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(71) Applicant *(for CA only)*: **SCHLUMBERGER CANADA LIMITED** [CA/CA]; 525-3rd Avenue S.W., Calgary, Alberta T2P 0G4 (CA).

(71) Applicant *(for FR only)*: **SERVICES PETROLIERS SCHLUMBERGER** [FR/FR]; 42 rue Saint Dominique, F-75007 Paris (FR).

(71) Applicant *(for GB, JP, NL only)*: **SCHLUMBERGER HOLDINGS LIMITED**; P. O. Box 71, Craigmuir Chambers, Road Town, Tortola, No Postal Code (VG).

(71) Applicant *(for all designated States except AG, AO, BA, BB, BR, BW, BZ, CA, CL, CN, CR, CU, DM, DO, DZ, EC, EG, FR, GB, GD, GE, GH, GM, GT, HN, IN, IS, JP, KE, KM, KN, LA, LC, LK, LR, LS, MA, ME, MG, MN, MW, MZ, NA, NG, NI, NL, PE, PG, PH, RS, SC, SD, SG, SL, SM, ST, SV, SY, SZ, TH, TZ, UA, UG, US, VC, VN, ZM, ZW)*: **SCHLUMBERGER TECHNOLOGY B.V.** [NL/NL]; Parkstraat 83-89, NL-2514 JG The Hague (NL).

(71) Applicant *(for AG, AO, BA, BB, BR, BW, BZ, CN, CR, DM, DO, DZ, EC, EG, GD, GE, GH, GM, GT, HN, IN, KE, KM, KN, LA, LC, LK, LR, LS, LY, MA, ME, MG, MN, MW, MZ, NA, NG, NI, PG, PH, RS, SC, SD, SG, SL, SM, ST, SV, SY, SZ, TZ, UA, UG, VC, VN, ZM, ZW only)*: **PRAD RESEARCH AND DEVELOPMENT LIMITED**; Craigmuir Chambers, Road Town, Tortola, No Postal Code (VG).

(71) Applicant *(for IS only)*: **SCHLUMBERGER TECHNOLOGY CORPORATION** [US/US]; 300 Schlumberger Drive, Sugar Land, Texas 77478 (US).

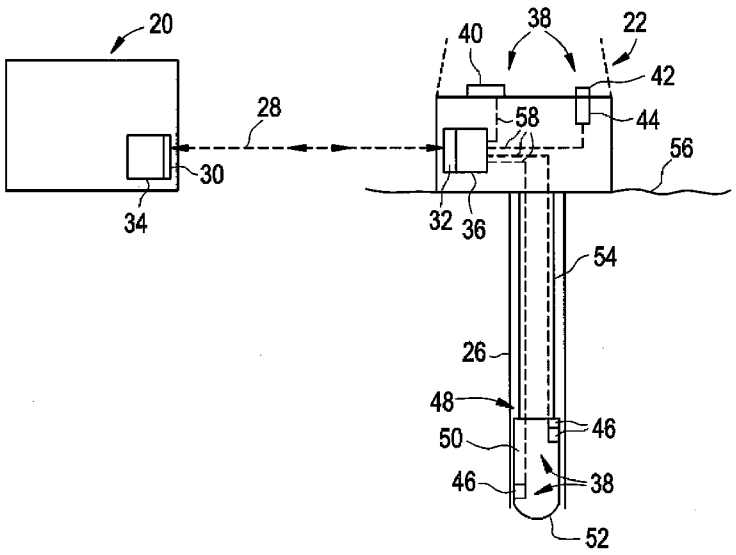
(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CODESAL, Pablo Ariel** [AR/AR]; Vicente Lopez 298 Piso 2 A, Buenos Aires, 1640 (AR). **MALAGON, Cecilia** [MX/MX]; Panama #300 Esquina Costa Rica, Colonia 27 De Sep-

[Continued on next page]

(54) **Title**: REMOTE DRILLING AND COMPLETIONS MANAGEMENT

FIG. 2



(57) **Abstract**: A methodology reduces the needed number of personnel on a rig by enabling performance of a variety of functions from a remote location. The method comprises utilizing a plurality of observation devices which monitor rig parameters remotely. Data from the observation devices is transmitted to a remote operations center used to analyze the data for determining operational changes to the rig. Control instructions may then be transmitted to the rig to implement the operational changes.

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tiembre, Poza Rica, Veracruz, CP 93320 (MX). **CHURCH, Philip Stuart** [GB/GB]; 25 Hardwicke Road, Reigate Surrey RH2 9HJ (GB). **GALUCCIO, Miguel** [AR/GB]; Schlumberger House, Buckingham Gate, Gatwick Airport, Gatwick Gloucestershire RH6 0NZ (GB).

(74) **Agents**: **GALLOWAY, Bryan P.** et al.; 5599 San Felipe, Suite 100, Houston, Texas 77056 (US).

