Trials@uspto.gov
571-272-7822

Paper 9
Date: August 6, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE INTEGRATION GROUP OF AMERICAS, INC.,
Petitioner,

v.

SITEPRO, INC.,
Patent Owner.

IPR2024-00724 (Patent 8,649,909 B1), IPR2024-00737 (Patent 11,175,680 B2), IPR2024-00738 (Patent 9,342,078 B2), IPR2024-00739 (Patent 9,898,014 B2), IPR2024-00740 (Patent 11,726,504 B2), IPR2024-00741 (Patent 10,488,871 B2), and IPR2024-00742 (Patent 11,294,403 B2)[1]

Before WILLIAM V. SAINDON, KRISTEN L. DROESCH, LYNNE H. BROWNE, and KEVIN W CHERRY, *Administrative Patent Judges.*[2]

BROWNE, *Administrative Patent Judge*.

TERMINATION
Due to Settlement Prior to Institution of Trial
*35 U.S.C. § 317; 37 C.F.R. § 42.74*

[1] This Order is entered into each case. The parties are not authorized to use this joint heading and filing style in their papers.
[2] None of the above-listed proceedings have an expanded panel. Rather, the judges constitute the panels of all of these proceedings.

With the Board's authorization, the Parties filed a Joint Motion to Terminate the instant proceeding on the basis of a settlement reached by the Parties. *See* Paper 7[3] ("Mot."); 35 U.S.C. § 317(a); 37 C.F.R. §§ 42.72, 42.74. The Parties also filed a copy of their written Settlement Agreement (Exhibit 1010), along with a Joint Request (Paper 8) to treat the Agreement as business confidential information under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

Trial has not been instituted in these proceedings. In the Joint Motion to Terminate, the Parties represent that they have entered into an agreement that has settled their dispute. Mot. 2.

> As part of the Agreement, the parties have stipulated to dismiss, with prejudice, the only district court litigation between the parties involving the '909 patent, *SitePro, Inc. v. WaterBridge Resources, LLC, WaterBridge Operating, LLC*," *WaterBridge Holdings, LLC, WaterBridge Management, Inc., and the Integration Group of the Americas, Inc.* and all proceedings currently pending before the Patent Trial and Appeal Board.

*Id.* at 2–3.

The Parties further state that "the Agreement is filed separately and concurrently with this motion, as Exhibit 1010," and "there are no other agreements or understandings, oral or written, between them, including any collateral agreements, made in connection with, or in contemplation of, the

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[3] For purposes of expediency, we cite to Papers and Exhibits filed in IPR2024-00724. Similar Papers and Exhibits were filed in IPR2024-00737, -00738, -00739, -00740, -00741, and -00742.

termination of this proceeding." Mot. 2. Under these circumstances, we determine that it is appropriate to terminate the instant proceeding.

In the Joint Request, the Parties request that the Settlement Agreement be treated as business confidential information and be kept separate from the file of the patents involved in these proceedings. Joint Request 1. After reviewing the Settlement Agreement between Petitioner and Patent Owner, we find that the Settlement Agreement contains business confidential information regarding the terms of settlement. We determine that good cause exists to treat the Settlement Agreement between Petitioner and Patent Owner as business confidential information pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

In consideration of the foregoing, it is hereby:

ORDERED that the Parties' request that the Settlement Agreement (Exhibit 1010) be treated as business confidential information, kept separate from the file of U.S. Patent No. 8,649,909 B1[4], and made available only to Federal Government agencies on written request, or to any person on a showing of good cause, under 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c), is *granted*; and

FURTHER ORDERED that the joint motion to terminate is *granted* and the proceeding is hereby *terminated*.

[4] The same applies to each of the challenged patents in each of the other proceedings.

