claim 19, wherein positioning an activating agent comprises positioning a hydrocarbon-based activating fluid at the remedial site.

23. The method as recited in claim 19, further comprising placing the swellable material in a cement slurry.

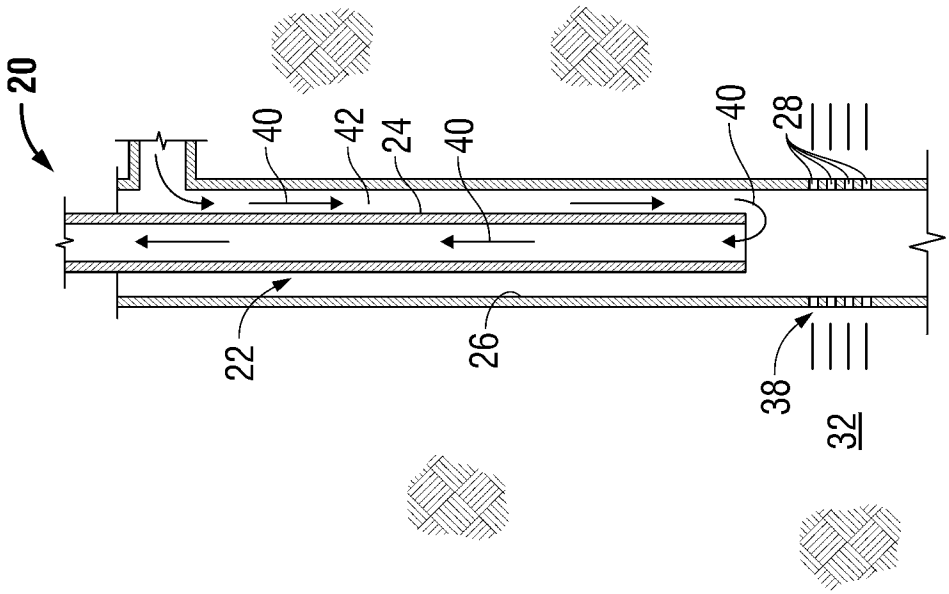