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REMOTE DRILLING AND COMPLETIONS MANAGEMENT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present document is based on and claims priority to U.S. Provisional Application Serial No. 61/290967, filed December 30, 2009 and U. S. Non Provisional Application Serial No. 12/963736, filed December 9, 2010.

BACKGROUND

[0002] A variety of subterranean fluids are recovered from underground formations through the use of wells drilled into or through the underground formations. Wells may be used for exploration and production related to a variety of fluids, including oil, gas, water, geothermal fluids and other types of liquids and/or gases. In many applications, a rig is employed to facilitate drilling and other well construction activities. Traditionally, a relatively large number of rig operators and other personnel have been employed on the rig to perform the complex operations related to construction of the well. However, the requirement of these relatively large numbers at the rig location adds to the expense and complexity of the operation.

SUMMARY

[0003] In general, the present invention provides a methodology for reducing the number of personnel on a rig. The method comprises utilizing a plurality of observation devices which monitor rig parameters remotely. Data from the observation devices is transmitted to a remote operations center, at which the data is analyzed for determining operational changes to the rig. Control instructions may then be transmitted to the rig to implement the operational changes.

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 illustration of a remote operations center in communication with a rig over a well, according to an embodiment of the present invention;

[0006] Figure 2 is a schematic illustration of control systems which may be utilized in the remote operations center and on the rig, according to an embodiment of the present invention;

[0007] Figure 3 is a schematic illustration of a computer-based control system which may be employed in the remote operations center to process data and/or output operational commands to the rig, according to embodiment of the present invention;

[0008] Figure 4 is a schematic illustration of the control system used on a rig to correspond with the remote operations center and/or to carry out rig related operational functions, according to an embodiment of the present invention;

[0009] Figure 5 is a schematic illustration of a hierarchy for operational control of a rig utilizing the remote operations center, according to an embodiment of the present invention; and

[0010] Figure 6 is schematic illustration of a remote operations center, according to an embodiment of the present invention.

DETAILED DESCRIPTION

[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 methodology which enables reductions in the number of personnel required on a rig. A plurality of observation devices is employed to monitor rig parameters remotely at, for example, a remote operations center. This allows the remote processing of data so that decisions may be made at the remote operations center regarding operational changes to the rig. Commands are then sent to the rig to implement the operational changes. In some embodiments, the collection of data at the rig is performed in real-time, and the real-time data is automatically transmitted to the remote operations center. The real-time data is then processed to determine the need for operational changes at the rig. If such operational changes are required, command signals may be relayed from the remote operations center to initiate automatic changes at the rig.

[0013] According to an embodiment of the present invention, the methodology may be employed generally with respect to hydrocarbon and water exploration and production. By way of example, the methodology and system to carry out the methodology may be employed for remote management of oil, gas, geothermal, and water well construction and recovery operations.

[0014] Embodiments of the present invention involve high volume drilling and completions activities, with similar well profiles, for enabling construction in an efficient manner. Such embodiments comprise new work processes and work flows that utilize technology to reduce the number of people required to perform certain tasks, as compared

to traditional operations. Related patent documents include: U.S. Publication No. US2008-0208475, entitled "Drilling Collaboration Infrastructure," to Schlumberger Technology Corporation by inventors George Karr, et al; U.S. Publication No. US-2009-0225630, entitled "Data Aggregation For Drilling Operations," to Schlumberger Technology Corporation by inventors Shunfeng Zheng. U.S. Publication No. US2008-0208475 and U.S. Publication No. US2009-0225630 are hereby incorporated by reference.

[0015] Various embodiments of the present invention include new ways of constructing wells (for oil, gas, geothermal, water) with the main supervision of such well construction located in a remote site, instead of the rig itself. This new process utilizes new technology enablers in the areas of telecommunications, data acquisition and software technology, and facilitates efficiency improvements in well construction operations based on:

- improved collaboration,
- reduced man-power requirements, and
- focused decision making processes.

[0016] In remote well drilling and completions management, the rig is an important component, because all physical operations happen at the rig. The rig comprises a crew of personnel for facilitating rig-based operations. An embodiment of the present invention includes a process having the steps of taking real-time digital measurements of important parameters on the rig (for example, through the use of sensors and/or video cameras, microphones, video-conference equipment, and so forth) and sending such measurements to a remotely located operations center, which may have an expert and/or management team. This remote operations center is in charge of receiving the real-time data, analyzing it, interpreting it, and making informed decisions based on such interpretations. In many applications, processing and analysis is performed automatically on, for example, a computer-based processor to enable decisions regarding rig operational changes. Those decisions are then communicated back to the rig crew personnel -- which is reduced in number due to the role of the remote operations center --

for execution. As described below, the implementation of those decisions may be automated and executed via a control system at the rig.

