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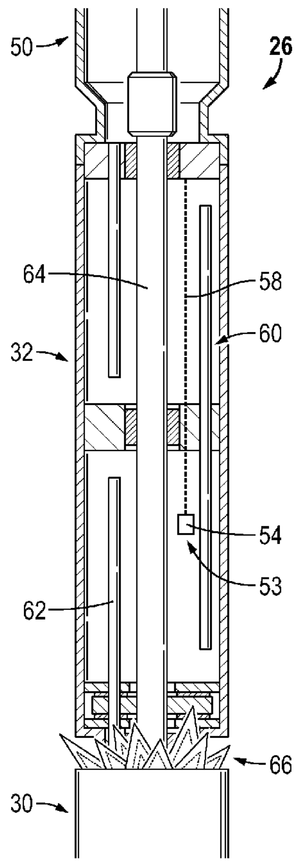
[Continued on next page]

(54) Title: SYSTEM AND METHODOLOGY FOR DETECTING PARAMETER CHANGES IN A PUMPING ASSEMBLY

FIG. 2



(57) Abstract: A technique facilitates monitoring of a pumping system, such as an electric submersible pumping system. A sensor is positioned in the electric submersible pumping system and used to monitor for a certain parameter change or parameter changes. In some applications, at least one sensor may be used to monitor for parameter changes in a fluid, e.g. changes in dielectric fluid. The at least one sensor also can be used to monitor for changes which indicate operational problems with a pumping system component, e.g. a shaft. Upon detection of the parameter change, the sensor or sensors provide a signal to a control system indicating the parameter change. Operation of the electric submersible pumping system can then be adjusted appropriately in response to the parameter change.

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PATENT APPLICATION

SYSTEM AND METHODOLOGY FOR DETECTING PARAMETER CHANGES IN A PUMPING ASSEMBLY

BACKGROUND

[0001] In many hydrocarbon well applications, well fluids or injection fluids are pumped by electric submersible pumping systems. For example, an electric submersible pumping system may be deployed in a wellbore and operated to produce oil or other production fluids. In some applications, the electric submersible pumping system may be used to inject fluid into a formation surrounding the wellbore. Many electric submersible pumping systems comprise a submersible pump used in combination with a submersible motor and a motor protector. A dielectric fluid may be used within the submersible motor and motor protector to protect the motor while enabling pressure balancing with the surrounding environment. Depending on the application, however, the electric submersible pumping system may be subjected to a variety of environmental factors and operational factors that can detrimentally affect continued operation of the pumping system.

SUMMARY

[0002] In general, a methodology and system are provided to facilitate monitoring of a pumping system, such as an electric submersible pumping system. A sensor is positioned in the electric submersible pumping system and used to monitor for a certain parameter change or parameter changes. In some applications, at least one sensor may be used to monitor for parameter changes in a fluid, e.g. changes in dielectric fluid parameters due to ingress of water or dielectric fluid breakdown. The at least one sensor also can be used to monitor for changes which indicate operational problems with a pumping system component, e.g. a shaft. Upon detection of the parameter change, the sensor or sensors provide a signal to a control system indicating the parameter change. Operation of the electric submersible pumping system can then be adjusted appropriately in response to the parameter change.

[0003] However, many modifications are possible without materially departing from the teachings of this disclosure. Accordingly, such modifications are intended to be included within the scope of this disclosure as defined in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Certain embodiments of the disclosure will hereafter be described with reference to the accompanying drawings, wherein like reference numerals denote like elements. It should be understood, however, that the accompanying figures illustrate the various implementations described herein and are not meant to limit the scope of various technologies described herein, and:

[0005] Figure 1 is an illustration of a well system comprising an electric submersible pumping system and a sensor system, according to an embodiment of the disclosure;

[0006] Figure 2 is an illustration of an example of a motor protector coupled with a submersible motor for use in an electric submersible pumping system and combined with at least one sensor, according to an embodiment of the disclosure;

[0007] Figure 3 is an illustration of another example of a motor protector for use in an electric submersible pumping system and combined with at least one sensor, according to an embodiment of the disclosure;

[0008] Figure 4 is an illustration of another well system comprising an electric submersible pumping system and a sensor system, according to an embodiment of the disclosure;

[0009] Figure 5 is an illustration of another well system comprising an electric submersible pumping system and a sensor system, according to an embodiment of the disclosure; and

[0010] Figure 6 is a schematic representation of a sensor system comprising a plurality of sensors in operational communication with a control system, e.g. processing system, coupled with an electric submersible pumping system controller, according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0011] In the following description, numerous details are set forth to provide an understanding of some embodiments of the present disclosure. However, it will be understood by those of ordinary skill in the art that the system and/or methodology may be practiced without these details and that numerous variations or modifications from the described embodiments may be possible.