IPR2024-00724, Patent 8,649,909 B1
IPR2024-00737, Patent 11,175,680 B2
IPR2024-00738, Patent 9,342,078 B2
IPR2024-00739, Patent 9,898,014 B2
IPR2024-00740, Patent 11,726,504 B2
IPR2024-00741, Patent 10,488,871 B2
IPR2024-00742, Patent 11,294,403 B2

FOR PETITIONER:

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
**United States Patent and Trademark Office**
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 034392-0437404 | 3874 |

909 7590 03/05/2024

Pillsbury Winthrop Shaw Pittman, LLP
PO Box 10500
McLean, VA 22102

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2121 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/05/2024 | ELECTRONIC |

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket_ip@pillsburylaw.com

| APPLICATION NO. | ISSUE DATE | PATENT NO. |
|---|---|---|
| 13/708,557 | 05-Mar-2024 | 08649909 |

Pillsbury Winthrop Shaw Pittman, LLP
PO Box 10500
McLean, VA 22102

# ELECTRONIC CERTIFICATE OF CORRECTION NOTIFICATION

Your electronic certificate of correction is now available, and can be accessed via Patent Center at https://patentcenter.uspto.gov.

The electronic certificate of correction is the official certificate of correction under 35 U.S.C. 254 or 255. For more information, please visit https://www.uspto.gov/electronicgrants.

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION



| | |
|---|---|
| PATENT NO. | : 8,649,909 B1 |
| APPLICATION NO. | : 13/708557 |
| DATED | : February 11, 2014 |
| INVENTOR(S) | : Aaron Phillips |

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 17, Line 45 (Claim 9), delete “processes” and replace with --processors--

Signed and Sealed this
Fifth Day of March, 2024

Katherine Kelly Vidal

Katherine Kelly Vidal
*Director of the United States Patent and Trademark Office*

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

# ELECTRONIC PAYMENT RECEIPT

| APPLICATION # | RECEIPT DATE / TIME | ATTORNEY DOCKET # |
|---|---|---|
| **13/708,557** | **01/30/2024 04:17:16 PM Z ET** | **034392-0437404** |

## Title of Invention

REMOTE CONTROL OF FLUID-HANDLING DEVICES

## Application Information

| | | | |
|---|---|---|---|
| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | 8649909 |
| CONFIRMATION # | 3874 | FILED BY | Nicole Banks |
| PATENT CENTER # | 64143621 | AUTHORIZED BY | Joshua Tucker |
| CUSTOMER # | 909 | FILING DATE | 12/07/2012 |
| CORRESPONDENCE ADDRESS | - | FIRST NAMED INVENTOR | Aaron Phillips |

## Payment Information

| PAYMENT METHOD | PAYMENT TRANSACTION ID | PAYMENT AUTHORIZED BY |
|---|---|---|
| **DA / 033975** | **E20241TG17488961** | **Nicole Banks** |

| PRE-AUTHORIZED ACCOUNT | PRE-AUTHORIZED CATEGORY |
|---|---|
| **033975** | **37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees); 37 CFR 1.19 (Document supply fees); 37 CFR 1.20 (Post Issuance fees); 37 CFR 1.21 (Miscellaneous fees and charges)** |

| FEE CODE | DESCRIPTION | ITEM PRICE($) | QUANTITY | ITEM TOTAL($) |
|---|---|---|---|---|
| 2811 | CERTIFICATE OF CORRECTION | 160.00 | 1 | 160.00 |
| | | | **TOTAL AMOUNT:** | **$160.00** |

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d)

and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | | |
|---|---|---|---|
| INVENTORS: | Aaron Phillips | CONFIRMATION NO.: | 3874 |
| SERIAL NO.: | 13/708,557 | ART UNIT: | 2121 |
| FILING DATE: | 07 December 2012 | EXAMINER: | Everett, Christopher E. |

FOR: REMOTE CONTROL OF FLUID-HANDLING DEVICES

**REQUEST FOR CERTIFICATE OF CORRECTION**
**UNDER 35 U.S.C. §255 AND PURSUANT TO 37 C.F.R. §1.323**

Attn. Certificate of Correction Branch
Mail Stop Post Issue
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

In accordance with 37 C.F.R. §1.323, it is respectfully requested that a Certificate of Correction be issued in the above-captioned patent for a mistake made by the Applicant.