[0017] Examples of some of the systems/tasks which may be automated according to the methodology described herein include: downlink-to-rotary steerable systems, control over mud pumps, control over weight on the bit, setting block position, and setting RPMs. Over time, rigs will become more and more automated, allowing for more machine-automated execution, hence reducing the personnel requirements on the rig even more. Still the concepts of embodiments of the present invention will remain the same, because the execution can be done by a machine, a person(s), or a combination of both.

[0018] In embodiments of the present invention described below, parties involved in the remote well management process may include, but are not limited to:

- Well Site Supervisor (Company Man),
- Directional Drilling Personnel,
- Measurement-While-Drilling Personnel,
- Optimization Engineer(s),
- Well Engineer(s),
- Drilling Engineer(s),
- Drilling Superintendent,
- Mud representative(s),
- Rig representative(s),
- Information Technology expert(s),
- Software expert(s), and
- Completions Personnel.

Other parties are optional and may include: Wireline personnel, Cementing personnel, Fracturing personnel, Coil Tubing personnel, and Testing personnel.

[0019] Referring generally to Figure 1, a schematic illustration is provided of a remote operations center 20 in communication with a rig 22 positioned over a well 24

which may be defined by one or more wellbores 26. In this embodiment, the remote operations center 20 may be located a substantial distance from rig 22, and may be positioned at a headquarters or at a variety of other locations around the world. Communications between the rig 22 and the remote operations center 20 are represented by line 28, and those communications may be via hard wire, e.g. land lines, wireless, or combinations of hard wired and wireless communication systems. By way of example, wireless, satellite-based communications may be applied to transmit data from rig 22 to remote operations center 20 and/or from remote operations center 20 to rig 22.

[0020] As illustrated in Figure 2, both the remote operations center 20 and the rig 22 comprise signal transmitters 30, 32, respectively, to transmit signals therebetween. The specific type of signal transmitter 30, 32 depends on the form of communication/communication lines 28 employed to deliver data from rig 22 to remote operations center 20 and/or to deliver control signals from remote operations center 20 to rig 22. In this example, signal transmitter 30 further cooperates with a control system 34 which may be a computer-based control system located at remote operations center 20. The signal transmitter 32 may be coupled into cooperation with a corresponding control system 36 located on rig 22. The remote control system 34 is used to receive and process data from rig 22. The processing of data may be accomplished solely on control system 34, or the processing may be accomplished in cooperation with experts and other personnel at remote operations center 20. The rig control system 36 is employed to collect and facilitate transmission of data to remote operations center 20, but the control system 36 also may be employed for carrying out commands regarding operational changes on the rig 22.

[0021] According to one embodiment, control system 36 is used to obtain real-time digital measurements of parameters on rig 22. The control system 36 in cooperation with signal transmitter 32 is further employed to automatically transmit the real-time digital measurements to the remote operations center 20 for processing. Once the data is processed and/or further analyzed at remote operations center 20, a determination is made as to whether rig operational changes are required. If so required, command data related

to the operational changes is transmitted back to rig 22 via control system 34 in cooperation with signal transmitter 30. These rig operational changes are then implemented at the rig 22 by, for example, automated actions, e.g. utilizing downlink-to-rotary steerable systems, controlling mud pumps, controlling weight on the bit, setting block position, automatically adjusting a toolface position of a downhole motor, automatically adjusting a toolface position of a downhole turbine, automatically adjusting properties, e.g. viscosity, density, fluid loss, and/or other properties, of drilling mud and/or completions mud, and changing drill string RPMs.

[0022] In the embodiment illustrated in Figure 2, the acquisition of data, e.g. the acquisition of real-time digital measurements of rig parameters, may be accomplished with a variety of different types of observation devices 38. By way of example, observation devices 38 may comprise one or more video cameras 40, microphones 42 or sensors 44. In the example illustrated, video cameras 40, microphones 42, and sensors 44 are located above the surface on rig 22. However, a variety of observation devices 38 also may be located downhole in wellbore 26. Depending on the specific application, a variety of downhole sensors 46 or other observation devices may be deployed on or in cooperation with various types of downhole equipment 48. In one example, downhole equipment 48 comprises a bottom hole assembly 50 having a drilling system for rotating a drill bit 52 in a wellbore drilling operation. As illustrated, the bottom hole assembly 50 may be deployed downhole by a suitable conveyance 54, such as drill string, extending down from the rig 22 positioned at a surface location 56.

[0023] The data collected by the various observation devices 38 is relayed to control system 36 via appropriate communication lines 58 which may be wired or wireless communication lines. In this example, the data is accumulated in real-time via control system 36 and, in cooperation with signal transmitter 32, is transmitted to remote operations center 20. The rig parameters observed and the type of observation devices 38 employed can vary depending on the specific operation, e.g. drilling operation or other service operation, carried out at rig 22.