[0012] The present disclosure generally relates to a method and system which facilitate monitoring of a pumping system, e.g. an electric submersible pumping system, to enable corrective action prior to failure of the pumping system. The system utilizes at least one sensor positioned in the electric submersible pumping system and used to monitor for a certain parameter change or parameter changes indicative of a problem. In some applications, several sensors may be used to monitor for the same parameter change or a plurality of parameter changes related to one or more potential problems.

[0013] According to an embodiment, at least one sensor may be used to monitor for parameter changes in a fluid. For example, at least one sensor may be positioned to monitor for changes in dielectric fluid parameters due to, for example, ingress of water or breakdown of the dielectric fluid. In other applications or in addition to monitoring for fluid changes, at least one sensor also may be used to monitor for other parameter changes related to system components. For example, the sensor or sensors may monitor for changes which indicate operational problems with an electric submersible pumping system shaft or other component.

[0014] Upon detection of the parameter change, the sensor or sensors provide a signal to a control system indicating the parameter change. Operation of the electric submersible pumping system can then be adjusted appropriately in response to the parameter change. The adjustment may comprise a variety of operational changes, such as changing a motor speed, adjusting a valve or other component of the overall well completion, stopping operation of the pumping system, and/or initiating a treatment operation with respect to the surrounding formation.

[0015] Referring generally to Figure 1, an embodiment of a well system 20 is illustrated as comprising an electrically powered system 22 which receives electric power via an electrical power cable 24. By way of example, the electrically powered system 22 may be in the form of an electric submersible pumping system 26. Although the electric submersible pumping system 26 may have a wide variety of components, examples of such components comprise a submersible pump 28, a submersible motor 30, and a motor protector 32.

[0016] In the example illustrated, electric submersible pumping system 26 is designed for deployment in a well 34 located within a geological formation 36 containing, for example, petroleum or other desirable production fluids. A wellbore 38 may be drilled and lined with a wellbore casing 40, although the electric submersible pumping system 26 may be used in open hole wellbores or in other environments. In the example illustrated, however, casing 40 may be perforated with a plurality of perforations 42 through which production fluids flow from formation 36 into wellbore 38. The electric submersible pumping system 26 is deployed into the wellbore 38 via a conveyance or other deployment system 44 which may comprise tubing 46, e.g. coiled tubing or production tubing. By way of example, the conveyance 44 may be coupled with the electric submersible pumping system 26 via an appropriate tubing connector 48.

[0017] In the example illustrated, electric power is provided to submersible motor 30 by electrical power cable 24. The submersible motor 30, in turn, powers submersible pump 28 which draws in fluid, e.g. production fluid, into the pumping system through a pump intake 50. The pumped fluid then exits through a discharge 52 and is produced or moved to the surface or other suitable location via tubing 46. However, the fluid may be pumped to other locations and/or along other flow paths. In some applications, for example, the fluid may be pumped along an annulus surrounding conveyance 44. In other applications, the electric submersible pumping system 26 may be used to inject fluid into the subterranean formation or to move fluids to other subterranean locations.

[0018] In the embodiment illustrated, well system 20 further comprises a sensor system 53 having a sensor 54 or a plurality of sensors 54 positioned in the electric submersible pumping system 26 to detect parameter changes which occur during, for example, operation of the electric submersible pumping system 26. By way of example, a sensor 54 or sensors 54 may be placed in the submersible motor 30 and/or the motor protector 32. Data from the sensor(s) is output to a control system 56 via a suitable communication line 58 which may be in the form of a wired or wireless communication line. In some applications, signals from sensors 54 may be transmitted to the surface via both wired and wireless sections of communication line 58.

[0019] In the illustrated example, control system 56 is positioned at a surface location, however the control system 56 can be positioned in whole or in part at downhole locations, surface locations, and/or remote locations. The control system 56 may be in the form of a processor-based system, e.g. computer system, which processes data from the sensor or sensors 54 to determine whether a parameter change has occurred and to determine whether that parameter change warrants a corrective action.

[0020] The corrective action may comprise adjusting operation of the electric submersible pumping system 26 to, for example, reduce the chance of failure with respect to components of the electric submersible pumping system 26. Consequently, the life of overall pumping system 26 may be extended. Depending on the type of application and the parameter change, the corrective action may comprise a variety of operational changes. Examples of such operational changes include changing a motor speed, adjusting a valve or other component of the overall well completion, stopping operation of the pumping system, and/or initiating a treatment operation with respect to the surrounding formation. In some embodiments, the corrective actions may involve actions taken by an operator to adjust operation of the electric submersible pumping system. However, the corrective actions also may be fully automated such that the control system 56 automatically outputs control signals to a motor controller or other controller which then adjusts operation of the electric submersible pumping system 26 in response to the detected parameter change.

