



(51) International Patent Classification:

E21B 43/22 (2006.01) E21B 47/008 (2012.01)  
E21B 44/00 (2006.01)

(21) International Application Number:

PCT/US2013/048412

(22) International Filing Date:

28 June 2013 (28.06.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13/536,478 28 June 2012 (28.06.2012) US

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(81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,

BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,  
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,  
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,  
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC,  
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,  
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every  
kind of regional protection available): ARIPO (BW, GH,  
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,  
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,  
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,  
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a  
patent (Rule 4.17(ii))

— as to the applicant's entitlement to claim the priority of the  
earlier application (Rule 4.17(iii))

Published:

— with international search report (Art. 21(3))

(54) Title: WIRELINE FLOW THROUGH REMEDIATION TOOL

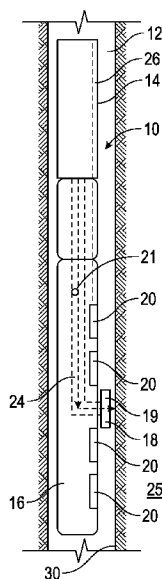


FIG. 1

(57) Abstract: A treatment tool treats downhole features with one additive using sensors that acquire information relating to the downhole feature. A conveyance device selectively positions the treatment tool in a borehole. A related method includes acquiring information relating to the downhole feature using a treatment tool positioned in a borehole, estimating a condition relating to the downhole feature based on the acquired information, and treating the downhole feature using at least one additive applied by the treatment tool. The method may also include estimating a change in the condition of the downhole feature after the treatment of the downhole feature.

## WIRELINE FLOW THROUGH REMEDIATION TOOL

### BACKGROUND OF THE DISCLOSURE

#### 1. Field of the Disclosure

[0001] The disclosure relates generally to systems and methods for treating subsurface features.

#### 2. Description of the Related Art

[0002] Hydrocarbons such as oil and gas are recovered from a subterranean formation using a borehole drilled into the formation. At times during or after the drilling of the borehole, it may be desirable to alter a condition of a downhole feature. One example of downhole feature having an undesirable condition is a formation having poor fluid mobility. Another example is a borehole section that may be structurally unstable. Still another example includes downhole equipment (*e.g.*, production tubing, pipelines, valves, etc.) that may be exposed to substances that corrode, degrade or otherwise reduce their efficiency or service life. Each of these conditions may be improved by treating the downhole feature in question with a suitable additive.

[0003] This disclosure provides, in part, enhanced additive treatment systems and methods suitable for such uses.

### SUMMARY OF THE DISCLOSURE

[0004] Aspects of the present disclosure may be used to diagnose, treat, and evaluate a downhole feature in a single trip. The downhole feature may be associated with a hydrocarbon producing well, a geothermal well, a groundwater well, or any other borehole formed in a subsurface formation.

[0005] In one aspect, a well treatment method according to the present disclosure may include acquiring information relating to the downhole feature using a treatment tool positioned in a borehole; estimating a condition relating to the downhole feature

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based on the acquired information; treating the downhole feature using at least one additive applied by the treatment tool; and estimating a change in the condition of the downhole feature after the treatment of the downhole feature.

[0006] In another aspect, a well treatment apparatus according to the present disclosure may include a treatment tool configured to treat the downhole feature with at least one additive; at least one sensor associated with the treatment tool, the at least one sensor being configured to acquire information relating to the downhole feature; and a conveyance device configured to selectively position the treatment tool in a borehole.

[0007] It should be understood that examples of certain features of the disclosure have been summarized rather broadly in order that detailed description thereof that follows may be better understood, and in order that the contributions to the art may be appreciated. There are, of course, additional features of the disclosure that will be described hereinafter and which will form the subject of the claims appended hereto.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] The advantages and further aspects of the disclosure will be readily appreciated by those of ordinary skill in the art as the same becomes better understood by reference to the following detailed description when considered in conjunction with the accompanying drawings in which like reference characters designate like or similar elements throughout the several figures of the drawing and wherein:

**Fig. 1** is a schematic elevation view of a treatment tool in accordance with one embodiment of the present disclosure;

**Fig. 2** is a schematic elevation view of a treatment tool having sealing elements in accordance with one embodiment of the present disclosure;

**Fig. 3** is a schematic elevation view of a treatment tool adapted for closed loop operation in accordance with one embodiment of the present disclosure;

**Fig. 4** is a schematic elevation view of a treatment tool used in conjunction with a drilling system in accordance with one embodiment of the present disclosure; and

**Fig. 5** is a flow chart illustrating a treatment method in accordance with one embodiment of the present disclosure.

#### DETAILED DESCRIPTION OF THE DISCLOSURE

[0009] The present disclosure relates to devices and methods for treating downhole features, such as a hydrocarbon bearing formation or well equipment, with one or more additives. The treatment may be performed during any stage of well construction or production (*e.g.*, drilling, logging, workover, remediation, etc.). An exemplary treatment system may be deployed to diagnose a particular condition and introduce one or more additives selected to adjust the condition. The additives may be any agent or substance that interacts with the downhole feature in a predetermined manner. The treatment system may also monitor the treatment to evaluate the treatment effectiveness. Further, the systems may be self-contained and mobile. That is, in a single trip, a condition of a selected downhole feature may be evaluated, treated, and re-evaluated. Moreover, the treatment system may be used to treat multiple zones or locations along the borehole during a single trip. Illustrative non-limiting embodiments of systems and related methods for treating a downhole feature with an additive are discussed below. While the present disclosure is discussed in the context of a hydrocarbon producing well, it should be understood that the present disclosure may be used in any borehole environment (*e.g.*, a geothermal well).