[0024] Depending on the specific systems and methodology employed, control system 34 and control system 36 may be constructed according to a variety of configurations. According to one example, control system 34 comprises a computer-based control system 60, as illustrated in Figure 3. In at least some applications, the computer-based control system 60 is an automated system programmed to process and evaluate data received from rig 22 and to automatically transmit command data back to the rig to implement rig operational changes. The computer-based control system 60 may comprise a central processing unit (CPU) 62 which is coupled with rig control system 36 via signal transmitters 30, 32 and communication system/lines 28. Additionally, computer-based control system 60 may comprise a memory 64, an input device 66, and an output device 68.

[0025] Input device 66 may comprise a variety of devices, such as a keyboard, mouse, voice recognition unit, touchscreen, other input devices, or combinations of such devices. Output device 68 may comprise a visual and/or audio output device, such as a monitor having a graphical user interface 69. Input device 66 and output device 68 may comprise individual or multiple devices which may be used to facilitate interaction with experts or other personnel located at the remote operations center 20. Additionally, the processing may be done on a single device or multiple devices located at the remote operations center 20. For example, control system 34 may comprise a plurality of computer-based control systems 60 which are networked together or otherwise combined to facilitate remote processing and analysis of data on a variety of rig parameters.

[0026] Rig control system 36 similarly may comprise a variety of control systems in the form of individual control devices or plural control devices which function in cooperation. In the embodiment illustrated in Figure 4, rig control system 36 is a computer based processing system designed to intake data on rig parameters from the various observation devices 38, such as video cameras, microphones, surface sensors, downhole sensors, and other devices designed to detect/measure desired parameters related to the operation of rig 22. Additionally, rig control system 36 may be designed to receive control commands from the remote operations center 20 via its transmitter 32.

Various rig operational changes may be carried out by rig personnel, but those rig operational changes also may be automatically implemented by rig control system 36 in many applications. During automated control, rig control system 36 communicates with various devices 70 (located on the rig 22 and/or located downhole in the well 24) via communication lines 72 which may be wired or wireless communication lines. Examples of automated functions which may be carried out by rig control system 36 include utilizing downlink-to-rotary steerable systems, controlling mud pumps, controlling weight on the bit, setting block position, automatically adjusting a toolface position of a downhole motor, automatically adjusting a toolface position of a downhole turbine, automatically adjusting properties, e.g. viscosity, density, fluid loss, and/or other properties, of drilling mud and/or completions mud, and changing drill string RPMs.

[0027] As described above, the ability to readily communicate data between rig 22 and remote operations center 20 facilitates an improved control over implementation of a given rig operation. Additionally, the ability to perform processing and analysis at the remote operations center 20 reduces the number of people that would otherwise be employed on the rig 22. By implementing the methodology described herein, a relatively small number of personnel may be deployed on rig 22, while other personnel are located at a more convenient location, i.e. at the remote operations center 20. The combination of automated processing and handling of data combined with the reduced number of rig personnel provides for more efficient and enhanced drilling operations and other rig-based operations.

[0028] The particular arrangement of personnel on rig 22 and at remote operations center 20 can vary substantially from one application to another. Regardless, the present methodology enables cooperation between a variety of participants without requiring the presence of those participants at the rig 22. Referring generally to Figure 5, an example of the interaction of rig personnel and remote operations center personnel to achieve a more efficient rig operation is illustrated.

[0029] In the example illustrated, both a drilling supervisor 74 and a rig superintendent 76 may communicate with each other, observe data, provide instructions, and interact with other systems and personnel on rig 22 and at remote operations center 20. For example, communications may be established with factory drilling supervisors 78 and with drilling supervisors 80 at one or both locations. Consequently, each factory drilling supervisor 78 or drilling supervisor 80 is better able to provide input to and receive input from other personnel, including company personnel 82, drilling crew personnel 84, and other persons and/or equipment at remote operations center 20 and/or rig 22. For example, the system and methodology enable easy person to person access and interaction with the control systems 34, 36, e.g. data servers. The interaction between persons/equipment also may include interaction with assistant drilling supervisors 86, with regional support centers, with rig safety coordinators 88, and with cooperating third parties 90.

[0030] The staff at remote operations center 20 may vary in number and responsibility according to the specific rig operation carried out via rig 22. As represented schematically in Figure 6, examples of functional personnel stationed at remote operations center 20 to interact with control system 34 may include a directional driller 92 and factory drilling supervisor 78. Other examples of possible personnel stationed at remote operations center 20 include an optimization engineer 96 and a well engineer 98. Each person may have access to control system 34 via appropriate input devices 66 and output devices 68. The various personnel may monitor data received from the observation devices 38 at the rig site, and they may provide input to improve the manual and/or automated control over rig 22. For example, programming adjustments may be made to adjust the automatic control over rig operational changes in response to data received from observational devices 38. The personnel at remote operations center 20 also may perform a variety of additional functions related to monitoring of the rig operation, adjusting the rig operation, communicating information to other interested parties (see Figure 5), and carrying out rig operational functions previously conducted by persons stationed on the rig.