[0021] Referring generally to Figure 2, an embodiment of well system 20 and sensor system 53 is illustrated. In this embodiment, at least one sensor 54 is disposed in motor protector 32 of electric submersible pumping system 26. The configuration of motor protector 32 may vary depending on the application. The illustrated example, however, includes a labyrinth type motor protector 32 having a labyrinth 60 disposed between external fluids and an internal dielectric fluid 62, e.g. dielectric oil. The submersible motor 30 and the labyrinth 60 contain the dielectric fluid 62. As illustrated, the motor protector 32 may be positioned between submersible motor 30 and pump intake 50. Additionally, an electric submersible pumping system shaft 64 may extend from submersible motor 30, through motor protector 32, and to the submersible pump 28. During operation, the submersible motor 30 rotates shaft 64 to power the submersible pump 28.

[0022] Dielectric fluid 62 maintains proper function of submersible motor 30 and the overall electric submersible pumping 26. Accordingly, contamination of the dielectric fluid 62, e.g. dielectric oil, can result in failure of the electric submersible pumping system 26. Contamination of the dielectric fluid 62 can occur due to well fluid ingress and/or degradation of the fluid 62 due to aging or other mechanisms. In this example, at least one of these sensors 54 may be located in the motor protector 32 to detect parameter changes in the dielectric fluid 62 indicative of potential failure of the electric submersible pumping system 26 if left unchecked. For example, the ingress of well fluids into motor protector 32 and thus into submersible motor 30 can cause a burnout, e.g. electrical failure, of the submersible motor 30 as represented figuratively and notated via reference numeral 66. In some applications, the sensor 54 or additional sensors 54 may be located in submersible motor 30 to monitor for the ingress of well fluids and/or other undesirable parameter changes with respect to the dielectric fluid 62.

[0023] Depending on the application, the illustrated sensor 54 may comprise a dielectric strength sensor, a viscosity sensor, a water sensor, and/or other type of sensor or sensors able to detect a parameter change with respect to the dielectric fluid 62. The sensor or sensors 54 provide monitoring of the properties of the dielectric fluid 62 to enable prognostic health management of the overall electric submersible pumping system 26 and well system 20. Upon detection of the parameter change, data is sent to control system 56 so that corrective action may be implemented. Additionally, monitoring of the dielectric fluid 62 enables estimation of the life of the electric submersible pumping system 26 based on trends in the parameter changes, e.g. dielectric oil property changes.

The corrective actions may be employed to, for example, achieve a longer run life of the electric submersible pumping system 26.

[0024] In a variety of applications, monitoring of the dielectric fluid 62 at the motor protector 32 and/or submersible motor 30 enables determination of the percentage of water ingress. The collected data also may be used to predict an ingress rate and a remaining time to motor failure. By collecting such data at, for example, control system 56, useful corrective actions may be made in a variety of applications and may be particularly useful in applications involving substantial difficulties and costs in replacing the electric submersible pumping system, e.g. subsea applications and applications involving electric submersible pumping system intervention constraints. Parameter changes in the dielectric fluid 62 provide a good indicator to initiate automated corrective actions or to help an operator plan appropriate actions with respect to well management prior to failure of the electric submersible pumping system 26.

[0025] Referring generally to Figure 3, another embodiment of motor protector 32 is illustrated as coupled with submersible motor 30. In this example, sensor system 53 comprises a plurality of the sensors 54 which are positioned to monitor a variety of parameters and to detect certain parameter changes. For example, the sensors 54 may comprise temperature sensors located proximate, for example, one or more journal bearings 68 and/or a thrust chamber of a thrust bearing 70, as illustrated. The sensors 54 also may comprise rotational speed sensors and/or angle sensors, e.g. torsional angle sensors, as illustrated by sensors 54 located along opposite ends of the shaft 64 of motor protector 32. The sensors 54 also may comprise shaft vibration sensors, such as the vibration sensor 54 located proximate a bag chamber 72 of motor protector 32.

[0026] In these examples, the sensors 54 may be employed to monitor for parameter changes related to shaft 64. Monitoring the condition of shaft 64 to enable detection of parameter changes indicative of a detrimental change can help predict shaft failures. Upon detection of the selected parameter changes, corrective action can be taken automatically via control system 56 and/or via intervention of an operator to change operation of the electric submersible pumping system 26. The operational changes can be used to optimize operating parameters and to prevent failure, thus prolonging the run life of the electric submersible pumping system 26. An individual sensor 54 or combinations of the sensors 54, e.g. combinations of sensors 54 described in the preceding paragraph, can be used to assess the running condition of shaft 64.

