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Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO. Includes application details for Terry Treiberg and examiner information for Michael J. Singletary.

Please find below and/or attached an Office communication concerning this application or proceeding.

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 102

In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.

Claims 1-7 and 13-15 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Phillips (US20190203579A1, 2019-07-04).

Regarding Claim 1, Phillips teaches a sensor system for a downhole pumping system [0019], comprising: a sensor subsystem for detecting movement of at least one component of the downhole pumping system [Claim 1], the sensor subsystem comprising: an axial motion sensor subsystem comprising a magnetometer, the magnetometer to be coupled to the at least one component of the downhole pumping system and to detect axial movement of the at least one component of the downhole pumping system based on variations in a magnet field detected by the magnetometer generated by movement of the at least one component of the downhole pumping system (Claim 1; [00126]); and a rotation sensor subsystem comprising a gyroscope, the gyroscope to be coupled to the at least one component of the downhole pumping system and to detect rotational movement of the at least one component of the downhole pumping system by detecting rotational velocity values with the gyroscope generated by rotation of the at least one component of the downhole pumping system [Claim 1 and 12; [00110]]; and a processor subsystem to receive data from the axial motion sensor subsystem and the rotation sensor subsystem [Claim 1], the processor subsystem to: determine axial movement of the at least one component of the downhole pumping system with the axial motion sensor subsystem[0021]; and determine rotational velocity of the at least one component of the downhole pumping system with the rotation sensor subsystem by sampling rotational velocity values generated by the rotation of the at least one component of the downhole pumping system with the gyroscope [0026; 0029; 0134; 0138; Fig. 6].

Regarding Claim 2, Phillips further teaches the sensor system of claim 1, wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system comprising at least one rod of the downhole pumping system extending from a surface location into a wellbore [Claim 1 and 13].

Regarding Claim 3, Phillips further teaches the sensor system of claim 2, wherein the processor subsystem is configured to verify the axial movement of the at least one rod before determining the rotation [0027; 00134; Claim 11; Fig. 6].

Regarding Claim 4, Phillips further teaches the sensor system of claim 2, wherein the processor subsystem is configured to determine a change in direction the at least one rod [0021-0022].

Regarding Claim 5, Phillips further teaches the sensor system of claim 4, wherein the processor subsystem is configured to begin sampling the rotational velocity after determining the change in direction the at least one rod [0110].

Regarding Claim 6, Phillips further teaches the sensor system of claim 5, wherein the processor subsystem is configured to continue sampling the rotational velocity until another change in direction the at least one rod is detected [0158].

Regarding Claim 7, Phillips further teaches the sensor system of claim 5, wherein the processor subsystem is configured to continue sampling the rotational velocity along

substantially an entire stroke of the at least one rod, the sampling beginning at a first change of direction of the at least one rod, continuing through a second change of direction of the at least one rod, and ceasing at a third change of direction of the at least one rod [0029; 0110].

Regarding Claim 13, Phillips teaches a sensor system for a downhole pumping system [0019], comprising: a sensor subsystem for detecting movement of at least one component of the downhole pumping system [Claim 1], the sensor subsystem comprising: an axial motion sensor subsystem comprising an axial motion sensor, the axial motion sensor to be coupled to the at least one component of the downhole pumping system and to detect axial movement of the at least one component of the downhole pumping system based on variations detected by the axial motion sensor generated by movement of the at least one component of the downhole pumping system [Col. 2, lines 33-48]; and a rotation sensor subsystem comprising a rotational sensor, the rotational sensor to be coupled to the at least one component of the downhole pumping system and to detect rotational movement of the at least one component of the downhole pumping system by sampling rotational velocity values with the rotational sensor generated by rotation of the at least one component of the downhole pumping system ([Claim 1 and 12; [00110]); and a processor subsystem to receive data from the axial motion sensor subsystem and the rotation sensor subsystem [Claim 1], the processor subsystem to: verify the axial movement of the at least one component of the downhole pumping system with the axial motion sensor subsystem; and when the axial movement has been verified, determine rotational velocity of the at

least one component of the downhole pumping system with the rotational velocity values detected by the rotation sensor subsystem [0021; Fig. 6; Claim 1].