[0031] As discussed above, the methodology and systems are employed to simplify control over rig operations with reduced rig personnel. The methodology may be implemented for a variety of rig operations, including drilling operations, which utilize many types of downhole tools and equipment. Several types of bottom hole assemblies and/or other drilling equipment and servicing equipment may be controlled downhole via input from rig personnel and/or remotely located personnel. Additionally, the number and type of observation devices, including downhole sensors, surface sensors, video monitoring equipment, audio equipment, and other types of observation devices may be employed to obtain data for processing and analysis at the remote operations center. The data may be processed and analyzed by different types of processing systems according to desired programs and algorithms alone or in combination with input from personnel at the remote operations center. Various levels of automated control also may be exercised over rig operational changes via control systems located at the remote operations center and/or at the rig.

[0032] 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 for constructing a well, comprising:

obtaining real-time digital measurements of parameters on a rig;

automatically transmitting the real-time digital measurements to a remote operations center;

processing the real-time digital measurements at the remote operations center to determine rig operational changes;

transmitting data on the rigged operational changes back to the rig; and

implementing the rig operational changes.

2. The method as recited in claim 1, wherein obtaining comprises utilizing sensors mounted on the rig.

3. The method as recited in claim 1, wherein obtaining comprises utilizing cameras located on the rig.

4. The method as recited in claim 1, wherein obtaining comprises utilizing microphones located on the rig.

5. The method as recited in claim 1, wherein implementing comprises automatically adjusting a rotary steerable system via a downlink-to-rotary steerable system.

6. The method as recited in claim 1, wherein implementing comprises automatically adjusting the operation of a mud pump.

7. The method as recited in claim 1, wherein implementing comprises automatically adjusting the weight on a drill bit.

8. The method as recited in claim 1, wherein implementing comprises automatically adjusting a block position on the rig.

9. The method as recited in claim 1, wherein implementing comprises automatically adjusting the RPM of a drilling system.

10. The method as recited in claim 1, wherein implementing comprises automatically adjusting a toolface position of a downhole motor.

11. The method as recited in claim 1, wherein implementing comprises automatically adjusting a toolface position of a downhole turbine.

12. The method as recited in claim 1, wherein implementing comprises automatically adjusting fluid properties of a mud fluid.

13. A method for constructing a well, comprising:

monitoring rig parameters via a plurality of different types of observation devices;

sending data on the rig parameters to a processing system at a remote operations center;

processing and analyzing the data at the remote operations center; and

controlling rig operational changes from the remote operations center based on results obtained from processing and analyzing the data.

14. The method as recited in claim 13, wherein monitoring comprises obtaining real-time digital measurements.

15. The method as recited in claim 14, wherein sending comprises automatically sending real-time digital measurement data to the remote operations center.

16. The method as recited in claim 13, wherein processing and analyzing comprises processing and analyzing the data on a computer-based processing system and outputting results to a graphical user interface.

17. The method as recited in claim 16, wherein controlling comprises utilizing the computer-based processing system and the remote operations center to automatically control the rig operational changes.

18. A method for efficient well construction, comprising:

reducing the number of personnel on a rig;

utilizing a plurality of observation devices to monitor rig parameters remotely;

making decisions regarding operational changes to the rig at a remote operations center; and

implementing the operational changes from the remote operations center.

19. The method as recited in claim 18, wherein making decisions comprises processing data from the observation devices on a computer-based processing system located at the remote operations center.

20. The method as recited in claim 18, wherein implementing comprises automatically changing a plurality of functions on the rig.