[0027] It should be noted that an individual sensor or combinations of sensors 54 may be used in a variety of motor protectors 32 and/or in a variety of motors 30. In the specific embodiment illustrated, for example, the motor protector 32 is a bag chamber style motor protector having bag chamber 72 and other cooperating components, such as one or more shaft seals 74 and one or more filters 76. In some applications, sensors 54 also may be used to monitor for parameter changes with respect to internal fluids, e.g. to monitor for ingress of water or other well fluids and/or to monitor for changes in properties of the internal dielectric oil 62.

[0028] Shaft 64 may fail in a variety of ways including shaft breakage. If the shaft 64 breaks within motor protector 32 or submersible motor 30, the failure is generally catastrophic with respect operation of the electric submersible pumping system 26. In some applications, a variety of the sensors 54 may be positioned throughout the motor protector 32 and/or submersible motor 30 to collect data from various points along electric submersible pumping system 26. For example, temperature data may be collected at features such as thrust bearings 70, journal bearings 68, shaft seals 74, and/or other locations as an indicator of potential problems with the shaft 64 itself or with the operational conditions to which shaft 64 is subjected. The sensors 54 also may be used to collect vibration data at selected positions, torsional shaft angle data, shaft loading and performance data, and/or other data. Such data also can be useful in monitoring shaft 64 and in detecting parameter changes indicative of potential problems with respect to operation of shaft 64 and thus operation of the overall electric submersible pumping system 26. Various corrective actions can be planned and taken to prevent shaft failure, to optimize performance of the shaft 64, and to thus prolong the run life of the electric submersible pumping system 26.

[0029] In a variety of downhole applications, the ingress of water (or other detrimental well fluids) can be a good indicator or predictor of failure with respect to submersible motor 30 and thus failure of the overall electric submersible pumping system 26. As illustrated in the embodiment of Figure 4, the electric submersible pumping system 26 may comprise a gauge 78 coupled with the submersible motor 30 at, for example, a lower end of the submersible motor 30. At least one of the sensors 54 may be in the form of a water detection sensor disposed in one or both of the gauge 78 and submersible motor 30 to monitor for the presence of water.

[0030] Generally, water ingress into the submersible motor 30 results in the water migrating to the bottom of the submersible motor 30 due to the heavier density of the water compared to the dielectric oil 62 within motor 30. Data provided by water sensor or sensors 54 to control system 56 indicates the parameter change due to the presence of water. The data also can be used to estimate the rate of water ingress and thus to predict motor burnout and thus failure of the electric submersible pumping system 26.

[0031] Referring generally to Figure 5, a modified version of the embodiment of Figure 4 is illustrated. In this latter embodiment, a water container or reservoir 80 is located between gauge 78 and submersible motor 30. The sensor or sensors 54 may be positioned at least in part at water reservoir 80 to monitor dielectric fluid 62 and to detect parameter changes with respect to the dielectric fluid 62, e.g. to detect the ingress of water. In this example, the reservoir 80 also can provide a buffer for collection of small amounts of water which migrate from the submersible motor 30 so as to prolong the run life of the submersible motor 30 and thus of the electric submersible pumping system 26.

[0032] Depending on the application, the water container/reservoir 80 may be an individual part constructed and connected to, for example, a lower end of the submersible motor 30. In other applications, the water container/reservoir 80 may be constructed as an extension of the submersible motor 30. Use of the reservoir 80 facilitates collection of data on the ingress of water with respect to its volume and ingress rate, thus enabling corrective action such as slowing the motor/pumping rate, temporarily stopping pumping, actuating valves or other components of the downhole well system to limit the incursion of water, changing production rates from other well zones, and/or other corrective actions. With slow rates of water ingress, the reservoir 80 also may serve as a water collection component which retains the water away from the interior of submersible motor 30. In some applications, placement of a sensor or sensors 54 within reservoir 80 and/or gauge 78 moves the sensor away from the heat generated by the submersible motor 30, thus enabling longer sensor life or use of different types of sensors. Water ingress into the submersible motor 30 can occur from a variety of sources and entry locations, including leakage at components such as a power cable head and/or motor protector 32.

[0033] As illustrated in Figure 6, sensor system 53 may comprise a variety of sensors 54 individually or in various combinations. By way of example, sensors 54 may comprise at least one temperature sensor 82, water sensor 84 (or other fluid type sensor), shaft load sensor 86, dielectric strength sensor 88, shaft speed sensor 90, shaft angle sensor 92, e.g. torsional angle sensor, a viscosity sensor 94, and/or other suitable sensors to detect the desired parameter change or changes. The data from the at least one sensor is provided to control system 56 via communication line 58.