[0010] Referring now to **Fig. 1**, there is shown one embodiment of a treatment system **10** for treating one or more downhole features of interest. The treatment tool **10** may be conveyed along a borehole **12** via a conveyance device **14**. In one embodiment, the treatment tool **10** may include a sub **16**, a port **18** for dispensing additives, and one or more sensors **20** for estimating one or more parameters of interest. The conveyance device **14** may be a tubular such as coiled tubing having a flow bore that conveys additives to the treatment tool **10**. A flow line **24** in the sub **16** directs the additive from the conveyance device **14** to the port **18**. The flow line **24** may be a fluid pathway or passage in the sub **16**.

[0011] The downhole features that may be treated by the treatment tool **10** may be naturally occurring and/or human made. Illustrative naturally occurring features include, but are not limited to, rock, earth, soil, liquid hydrocarbons, gaseous hydrocarbons, brine, water, and other substances, which may be homogeneous fluids

or mixtures of fluids, that make up a subsurface formation or are produced from a subsurface formation. Illustrative human made features include, but are not limited to: mechanical devices such as wellbore tubulars (e.g., casing, liners, production tubing), production devices, intelligent well completions, anchors, sand screens, valves, packers; functional materials and chemicals such as gravel, cement, proppants, surface injected fluids (e.g., water or steam), and relative permeability modifiers; and other devices that may be disposed in a borehole to perform one or more functions. The human made feature(s) may be conveyed from the surface into the borehole or constructed *in situ*. It should be understood that the feature(s) to be treated may be inside a well tubular, in an annulus between the well tubular and a borehole wall, in a cement sheath between a well tubular and a formation, or in the formation.

**[0012]** During drilling of the borehole or any time thereafter, these downhole features may have or develop an undesirable condition. As used herein, the term “condition” refers to a state, property, phase, characteristic of the downhole feature. Illustrative conditions include a material property (e.g., permeability, porosity, mobility, etc.), a mechanical property (e.g., hardness, ductility, Young’s Modulus, etc.), a chemical property (e.g., acidity, pH), a fluid property (e.g., phase, viscosity, salinity, water content, etc.), erosion, corrosion, plugging, structural instability, etc. A condition may be considered “undesirable” because it may impair hydrocarbon production rates, damage a subsurface formation, reduce the service life of well equipment, render a borehole unstable, or otherwise reduce the efficiency or commercial value of a hydrocarbon reservoir.

**[0013]** To identify and quantify such conditions, the sensors **20** may be configured to acquire information relating to the downhole feature(s) of interest. The sensors **20** may be in signal communication with a controller (not shown) via a suitable communication line **26**. It should be understood that the type of sensors **20** used on the treatment tool **10** depends on the downhole feature to be treated. Illustrative, but not exhaustive, sensors are discussed below.

**[0014]** For evaluating parameters of subsurface formations, the sensors **20** may include formation evaluation sensors such as resistivity tools, nuclear magnetic resonance (NMR) tools, gamma ray detectors, acoustic tools, and other well logging tools that provide information relating to a geological parameter, a geophysical parameter, a petrophysical parameter, and/or a lithological parameter. Thus, the

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sensors **20** may include sensors for estimating formation resistivity, dielectric constant, the presence or absence of hydrocarbons, acoustic porosity, bed boundary, formation density, nuclear porosity and certain rock characteristics, permeability, capillary pressure, and relative permeability. It should be understood that this list is illustrative and not exhaustive.

[0015] For estimating properties of downhole fluids (naturally occurring or engineered), the treatment tool may include sensors **20** for estimating aromatic content; asphaltene content; bacterial content; bubble point; chemical composition (this overlaps the parameters with the word “content”); color; density; specific gravity; hydrate (gas hydrate) content; naphthenic content; nitrogen content; odor; oxygen content; radioactivity; salt content; solids content; sulfur content; paraffinic content; pH (acidity/alkalinity); phase (defined as gas or liquid); pressure; temperature; viscosity. Illustrative devices include, but are not limited to, spectrometers, dielectric sensors, optical analyzers, detectors using gas chromatography, ion selective sensors, resonators, refractometers, etc.