FIG. 1

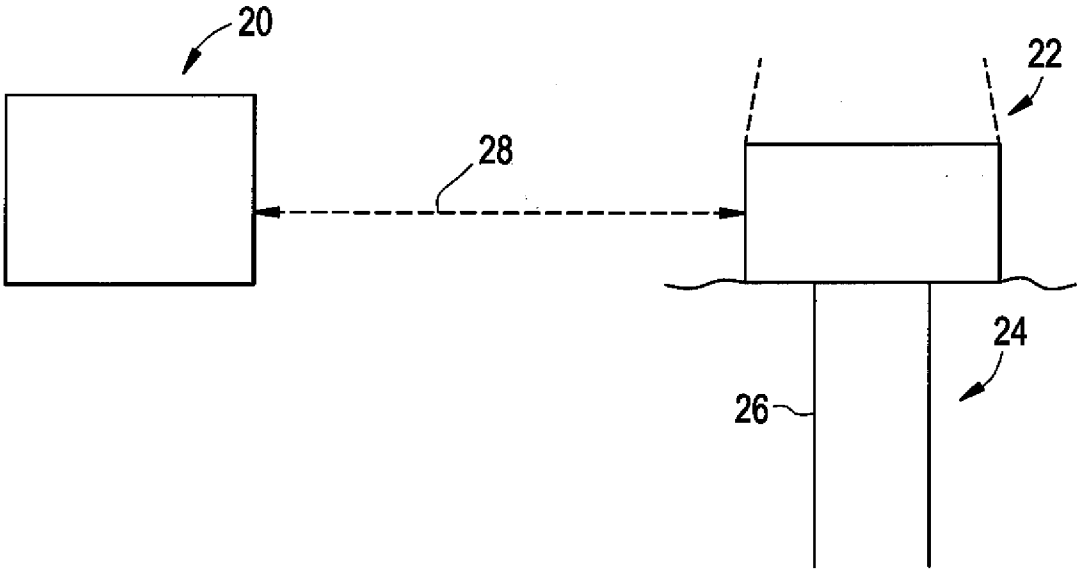

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FIG. 2

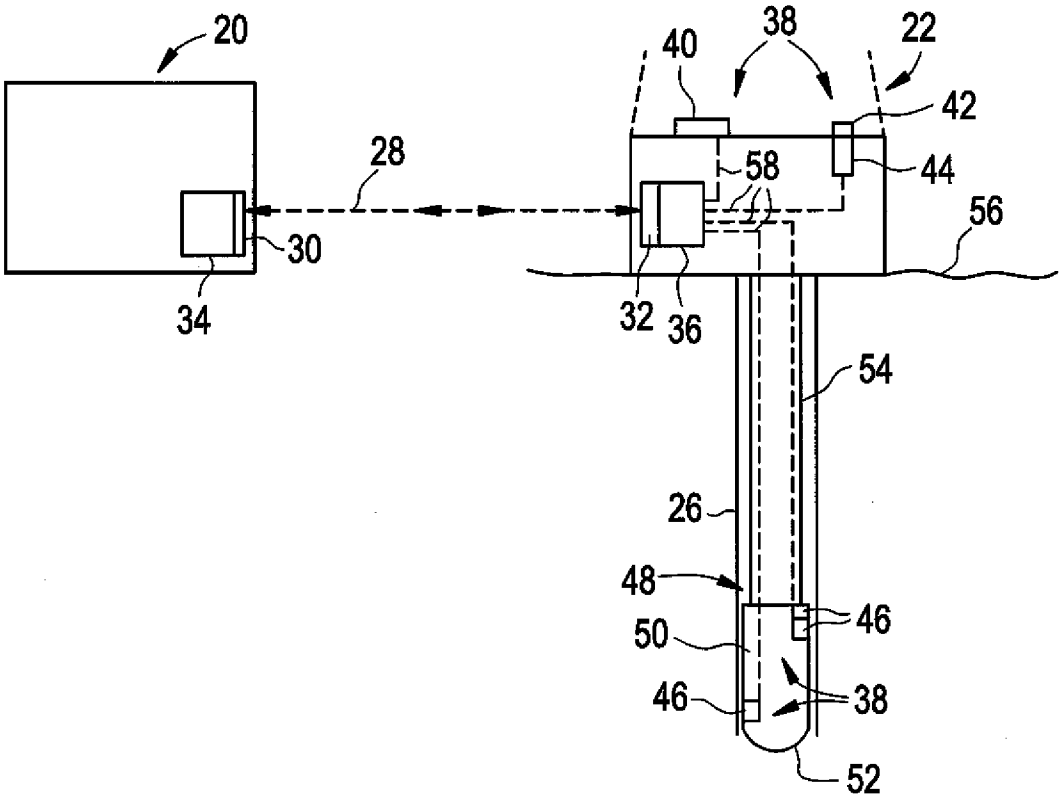

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FIG. 3

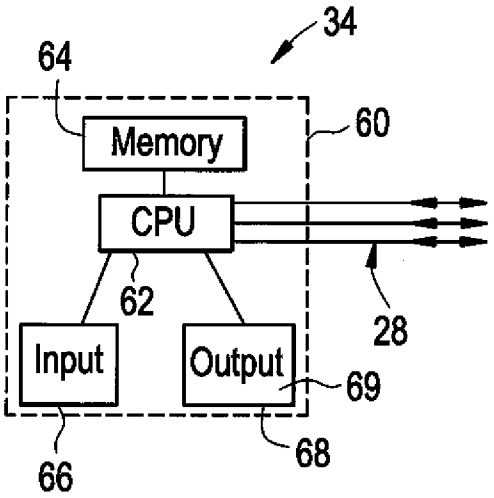

34
64
Memory
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CPU
62
28
Input
Output
69
66
68