[0034] In a variety of applications, the control system 56 is a processor-based control system, e.g. computer-based system, which may be used to process the data according to desired programs, e.g. models, to determine occurrence of the parameter change or changes. The processed data can then be used to determine the appropriate corrective action automatically or with the intervention of an operator. In some applications, for example, the control system 56 may be used to determine the appropriate corrective action. Control signals may then be provided automatically by the control system 56 to a corresponding controller 94 which adjusts operation of the electric submersible pumping system 26 so as to extend its run life or to perform another corrective action. By way of example, controller 94 may comprise a motor controller which controls the speed and operation of submersible motor 30.

[0035] Depending on the application, the structure of electric submersible pumping system 26 and of individual components within pumping system 26 may vary to accommodate the characteristics of a given application. For example, a variety of submersible motors 30 and motor protectors 32 may be utilized. Similarly, many types of sensor systems 53 and individual sensors 54 may be employed in submersible motor 30, motor protector 32, and/or other components of electric submersible pumping system 26 to monitor system operation and to detect a specific parameter change or parameter changes. The control system 56 also may be programmed or otherwise adapted to process many types of data received from the sensors 54 and to determine an appropriate corrective action based on a variety of models or other programs selected as appropriate for a given application. An individual sensor or a plurality of similar or dissimilar sensors may be located at various positions within the electric submersible pumping system so as to enable reliable detection of the desired parameter change or changes.

[0036] Although a few embodiments of the disclosure 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 disclosure. Accordingly, such modifications are intended to be included within the scope of this disclosure as defined in the claims.

CLAIMS

What is claimed is:

1. A system for use in a well operation, comprising:

positioning a sensor in an electric submersible pumping system;

using the sensor to monitor a fluid for a parameter change;

upon detection of the parameter change in the fluid, providing a sensor signal to a control system indicating the parameter change; and

adjusting operation of the electric submersible pumping system in response to the parameter change.

2. The method as recited in claim 1, further comprising monitoring a shaft of the electric submersible pumping system for an indication of potential shaft failure.

3. The method as recited in claim 1, wherein using comprises using the sensor to monitor properties of a dielectric oil.

4. The method as recited in claim 1, wherein using comprises using the sensor to monitor for the presence of water in the electric submersible pumping system.

5. The method as recited in claim 4, wherein using comprises using the sensor to monitor for the presence of water in a water reservoir located below a submersible motor of the electric submersible pumping system.

6. The method as recited in claim 1, wherein positioning a sensor comprises positioning a dielectric strength sensor.

7. The method as recited in claim 1, wherein positioning a sensor comprises positioning a viscosity sensor.

8. The method as recited in claim 2, wherein positioning a sensor comprises positioning a temperature sensor proximate a journal bearing supporting a shaft of the electric submersible pumping system.

9. The method as recited in claim 2, wherein positioning a sensor comprises positioning rotational shaft speed and angle sensors.

10. The method as recited in claim 1, wherein positioning a sensor comprises positioning the sensor at a bottom of a submersible motor of the electric submersible pumping system.

11. A system, comprising:

an electric submersible pumping system having a submersible motor, a motor protector, and a submersible pump powered by the submersible motor;

a plurality of sensors disposed in at least one of the submersible motor and the motor protector to monitor for an undesirable parameter change; and

a processor system that receives data from the plurality of sensors and processes the data to determine whether the undesirable parameter change has occurred and to provide an output regarding corrective action.

12. The system as recited in claim 11, wherein the plurality of sensors comprises a sensor to monitor for the presence of water in the submersible motor.

13. The system as recited in claim 11, wherein the plurality of sensors comprises a sensor to monitor properties of a dielectric oil in the motor protector.

14. The system as recited in claim 11, wherein the plurality of sensors comprises a sensor to monitor loading on a shaft of the electric submersible pumping system.

15. The system as recited in claim 11, wherein the plurality of sensors comprises a sensor to monitor temperature at a journal bearing of a shaft of the electric submersible pumping system.

16. The system as recited in claim 11, wherein the plurality of sensors comprises a water detection sensor positioned at a water reservoir located at a bottom end of the submersible motor.

17. A method, comprising:

positioning a sensor in an electric submersible pumping system;

using the sensor to monitor a shaft of the electric submersible pumping system for indication of a parameter change;

upon detection of the parameter change related to the shaft, providing a sensor signal to a control system indicating the parameter change; and

adjusting operation of the electric submersible pumping system in response to the parameter change.

18. The method as recited in claim 17, wherein positioning comprises positioning a plurality of sensors in the electric submersible pumping system to monitor the shaft and to monitor a fluid within the electric submersible pumping system.