There is a minor typographical error in issued claim 9 of U.S. Patent 8,649,909 (hereinafter "the `909 patent"). Applicant respectfully requests that claim 9 in the `909 patent be corrected as follows (showing markings). None of the following changes add new matter:

> 9. The system of claim 1, comprising a remote terminal unit through which the one or more ~~processes~~processors communicate with a fluid-handling device among the plurality of fluid-handling devices, wherein translating the received commands comprises:
>
> identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command;
>
> identifying a command code operative to cause the component to execute the received command; and
>
> sending to the address on the serial bus the command code.

Applicant respectfully notes the nature of the typographical error does not constitute new matter or require reexamination because the requested change does not materially affect the scope or meaning of the patent.

Support for the amendments may be found throughout the original application.

Attached is a properly completed Certificate of Correction Form PTO-SB44 showing the needed corrections. It is requested that this form be certified by the Commissioner by affixing the official seal of certification and returning the same to the undersigned attorney.

The Commissioner is authorized to charge the fee, credit any overpayment, for issuance of this Certificate of Correction pursuant to 37 C.F.R. §1.20(a) in the amount of $160.00 (or other amount necessary), to Deposit Account No. 03-3975.

Respectfully submitted,

Date: 30 January 2024

/Joshua Tucker/

Joshua Tucker
Registration No. 63,809
Pillsbury Winthrop Shaw Pittman LLP
P.O. Box 10500
McLean, VA 22102
Phone 512-580-9628
Customer No. 00909

PTO/SB/44 (09-07)
Approved for use through 03/31/2026. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

# UNITED STATES PATENT AND TRADEMARK OFFICE
## CERTIFICATE OF CORRECTION



PATENT NO. : 8,649,909

APPLICATION NO.: 13/708,557

ISSUE DATE : 11 February 2014

INVENTOR(S) : Aaron Phillips

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims:

Column 17, line 45 (claim 9), delete "processes" and replace with --processors--

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):
Pillsbury Winthrop Shaw Pittman, LLP
c/o Joshua Tucker, Reg. No. 63809
P.O. Box 10500
McLean, VA 22102C

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0033. Public burden for this form is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. If filing this completed form by mail, send to: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013). https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf

Routine uses of the information in this record may include disclosure to: 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law; 2) a Federal, state, local, or international agency, in response to its request; 3) a contractor of the USPTO having need for the information in order to perform a contract; 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record; 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record; 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations; 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals; 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)); 9) the Office of Personnel Management (OPM) for personnel research purposes; and 9) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

### Additional Uses

Additional USPTO uses of the information in this record may include disclosure to: 1) the International Bureau of the World Intellectual Property Organization, if the record is related to an international application filed under the Patent Cooperation Treaty; 2) the public i) after publication of the application pursuant to 35 U.S.C. 122(b), ii) after issuance of a patent pursuant to 35 U.S.C. 151, iii) if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections, or an issued patent, or iv) without publication of the application or patent under the specific circumstances provided for by 37 CFR 1.14(a)(1)(v)-(vii); and/or 3) the National Archives and Records Administration, for inspection of records.

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
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# ELECTRONIC ACKNOWLEDGEMENT RECEIPT

| APPLICATION # | RECEIPT DATE / TIME | ATTORNEY DOCKET # |
|---|---|---|
| **13/708,557** | **01/30/2024 04:17:16 PM Z ET** | **034392-0437404** |

## Title of Invention

REMOTE CONTROL OF FLUID-HANDLING DEVICES

## Application Information

| | | | |
|---|---|---|---|
| APPLICATION TYPE | Utility - Nonprovisional Application under 35 USC 111(a) | PATENT # | 8649909 |
| CONFIRMATION # | 3874 | FILED BY | Nicole Banks |
| PATENT CENTER # | 64143621 | FILING DATE | 12/07/2012 |
| CUSTOMER # | 909 | FIRST NAMED INVENTOR | Aaron Phillips |
| CORRESPONDENCE ADDRESS | - | AUTHORIZED BY | Joshua Tucker |

## Documents

**TOTAL DOCUMENTS: 1**

| DOCUMENT | PAGES | DESCRIPTION | SIZE (KB) |
|---|---|---|---|
| 034392-0437404 Request for Certificate of Correction-Applicant Error filed 30JAN2024.pdf | 4 | Request for Certificate of Correction | 253 KB |