[0016] One or more of the sensors **20** may also be configured to acquire information relating to the treatment tool **10**. For example, a sensor **21** may be positioned along the flow line **24** to monitor one or more parameters relating to the additive(s) being dispensed by the port **18**. Illustrative parameters may include flow rate, pressure, phase, etc.

[0017] To perform the treatments during a single trip, the treatment tool **10** may use a “high bandwidth” transmission to transmit the information acquired by the sensors **20** to the surface for analysis. For instance, the communication line **26** for transmitting the sensor information may be an optical fiber, a metal conductor, or any other suitable signal conducting medium. One non-limiting communication line is a TELECOIL coiled tubing system available from BJ Services, Inc that uses coiled tubing with a small diameter signal conductor line. It should be appreciated that the use of a “high bandwidth” communication line may allow surface personnel to monitor and control the treatment activity in “real time.” Also, the sensors **20** may be arrayed axially and / or circumferentially along the sub **16** and the port **18** may be nested within a cluster of sensors **20**. Strategically distributing the sensors **20** at and around the region where an additive is being applied may increase the accuracy and resolution of the information acquired by the sensors **20**.

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[0018] The port 18 may be configured to engage and seal against an adjacent surface. As shown in Fig. 1, the surface may be a wall of a casing 30 (which may be perforated). The port 18 may include a packer element 19 that forms a circumferential seal around an opening (not shown) of the port 18. The tool 10 may include arms or stand-offs (not shown) positioned opposite of the port 18. These arms or similar devices may be extended radially outward to thrust the tool 10 and the port 18 against the desired surface. Alternatively or additionally, the port 18 may include a radially extendable probe that may be driven outward using a mechanical, electro-mechanical, or hydraulic actuator (not shown).

[0019] In one exemplary mode of use, the treatment tool 10 is conveyed into a selected location in the well 12 by the conveyance device 14, which may be coiled tubing. Once appropriately positioned, the sensors 20 may be used to acquire information relating to one or more conditions in the well. Of course, the sensors 20 may be operated to acquire information prior to positioning as well. In either case, the sensors 20 generate signals indicative of one or more parameters relating to the downhole feature or features. These signals may be conveyed via the signal conductor 26 to the surface. Personnel at the surface process the sensor signals to estimate one or more downhole conditions of interest. If personnel conclude that it is desirable to adjust the condition(s), one or more additives are pumped down the conveyance device 14 to the treatment tool 10. The port 18 expels the additive into the selected location. The sensors 20 may continue to furnish information relating to the condition(s) during treatment to thereby allow personnel at the surface to monitor the treatment activity (*e.g.*, evaluate a change in the downhole condition).

[0020] Additionally, after the treatment is complete, the sensors 20 may be used to evaluate the effectiveness of the treatment. That is, the sensors 20 may estimate one or more parameters relating to the treated downhole feature to determine whether a particular downhole condition has been adequately adjusted or whether further treatment is desired. After the treatment is complete, the treatment tool 10 may be retrieved to the surface. Alternatively, the treatment tool 10 may be moved to one or more additional locations in the borehole.

[0021] Referring to Fig. 2, there is shown another embodiment of a treatment tool 10 in accordance with the present disclosure. The Fig. 2 treatment tool 10 may include a sub 16, a port 18, and one or more sensors 20. In this embodiment, the

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conveyance device **14** may be a wireline, e-line, or other non-rigid carrier that does not have a bore suited to convey additives. Thus, a separate umbilical **31** may be used to convey additives to the treatment tool **10**. For example, the umbilical **31** may flow the additive(s) to a flow line **24** in the sub **16** that channels the additive(s) to the port **18**.

[0022] The embodiment of **Fig. 2** also includes sealing elements **40** that may be activated to form an isolated annular zone **42**. The sealing elements **40** may be packers or other suitable sealing devices that engage and form an annular seal with an adjacent surface (*e.g.*, open hole surface, liner, casing, etc.). In the **Fig. 2** embodiment, the additive may be dispensed into the annular zone **42**. As in the **Fig. 1** embodiment, the sensors **20** may be arrayed such that the area in which the additive is dispensed may be monitored.

[0023] Referring to **Fig. 3**, there is shown still another embodiment of a treatment tool **10** in accordance with the present disclosure. The treatment tool **10** may include a sub **16**, a port **18**, and one or more sensors **20**. However, a downhole reservoir **50** supplies the additive(s) for the treatment tool **10**. A pump (not shown) or other suitable fluid mover may be used to flow the additive(s) through a flow line **24** formed in the sub **16** that directs the additive(s) to the port **18**. Further, a downhole controller **52** may be programmed to control one or more aspects of the operation of the treatment tool **10**. The embodiment of **Fig. 3** may also include a sealing element **40** that may be activated to hydraulically isolate a lower well section **56** from an upper well section **58**. The sealing elements **40** may be packers or other suitable sealing devices that engage and form an annular seal with an adjacent surface (*e.g.*, open hole surface, liner, casing, etc.). As in the **Fig. 1** embodiment, the sensors **20** may arrayed such that the area in which the additive is dispensed may be monitored.