19. The method as recited in claim 17, wherein positioning comprises positioning a plurality of sensors and using comprises using the plurality of sensors to measure temperature at a location along the shaft.

20. The method as recited in claim 18, wherein using comprises monitoring properties of a dielectric fluid in the electric submersible pumping system.

FIG. 1

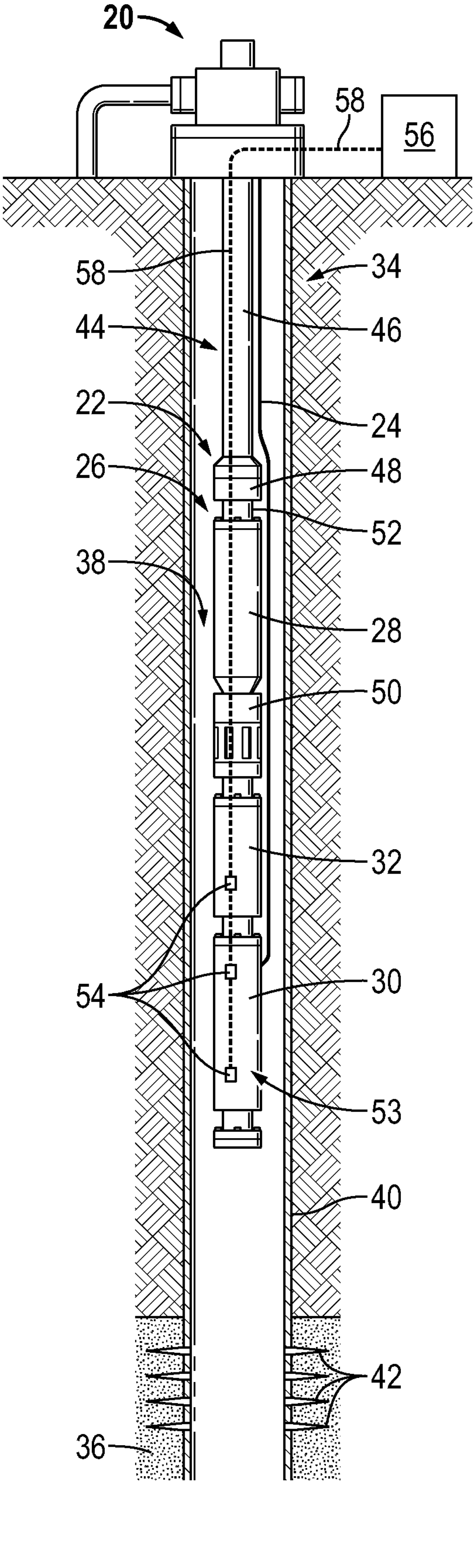
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FIG. 2

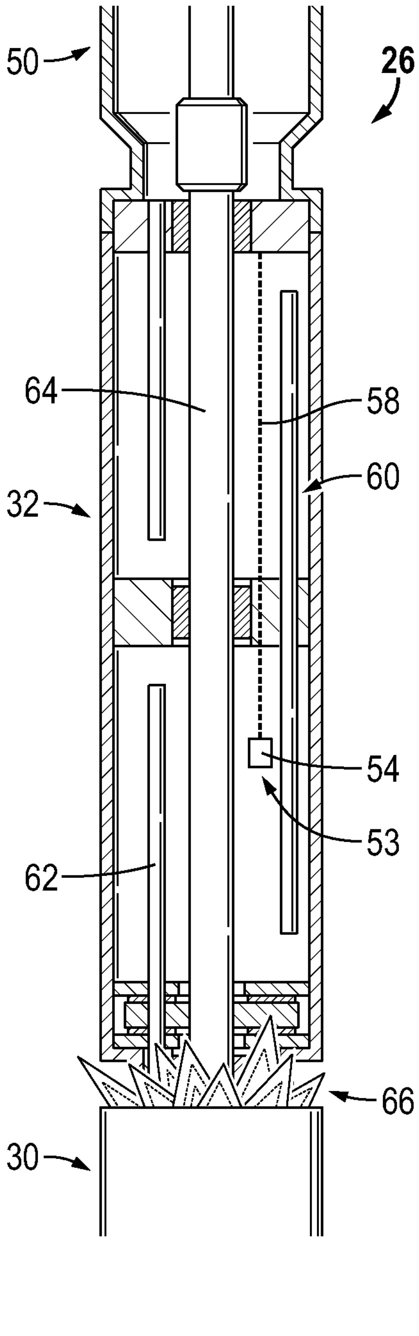
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FIG. 3