FIG. 2

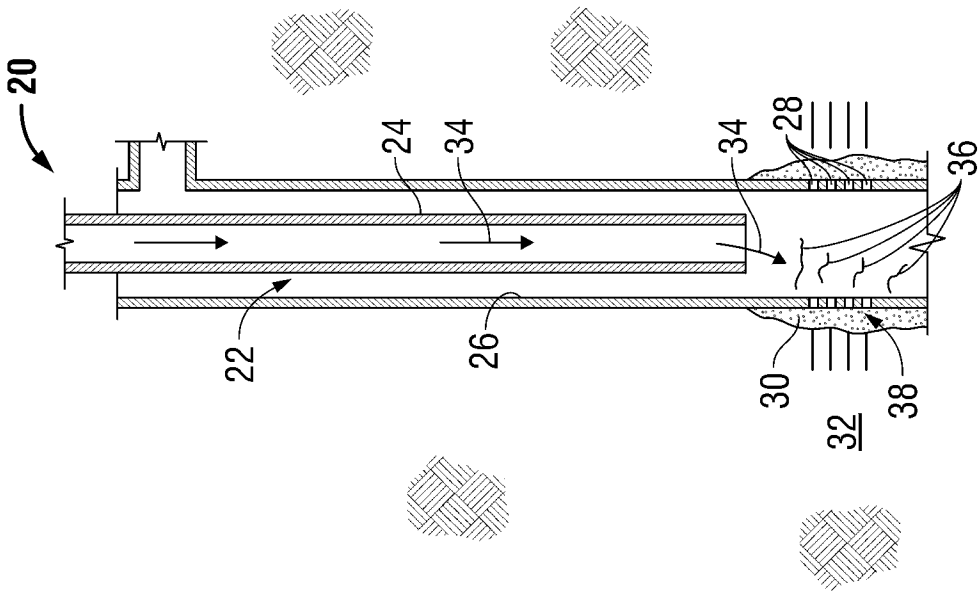

FIG. 1

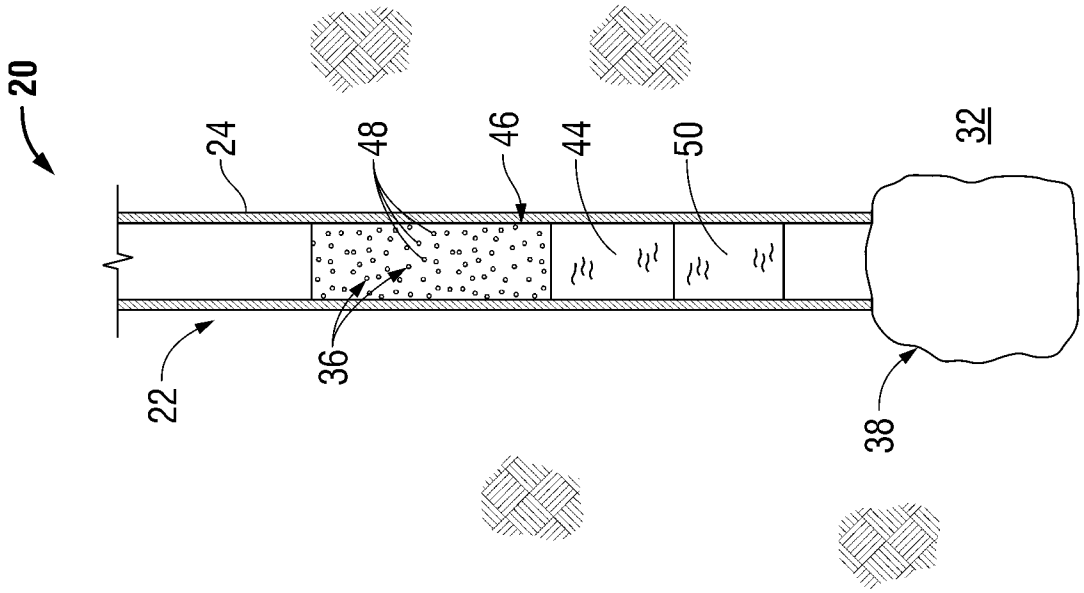

FIG. 4

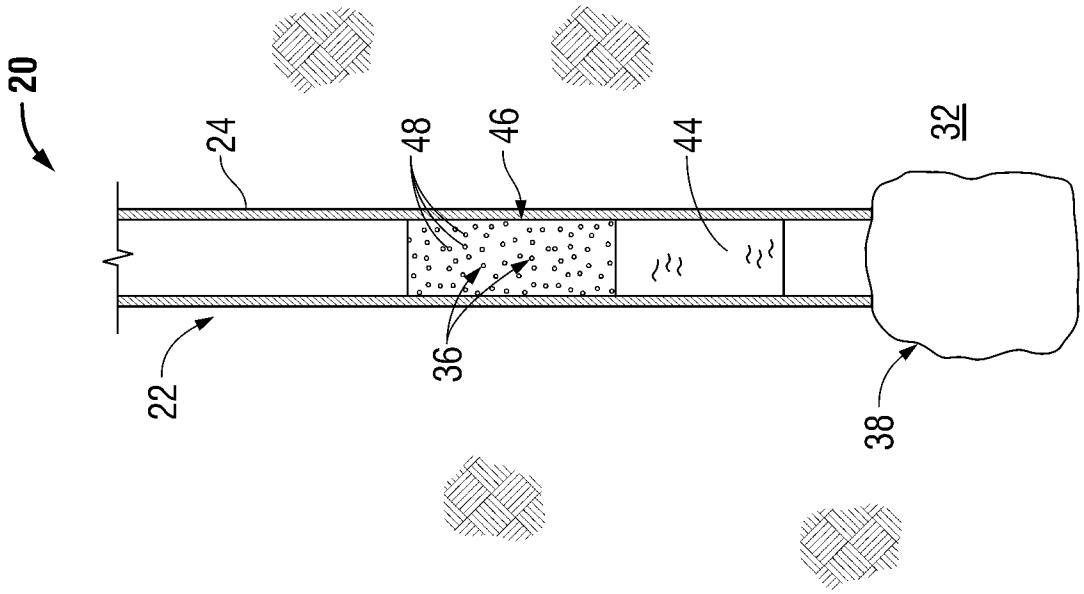

FIG. 3

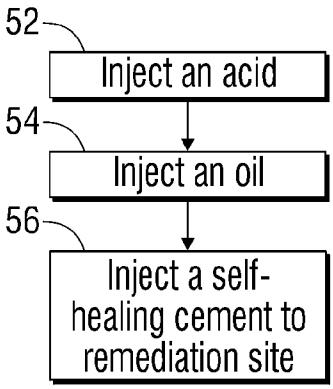
52
Inject an acid
54
Inject an oil
56
Inject a self-healing cement to remediation site