[0024] The controller **52** may be programmed to autonomously control the treatment operation. For instance, the controller **52** may include an information processing device (not shown) in signal communication with the sensors **20**. The controller **52** may be programmed with algorithms, programs, mathematical models, or instructions to estimate a condition relating to the downhole feature based on the acquired information and / or estimate a change in the condition of the downhole

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feature after the treatment of the downhole feature. The controller **52** may also operate in a semi-autonomous mode by cooperating with a surface controller (not shown).

[0025] In an exemplary mode of use, the **Fig. 3** treatment tool **10** may be positioned in the borehole **12** at a desired location. Either by a surface signal or by using pre-programmed logic, the controller **52** may initiate a treatment program by first evaluating one or more downhole conditions using the sensors **20**. Using the information provided by the sensors **20** and pre-programmed instructions, the controller **52** may select one or more additives for adjusting or modifying a condition of a downhole feature. The controller **52** may continue to monitor the downhole condition as the additive is being applied. Afterward, the controller **52** may perform further evaluation of the downhole condition using the sensors **20** to determine the effectiveness of the treatment.

[0026] It should be appreciated that in this mode of use, only a single “trip” is needed to identify conditions that may require remediation, treat the condition, and evaluate the effectiveness of the treatment. That is, all of these activities are performed by one treatment tool during a single deployment in the well. Thus, the need for a first trip to evaluate a condition and a separate second trip to treat the condition may be eliminated. Also eliminated may be additional trips into the well to evaluate the treatment.

[0027] It should be appreciated that the above-described embodiments may be adapted for use after the borehole **12** (**Fig. 1**) has been drilled. For example, the treatment tool **10** may be used after a borehole section has been drilled or after an open hole section has been cased and cemented. Also, the treatment tool **10** may be used in producing wells.

[0028] Additionally, embodiments of the present disclosure may be used during drilling of a borehole **12**. Referring now to **Fig. 4** there is schematically illustrated a drilling system that may include one or more treatment tools **10** according to aspects of the present disclosure. A treatment tool **10** may be used to treat one or more downhole features during drilling of the borehole **12**. While a land system is shown, the teachings of the present disclosure may also be utilized in offshore or subsea applications. A drilling system **100** may have a bottom hole assembly (BHA) or

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drilling assembly **102** is conveyed via a tubing **104** into the borehole **12**. The tubing **104** may include a rigid carrier, such as jointed drill pipe or coiled tubing, and may include embedded conductors for power and / or data for providing signal and / or power communication between the surface and downhole equipment. The BHA **102** may include a drilling motor **106** for rotating a drill bit **108**.

[0029] At the surface, an additive supply system **110** may be used to supply one or more additives to the treatment tool(s) **10**. In one embodiment, the system **110** may include an additive supply unit **112**, an injector unit **114**, and a controller **116**. The system **110** may direct the additive(s) into an umbilical **118** disposed inside or outside of the tubing **104**. The additive supply unit **112** may include multiple tanks for storing different additives and one or more pumps for pumping the additives. The injector unit **114** selectively injects these additives into the umbilical **118**. Additionally, or alternatively, the additives may be pumped into the tubing **104**. The injector unit **114** may be a pump such as a positive displacement pump, a centrifugal pump, a piston-type pump, or other suitable device for pumping fluid. The controller **116** may control operations by utilizing an information processing device having suitable software programs.

[0030] During use, the treatment tool **10** may estimate one or more parameters of interest relating to a selected downhole feature of interest as the drilling system **150** drills the borehole. The sensors **20** may generate information that may be transmitted to the surface via a suitable communication link. Various options are available for the subsequent treatment operation.

[0031] In one treatment mode, drilling is interrupted and sealing elements **40** may be activated to provide an isolated treatment zone. Next, one or more additives may be pumped into the borehole **12** via the umbilical **118** and / or the tubing **104**. The sensors **20** may continue to provide information during and after the additive treatment to evaluate effectiveness. In another treatment mode, an additive may be dispensed as the borehole **12** is being drilled; *i.e.*, without interrupting drilling. In still another treatment mode, the treatment may be performed while the drilling system **150** is being pulled out of the borehole **12**. It should be understood that such treatment modes are only illustrative and other modes of use are encompassed in the present disclosure.

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[0032] Referring now to **Fig. 5**, there is shown an illustrative well treatment method **140** for minimizing scale deposition (*i.e.*, a “scale squeeze”). At step **142**, the treatment tool may be conveyed into a borehole that intersects one or more production zones that produces some amount of water. At step **144**, the on-board sensors of the treatment tool may be used to obtain information relating scale formation (*i.e.*, a well condition) at a first production zone. This information may be the presence of a scale deposition indicator(s), *e.g.*, such as concentration or amount of a scale inhibitors and / or ionic material in the fluid produced from the first zone. At step **146**, this information is conveyed to the surface where personnel determine whether the sensor information indicates a risk of unacceptable scale formation.