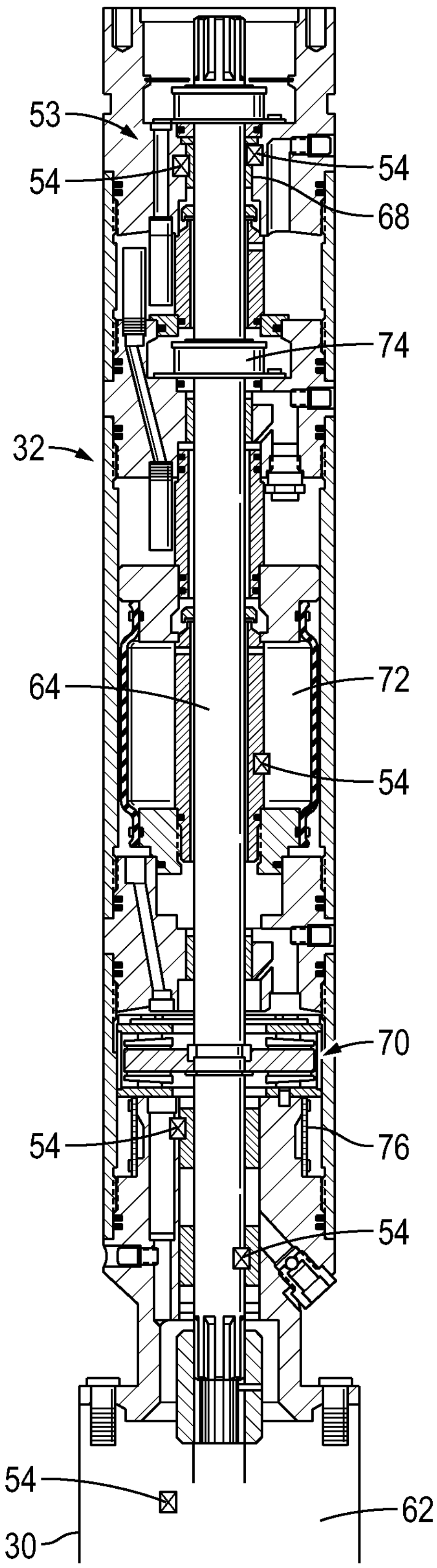
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FIG. 4

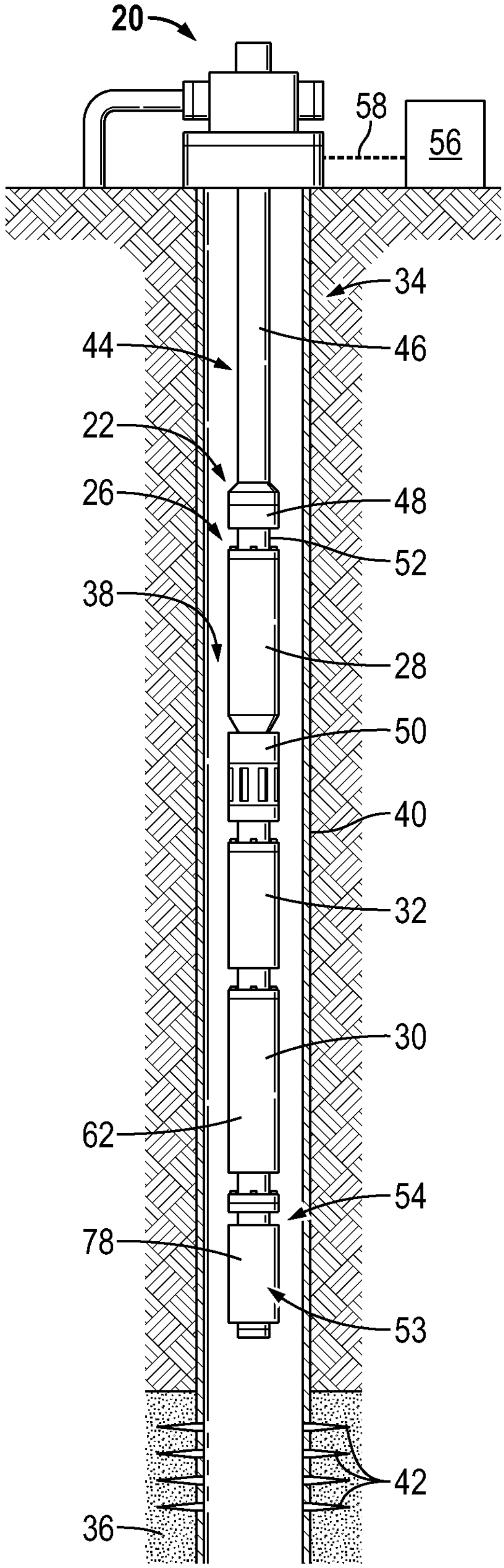
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FIG. 5