Regarding Claim 14, Phillips further teaches the sensor system of claim 13, wherein the axial motion sensor subsystem comprises a magnetometer and the rotation sensor subsystem comprises a gyroscope [Claim 8; Claim 12].

Regarding Claim 15, Phillips further teaches the sensor system of claim 14, wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system comprising at least one rod of the downhole pumping system extending from a surface location into a wellbore, and wherein the processor subsystem is configured to continue sampling the rotational velocity values of the at least one rod over a stroke of the at least one rod [0029; 0042; 00103; 00110].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious

before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 10 and 11 are rejected under 35 U.S.C. 103 as being unpatentable over Phillips (US 20190203579A1, 04-07-2019).

Regarding Claim 10, Phillips teaches the sensor system of claim 1, wherein the processor subsystem is configured to determine the rotational velocity of the at least one component of the downhole pumping system by summing both positive and negative samples of the rotational velocity values sensed by the rotation sensor subsystem [0029; 0110; 0115].

Although Phillips does not specifically disclose the summing both positive and negative samples of the rotational velocity values, acceleration is the rate of change of velocity over time, and velocity is the rate of change of position over time.

Therefore, it would have been obvious to a person of ordinary skill in the art that determining rotational velocity by summing both positive and negative samples, was previously taught by Phillips.

Regarding Claim 11, Phillips further teaches the sensor system of claim 10, wherein the processor subsystem is configured to compare the determined rotational velocity of the at least one component of the downhole pumping system with an expected amount of rotational velocity to determine a failure in the rotation of the at least one component of the downhole pumping system [Claim 1; Claim 10].

Claims 8, 9, and 16-18 are rejected under 35 U.S.C. 103 as being unpatentable over Phillips, in view of Hurst et al. (US9140113B2, 2015-09-22), herein referred to as Hurst.

Regarding Claim 8, Phillips teaches all of the limitations of Claim 1. Phillips further teaches wherein the sensor subsystem is configured to detect movement of the at least one component of the downhole pumping system (abstract).

Phillips fails to specifically mention a tubing rotator, he does mention tubing that surrounds the rod string (which is well known in the art as a tubular rotator (Hurst Col. 3, lines 42-49)).

However, in a related field, Hurst teaches wherein monitoring is performed by a mechanism incorporated in at least one of a load cell, a rod rotator, or a tubing rotator (Claim 2).

Therefore, it would have been obvious to a person of ordinary skill in the art prior to the effective filing date of the claimed invention to have modified Phillips to incorporate the teachings of Hurst by including: a tubing rotator in order to distribute wear.

Regarding Claim 9, the combination further teaches the sensor system of claim 8, wherein the sensor subsystem is configured to detect rotation of the tubing rotator while detecting axial movement of a polished of the downhole pumping system (Phillips: Claim 1, Fig. 6).

Regarding Claim 16, Phillips teaches a sensor system for a downhole pumping system, comprising: a sensor subsystem for detecting movement (Abstract). Phillips further teaches a rotation sensor subsystem comprising a rotational sensor, the rotational sensor to be coupled to the at least one component of the downhole pumping system and to detect rotational movement of the at least one component of the downhole pumping system by sampling rotational velocity values with the rotational sensor generated by rotation of the at least one component of the downhole pumping system ([Claim 1 and 12; 00110]). Additionally, Phillips discloses a processor configured to compare the determined rotational velocity of the at least one component of the downhole pumping system with an expected amount of rotational velocity to determine a failure in the rotation of the at least one component of the downhole pumping system [Claim 1; Claim 10].

Phillips fails to specifically mention a tubing rotator, he does mention tubing that surrounds the rod string (which is well known in the art as a tubular rotator (Hurst Col. 3, lines 42-49).

However, in a related field, Hurst teaches wherein monitoring is performed by a mechanism incorporated in at least one of a load cell, a rod rotator, or a tubing rotator (Claim 2).