[0033] If the results are acceptable, then the treatment tool may be moved to a second production zone at step **148**, or retrieved to the surface at step **150**. If the results are unacceptable, then at step **152** the treatment device injects a scale inhibitor (*e.g.*, phosphonated carboxylic acids) into the first production zone. After the treatment is complete, at step **154**, the sensors of the treatment tool are again used to obtain information relating to scale formation to evaluate the effectiveness of the treatment. If the results are acceptable, then the treatment tool may be moved to a second production zone (step **148**) or retrieved to the surface (step **150**). If the results are unacceptable, then further treatment may be applied by repeating step **152**.

[0034] In a similar fashion, embodiments of the present disclosure may be used to control asphaltene deposition. In one illustrative method, the on-board sensors of the treatment tool are configured to obtain information relating to the presence or concentration of asphaltenes in the produced fluid at a production zone. If the concentration of asphaltenes is out of an expected or desired range, personnel may use the treatment tool to treat the production zone with an asphaltine inhibitor. The effectiveness of the treatment may be thereafter evaluated using the sensors of the treatment tool. The treatment tool may be configured to treat one condition or may include suitable on-board sensors to treat a variety of well conditions.

[0035] It should be appreciated that embodiments of the treatment tool can evaluate well conditions at discrete intervals in the well and to treat only those specific intervals that have an out-of-norm condition. Many wells may have several zones from which formation fluids are produced. These formation fluids commingle in the borehole or production tubing and flow to the surface. Thus, analyzing the fluid at the

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surface may identify a particular undesirable condition. However, such an analysis, by itself, may not furnish information as to which zone or zones have the undesirable condition. Advantageously, the treatment tools according to the present disclosure may be used to cost-efficiently isolate and treat specific zones in a single trip.

[0036] Controlling scale and asphaltine deposition are merely examples of the variety of downhole conditions that may be treated with the treatment tool **10**. Discussed below are non-limiting applications for the treatment tools according to the present disclosure. The treatment tool **10** may be used for borehole acid treatment to remove scale or similar deposits from perforations and well-completion components. Acidization may also be used to control, among other things, corrosion, paraffin, emulsion, hydrates, hydrogen sulfide, inorganics and other harmful substances. Other uses include damage removal, completion and stimulation of horizontal wells, matrix acidizing, fracture acidizing and gel breaking. Additives for such uses include, but are not limited to, hydrochloric acid and viscoelastic surfactant (VES) based fluids.

[0037] The treatment tool **10** may be used to treat a downhole feature using nanoparticles. Suitable nanoparticles include alkaline earth metal oxides, alkaline earth metal hydroxides, alkali metal oxides, alkali metal hydroxides, transition metal oxides, transition metal hydroxides, post-transition metal oxides. Illustrative applications include recharging beds or packs of substrate particles with nanoparticles, zone isolation and flow control in water shutoff, stabilizing clays, such as clays in a subterranean formation,

[0038] The treatment tool **10** may be used for borehole acid treatment to blocking gels, cement, microcement, silicates, and other materials to strengthen a borehole. VES-gelled fluids have been widely used as gravel-packing, frac-packing and fracturing fluids. The treatment tool **10** may be used to treat subterranean hydrocarbon formations, such as in hydraulic fracturing, completion fluids, gravel packing fluids and fluid loss pills.

[0039] While the present teachings have been discussed in the context of hydrocarbon producing wells, it should be understood that the present teachings may be applied to geothermal wells, groundwater wells, subsea analysis, etc.

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[0040] As used herein, the term "additive" generally refers to an engineered material that is formulated to perform a desired task. For example, an "additive" may be any material(s), agent(s) or substance(s) that interact with the downhole feature in a predetermined manner. An additive may be a gas, liquid, a gel, plasma, or a solid entrained in a fluid carrier. An additive may be chemically active (*e.g.*, an acid), thermally active, electromagnetically responsive (*e.g.*, magnetorheological fluids), mechanical (*e.g.*, a proppant, gravel, cement, resin, etc.) or have specialized material properties (*e.g.*, relative permeability modifiers). Also, merely for brevity, this disclosure refers to an "additive" in the singular. It should be understood that such references are inclusive of the plural "additives."

[0041] The term "conveyance device" as used above means any device, device component, combination of devices, media and/or member that may be used to convey, house, support or otherwise facilitate the use of another device, device component, combination of devices, media and/or member. Exemplary non-limiting conveyance devices include drill strings of the coiled tube type, of the jointed pipe type and any combination or portion thereof. Other conveyance device examples include casing pipes, wirelines, wire line sondes, slickline sondes, drop shots, downhole subs, BHA's, drill string inserts, modules, internal housings and substrate portions thereof, self-propelled tractors.

[0042] As used above, the term "sub" refers to any structure that is configured to partially enclose, completely enclose, house, or support a device. The term "information" as used above includes any form of information (Analog, digital, EM, printed, etc.). The term "information processing device" herein includes, but is not limited to, any device that transmits, receives, manipulates, converts, calculates, modulates, transposes, carries, stores or otherwise utilizes information. An information processing device may include a microprocessor, resident memory, and peripherals for executing programmed instructions.