FIG. 4

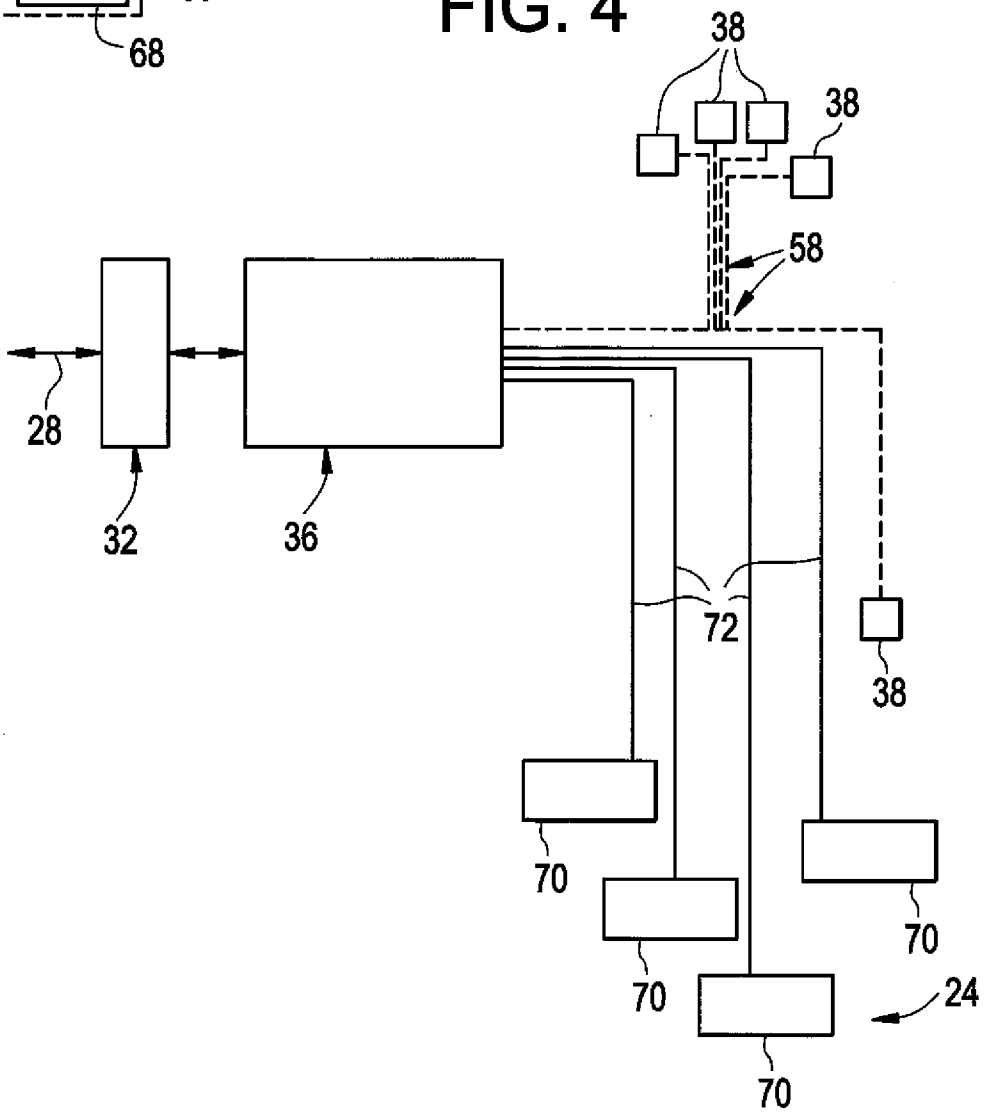

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FIG. 5

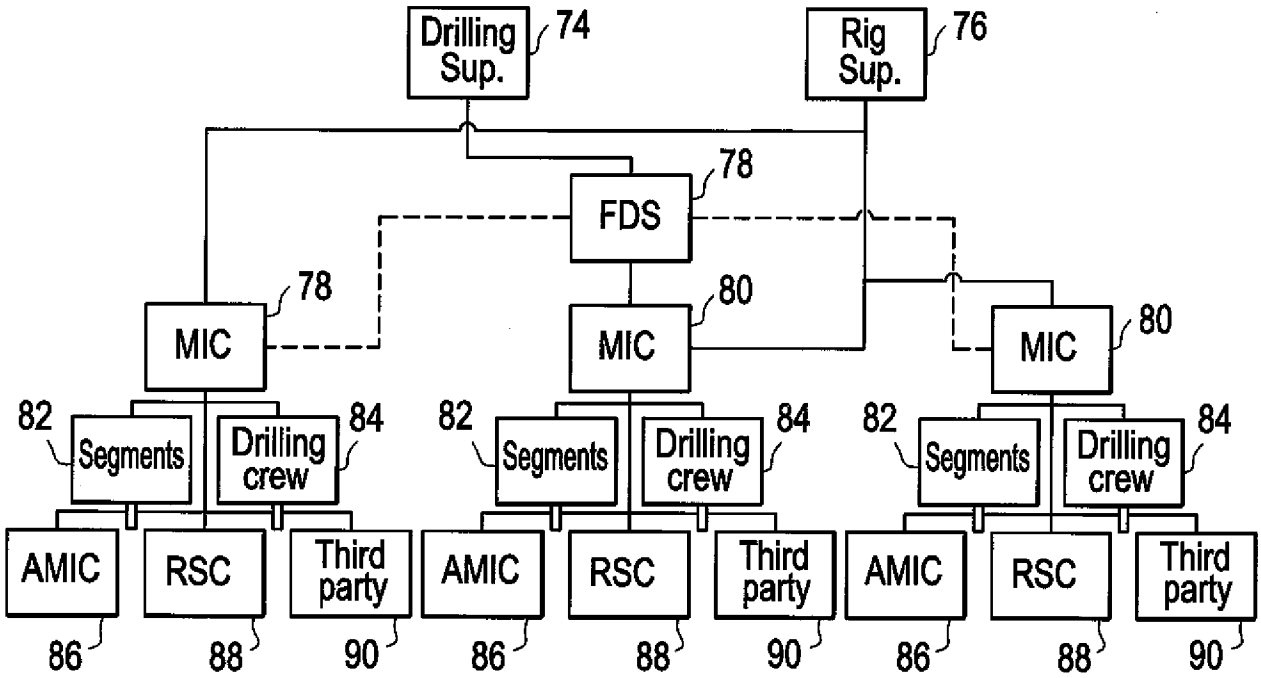
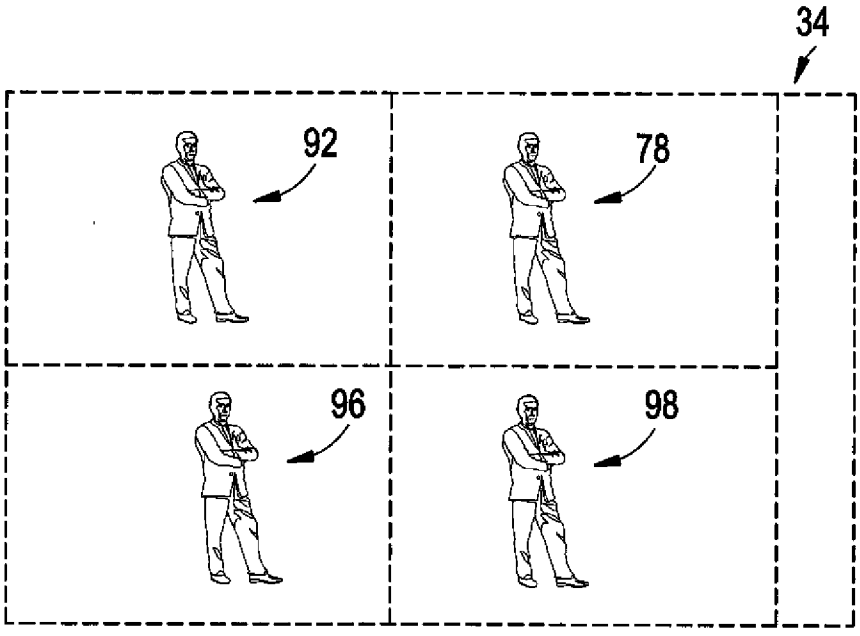

Drilling Sup.
74
Rig Sup.
76
FDS
78
MIC
78
MIC
80
MIC
80
82
Segments
Drilling crew
84
AMIC
RSC
Third party
86
88
90

FIG. 6


34
92
78
96
98

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 10/60850

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - E21B 47/00 (2011.01)
USPC - 166/250.01
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)
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USPC: 166/250.01

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
IPC(8): E21B 47/00 (2011.01); USPC: 166/250.01, 250.15, 53, 65.1; 175/25, 40; 700/275; 702/6, 9 - term limited -

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(PGPB, USPT, EPAB, JPAB); Google Scholar; Google Patent -- Search Terms: oil rig well wellbore platform offshore seabed seafloor ocean remote on-site off-site control sensor monitor satellite web internet secure access control camera surveillance CCTV video motor turbine crew operator personnel driller boss human GUI user interface digit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2008/0173480 A1 (Annaiyappa et al.) 24 July 2008 (24.07.2008) para. [0002] through [0082], Fig. 1-6	1-9 and 12-20 ---------- 10 and 11
Y	US 2004/0124012 A1 (Dunlop et al.) 01 July 2004 (01.07.2004) para. [0004], [0222], Fig. 10	10 and 11
A	US 2008/0208475 A1 (Karr et al.) 28 August 2008 (28.08.2008) entire document	1-20
A	US 6,873,267 B1 (Tubel et al.) 29 March 2005 (29.03.2005) entire document	1-20
A	WO 2007/136378 A1 (Kwok et al.) 29 November 2007 (29.11.2007) (29.11.2007) entire document	1-20

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02 April 2011 (02.04.2011)	15 APR 2011
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