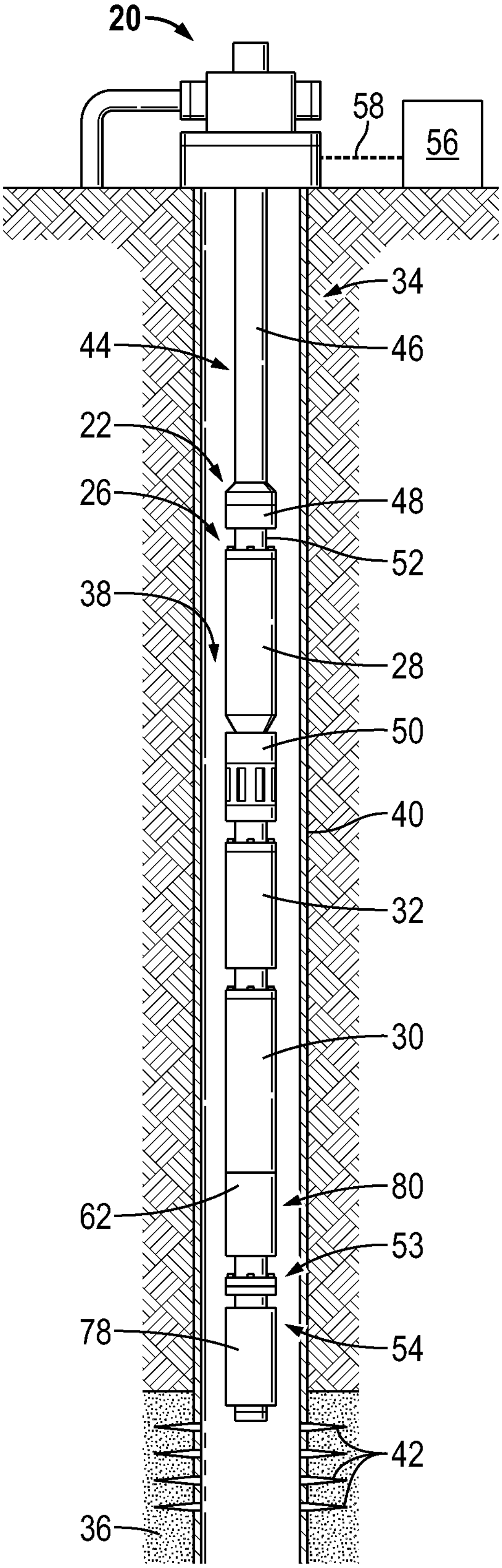
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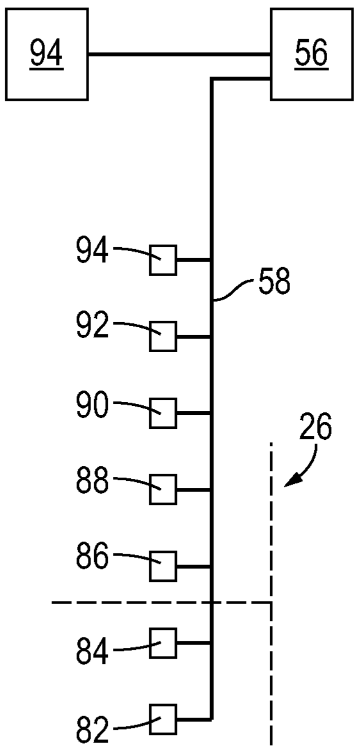
FIG. 6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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/022160

A. CLASSIFICATION OF SUBJECT MATTER

E21B 43/12(2006.01)i, E21B 21/08(2006.01)i, F04D 13/10(2006.01)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 43/12; E21B 47/00; E21B 15/00; E21B 49/08; E21B 7/04; E21B 29/02; E21B 4/18; E21B 21/08; F04D 13/10

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) & Keywords: well, operation, sensor, pump, monitor, fluid, parameter, change and processor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004-0231842 A1 (SHAMMAI et al.) 25 November 2004 See paragraphs [0005], [0050], [0107]-[0108]; claim 8; and figure 4.	1,3-7,10-16
Y		2,8-9,17-20
Y	US 2010-0065336 A1 (WELLS et al.) 18 March 2010 See paragraph [0008] and claim 1.	2,8-9,17-20
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A	US 2008-0128128 A1 (VAIL et al.) 05 June 2008 See claims 1, 8, 13 and figure 1.	1-20
A	US 5213159 A (SCHNEIDER, JOHN L.) 25 May 1993 See claims 1, 4, 12.	1-20

☐ Further documents are listed in the continuation of Box C.　　☒ See patent family annex.

* Special categories of cited documents:
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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
25 November 2015 (25.11.2015)	**27 November 2015 (27.11.2015)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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