[0043] The present disclosure is susceptible to embodiments of different forms. There are shown in the drawings, and herein will be described in detail, specific embodiments of the present disclosure with the understanding that the present disclosure is to be considered an exemplification of the principles of the disclosure and is not intended to limit the disclosure to that illustrated and described herein.

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**CLAIMS**

What is claimed is:

1. A method for treating a downhole feature, comprising:
  - acquiring information relating to the downhole feature using a treatment tool positioned in a borehole;
  - estimating a condition relating to the downhole feature based on the acquired information;
  - treating the downhole feature using at least one additive applied by the treatment tool; and
  - estimating a change in the condition of the downhole feature after the treatment of the downhole feature.
2. The method of claim 1, wherein the downhole feature is a naturally occurring feature selected from one of: (i) a subsurface formation, and (ii) a fluid produced from the subsurface formation.
3. The method of claim 1, wherein the downhole feature is a human-made feature.
4. The method of claim 1, wherein the at least one additive is one of: (i) an additive formulated to adjust a formation parameter; (ii) an additive formulated to adjust a chemical property, (iii) an additive formulated to adjust a fluid property, and (iv) a corrosion inhibitor.
5. The method of claim 1, further comprising positioning the treatment tool in the borehole, keeping the treatment tool in the borehole while the condition is estimated, and conveying the treatment tool out of the borehole after the treatment of the downhole feature.
6. The method of claim 1, further comprising selectively isolating a borehole location before treating the downhole feature.
7. The method of claim 1, further comprising moving the treatment tool to a plurality of locations in the borehole.

8. The method of claim 1, further comprising flowing the at least one additive through the treatment tool.
9. The method of claim 1, further comprising: drilling the borehole using a drill string, wherein the treatment tool is positioned on the drill string.
10. The method of claim 1, wherein the information relates to a scale deposition indicator, the well condition relates to scale formation, and the at least one additive includes a scale inhibitor.
11. The method of claim 1, wherein the information relates to asphaltene, the well condition relates to asphaltene deposition, and the at least one additive includes an asphaltine inhibitor.
12. An apparatus for treating a downhole feature, comprising:
  - a treatment tool configured to treat the downhole feature with at least one additive;
  - at least one sensor associated with the treatment tool, the at least one sensor being configured to acquire information relating to the downhole feature; and
  - a conveyance device configured to selectively position the treatment tool in a borehole.
13. The apparatus of claim 12, wherein the conveyance device is a tubular configured to convey the at least one additive to the treatment tool.
14. The apparatus of claim 13, wherein the treatment tool includes a port and a flow path for conveying the at least one additive from the tubular to the port.
15. The apparatus of claim 14, wherein the at least one sensor is positioned proximate to the port.

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16. The apparatus of claim 14, wherein the at least one sensor includes a plurality of sensors arrayed at the port.

17. The apparatus of claim 12, further comprising at least one sealing device for selectively isolating a selected borehole location.

18. The apparatus of claim 17, wherein the selected borehole location is one of: (i) an area on a surface adjacent to the treatment tool, and (ii) an annular space between the treatment tool and an adjacent surface.

19. The apparatus of claim 12, further comprising a signal conducting media configured to convey the information acquired by the at least one sensor to a surface location.

20. The apparatus of claim 19, further comprising an information processing device in signal communication with the signal conducting media and configured to control the treatment tool in response to the information acquired by the at least one sensor.

21. The apparatus of claim 19, further comprising an information processing device in signal communication with the signal conducting media, the information processing device being configured to at least one of: (i) estimate a condition relating to the downhole feature based on the information acquired by the at least one sensor; and (ii) estimate a change in the condition of the downhole feature after the treatment of the downhole feature.

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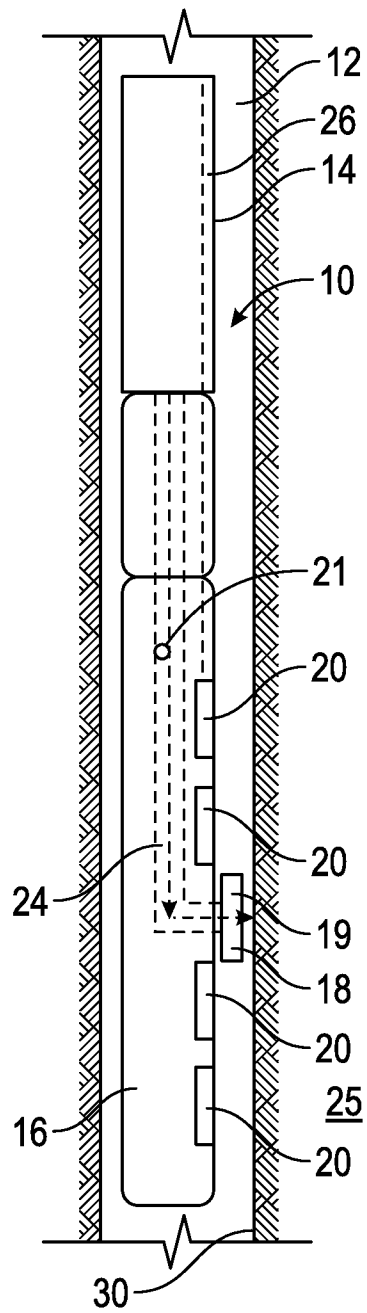