Therefore, it would have been obvious to a person of ordinary skill in the art prior to the effective filing date of the claimed invention to have modified Phillips to incorporate the teachings of Hurst by including: a tubing rotator in order to distribute wear.

Regarding Claim 17, the combination further teaches the sensor system of claim 16, wherein the rotation sensor subsystem comprises at least one of a gyroscope or an accelerometer [Phillips: Claim 12].

Regarding Claim 18, the combination teaches all of the limitations of Claim 16. The combination further teaches wherein the rotation sensor subsystem is configured to monitor the rotation of the tubing rotator along a path that extends in a direction substantially perpendicular to a surface upon which the downhole pumping system is positioned [Hurst: Col. 13, lines 50-63].

Although Hurst doesn't specifically disclose "monitoring the rotation of the tubing rotator along a path that extends in a direction substantially perpendicular to a surface upon which the downhole pumping system is positioned," it is inherent that the path

would be substantially perpendicular being that the monitoring system is surface level and the tubing rotator is subsurface and perpendicular to the surface.

Claim 12, 19 and 20 are rejected under 35 U.S.C. 103 as being unpatentable over Phillips, in view of Fyfe et al. (US 11319794B2, 2022-05-03) herein referred to as Fyfe.

Regarding Claim 12, Phillips teaches all of the limitations of Claim 1.

Phillips fails to teach a vibration sensor subsystem for monitoring vibration of the at least one component of the downhole pumping system over a vibrational baseline. However, in a related field,

Fyfe discloses a dynamometer that measures vibration of the polished rod (Col. 2, lines 14-18; Fig. 4-5).

Therefore, it would have been obvious to a person of ordinary skill in the art prior to the effective filing date of the claimed invention to have modified Phillips to incorporate the teachings of Fyfe by including: a vibration sensor in order to give early warning of pump failure.

Regarding Claim 19, Phillips teaches a method of detecting motion of at least one component of a downhole pumping system, the method comprising: detecting axial movement of at least one component of the downhole pumping system based on variations detected by an axial motion sensor coupled to the at least one component of the downhole pumping system generated by translation of the at least one component

of the downhole pumping system [0077]; detecting rotational movement of the at least one component of the downhole pumping system with a rotational sensor generated by rotation of the at least one component of the downhole pumping system ([Claim 1 and 12; [00110]); and verifying axial movement of the at least one component of the downhole pumping system with the axial motion sensor before the detecting of the rotational movement of the at least one component of the downhole pumping system with the rotational sensor [0027; 00134; Claim 11; Fig. 6].

Regarding Claim 20, The method of claim 19, further comprising comparing a rotational velocity detected with the rotational sensor with a threshold value to determine a performance characteristic of the at least one component of the downhole pumping system [0026; 0158; Claim 9].

Conclusion

The prior art made record and not relied upon is considered pertinent to applicant's disclosure.

Freyer (Apparatus And Methods For Estimating Loads And Movements Of Members Downhole, 2008-02-14) teaches This disclosure, in one aspect, provides an apparatus for use in a wellbore that includes a member having an encoded magnetic field and a sensor proximate the encoded magnetic field that measures a change in the magnetic field due to a change in the load on the member. In another aspect, a method for measuring loads on a downhole tool is provided that comprises inducing an encoded

magnetic field along a section of a member of the tool and detecting a change in the magnetic field due to a load on the member when the tool is in the wellbore;

Estes (Use Of MWD Assembly For Multiple-well Drilling, 2003-12-25) teaches a measurement-while-drilling (MWD) downhole assembly for use in drilling boreholes which utilizes gyroscopes, magnetometers and accelerometers for determining the borehole inclination and azimuth during the drilling of the borehole.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL J SINGLETARY whose telephone number is (571)272-4593. The examiner can normally be reached Monday-Friday 8:00am-5:00pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Manish Shah can be reached on (571) 272-2152. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/MICHAEL J SINGLETARY/

Examiner, Art Unit 2863

/Manish S Shah/

Primary Examiner, Art Unit 2853