FIG. 5

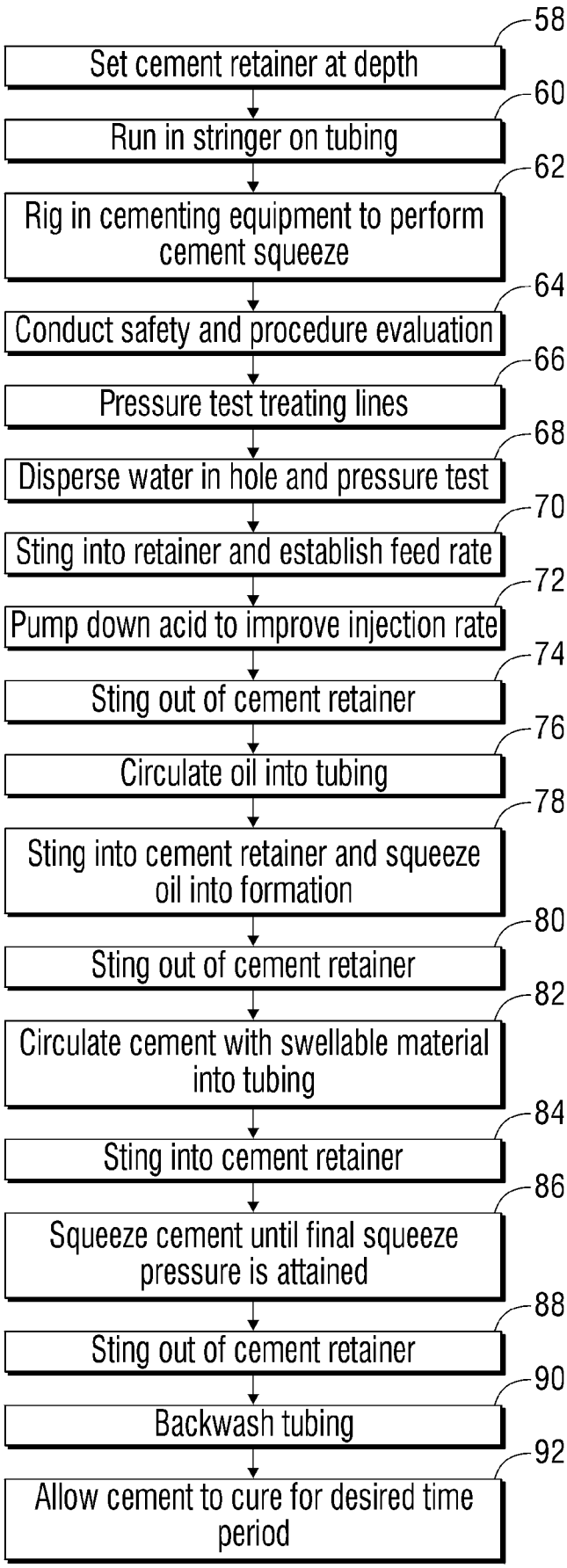
58
Set cement retainer at depth
60
Run in stringer on tubing
62
Rig in cementing equipment to perform cement squeeze
64
Conduct safety and procedure evaluation
66
Pressure test treating lines
68
Disperse water in hole and pressure test
70
Sting into retainer and establish feed rate
72
Pump down acid to improve injection rate
74
Sting out of cement retainer
76
Circulate oil into tubing
78
Sting into cement retainer and squeeze oil into formation
80
Sting out of cement retainer
82
Circulate cement with swellable material into tubing
84
Sting into cement retainer
86
Squeeze cement until final squeeze pressure is attained
88
Sting out of cement retainer
90
Backwash tubing
92
Allow cement to cure for desired time period

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/051444

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B33/13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, TULSA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/122071 A1 (REDDY B R [US]; SAVERY MARK R [US]; RAVI KRISHNA M [US]; WHITFILL DON) 8 June 2006 (2006-06-08)	1,3-6, 8-9,11, 13-17, 19-21,23
Y	paragraph [0061]	2,7,10, 12,18,22
Y	P. CAVANAGH ET AL: "Self-Healing Cement - Novel Technology to Achieve Leak-Free Wells" SPE/IADC 105781, 20 February 2007 (2007-02-20), pages 1-13, XP002541392 page 4, column 1, paragraph 2 Swelling Properties in an Oil-Environment; page 4, column 2, paragraph 4 - paragraph 5	2,7,10, 12,18,22

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 August 2009	01/09/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schouten, Adri

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2009/051444

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/086501 A1 (CREEL PRENTICE G [US]; REDDY B R [US]; DALRYMPLE EDLON D [US]) 27 April 2006 (2006-04-27) paragraph [0010] paragraph [0015] -----	1,4-5
A	J. ROTH ET AL: "Innovative Hydraulic Isolation Material Preserves Well Integrity" IADC/SPE 112715, 4 March 2008 (2008-03-04) , pages 1-14, XP002541394 the whole document -----	1-23

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2009/051444

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006122071 A1	08-06-2006	BR PI0517496 A	07-10-2008
		CA 2590169 A1	15-06-2006
		EP 1853680 A1	14-11-2007
		WO 2006061561 A1	15-06-2006
		US 2009137431 A1	28-05-2009
US 2006086501 A1	27-04-2006	NONE	