FIG. 1

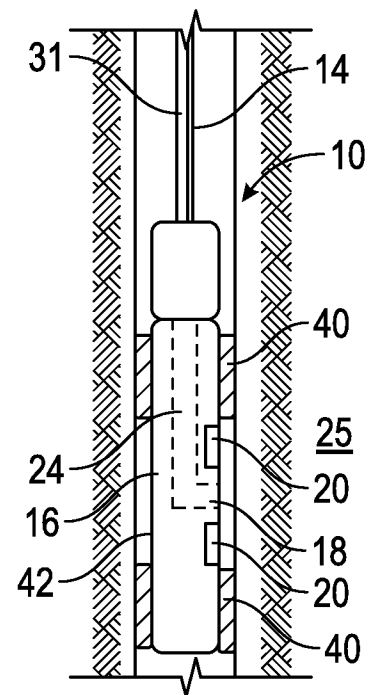


FIG. 2

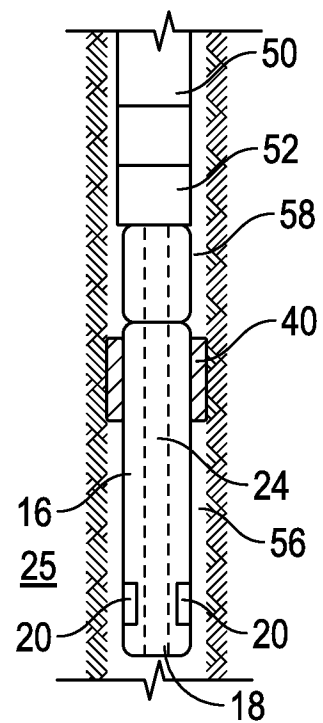


FIG. 3

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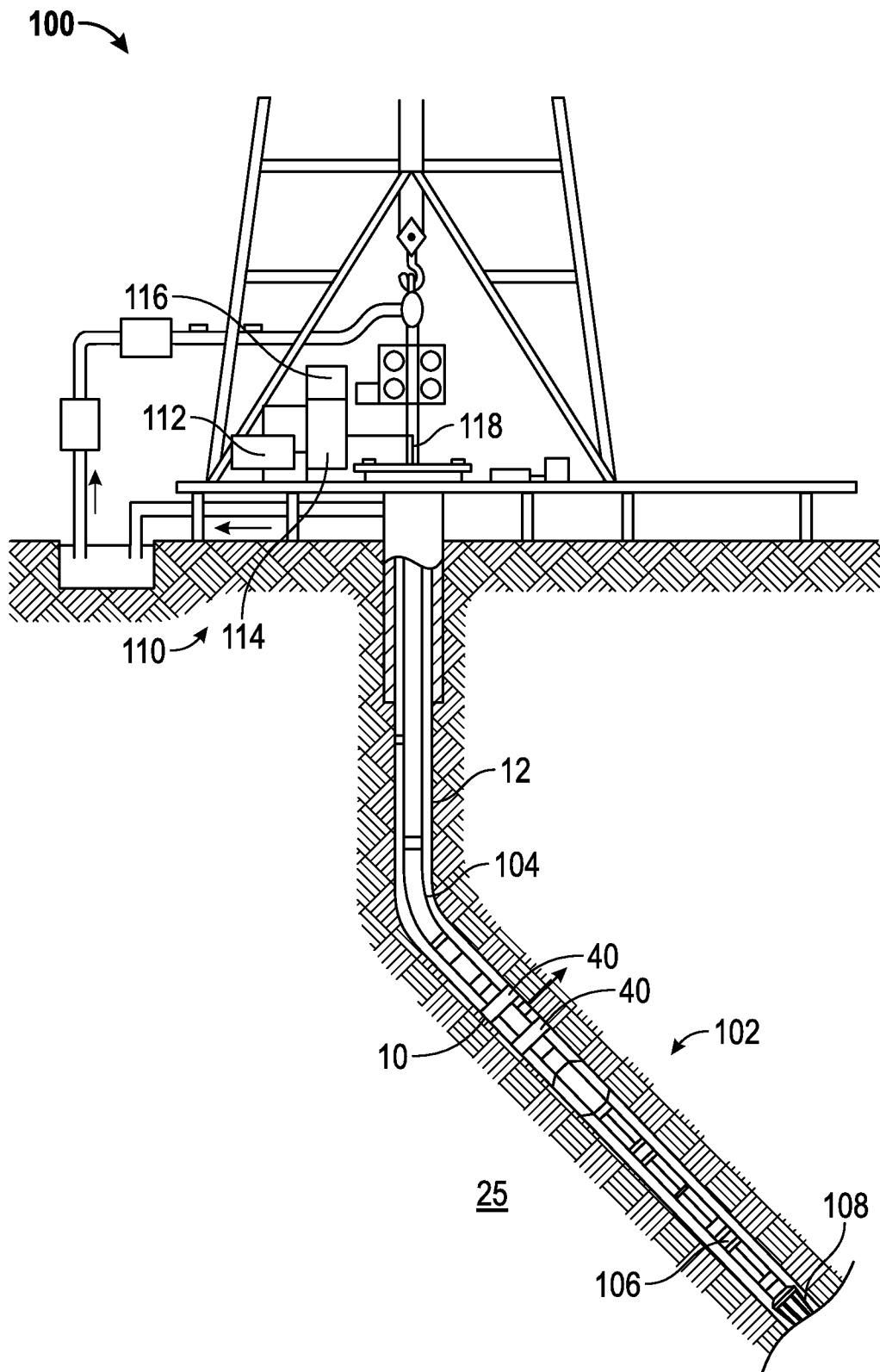


**FIG. 4**

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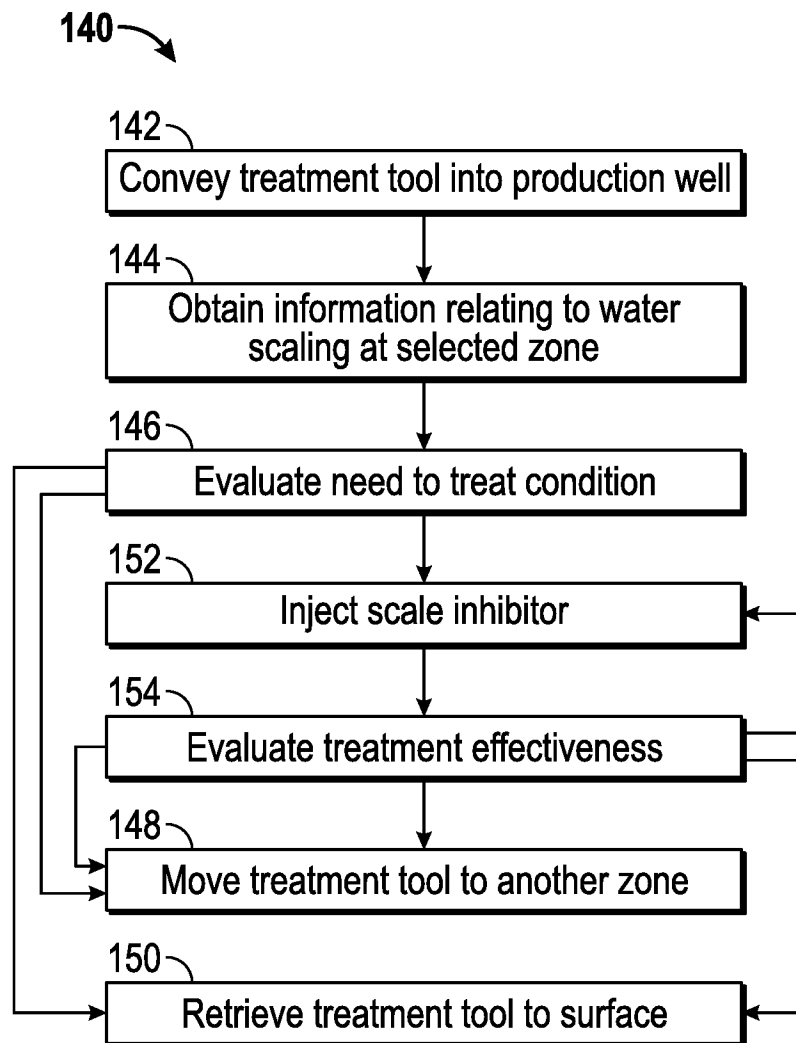


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2013/048412****A. CLASSIFICATION OF SUBJECT MATTER****E21B 43/22(2006.01)i, E21B 44/00(2006.01)i, E21B 47/008(2012.01)i**

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 43/22; E21B 47/00; E21B 43/01; E21B 43/00; G01N 21/41; E21B 41/00; E21B 37/06; E21B 44/00; E21B 47/008

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; Keywords: wellbore, sensor, data, string, treatment, additive, and formation

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                         | Relevant to claim No. |
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| A         | US 7234524 B2 (SHAW et al.) 26 June 2007<br>See abstract; column 2, lines 7-33, column 3, lines 55-62; claims 1,30;<br>and figure 1.                       | 1-21                  |
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Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

25 September 2013 (25.09.2013)

Date of mailing of the international search report

**25 September 2013 (25.09.2013)**

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