## Digest

| DOCUMENT | MESSAGE DIGEST(SHA-512) |
|---|---|
| 034392-0437404 Request for Certificate of Correction-Applicant Error filed 30JAN2024.pdf | 82A06459C4F5782A9FB615EBC2E2441E1B3F77419704C5A3D BAC5F9C288BA6403F2B4A2DF1E36AFC29CD2107A903217FB 67C7E762FE437C331CC2C0A21F3625A |

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 |

**CONFIRMATION NO. 3874**

909
Pillsbury Winthrop Shaw Pittman, LLP (NV)
PO Box 10500
McLean, VA 22102

**POA ACCEPTANCE LETTER**

*OC000000074363481*

Date Mailed: 04/02/2015

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/27/2015.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/atesfai/

---

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

# POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|---|---|
| 13/708,557 | 2012-12-07 |

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 00909

**OR**

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

**Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:**

☑ The address associated with the above-mentioned Customer Number

**OR**

☐ The address associated with Customer Number: 00909

**OR**

| | | | | | |
|---|---|---|---|---|---|
| Firm or Individual Name | | | | | |
| Address | | | | | |
| City | | State | | Zip | |
| Country | | | | | |
| Telephone | | Email | | | |

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

AmpliSine Labs LLC

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

**SIGNATURE of Applicant for Patent**

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

| | | | |
|---|---|---|---|
| Signature | | Date (Optional) | 2-19-15 |
| Name | | | |
| Title | Chief Financial & Chief Business Officer | | |

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

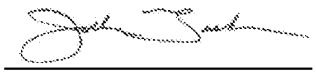
☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

**General Authorization for Payment of Fees**

The Commissioner is authorized to charge any additional fees that may be required to Deposit Account No. 033975.



Josh Tucker
Reg. No. 63809

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 21895621 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | REMOTE CONTROL OF FLUID-HANDLING DEVICES |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Kathryn Seeman |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 27-MAR-2015 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 15:55:56 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Power of Attorney | 034392_0437404_POA.pdf | 1046461<br>dd2677b86fd9637f7c86fab676c999e173cc31b1 | no | 1 |

| Warnings: |
|---|
| **Information:** |

| | | | | | |
|---|---|---|---|---|---|
| 2 | Miscellaneous Incoming Letter | General_Auth_for_Payment_034392_0437404.pdf | 189065<br>4d7851f5d76326bbf15deecba27557a14d43bf97 | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | | **Total Files Size (in bytes):** | 1235526 | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/47 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
U.S. Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

# "FEE ADDRESS" INDICATION FORM

**Address to:**
**Mail Stop M Correspondence**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, VA 22313-1450**

**- OR -**

**Fax to:**
**571-273-6500**

**INSTRUCTIONS:** The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. **When to check the first box below**: If you have a Customer Number to represent the fee address. **When to check the second box below**: If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see the Manual of Patent Examining Procedure (MPEP) § 403.

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☑ Customer Number: 000197

***OR***

☐ The attached Request for Customer Number (PTO/SB/125) form.

| PATENT NUMBER (if known) | APPLICATION NUMBER |
|---|---|
| 8,649,909 | 13/708,557 |

Completed by (check one):

☐ Applicant/Inventor — /Joshua Tucker/ (Signature)

☑ Attorney or Agent of record 63,809 (Reg. No.) — Joshua Tucker (Typed or printed name)

☐ Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96) — 512-494-3623 (Requester's telephone number)

☐ Assignee recorded at Reel _____ Frame_____ — September 10, 2014 (Date)

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more that one signature is required, see below*.

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.363. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 5 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS.
**SEND TO: Mail Stop M Correspondence, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 20100910 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | REMOTE CONTROL OF FLUID-HANDLING DEVICES |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Kathryn Seeman |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 10-SEP-2014 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 15:48:34 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Maintenance Fee Address Change | Fee_Address_000314_000003.pdf | 313879<br>7b8183a2ceb594767c8be23ad748404d3b887fa2 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

| Total Files Size (in bytes): | 313879 |
|---|---|

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 02/11/2014 | 8649909 | 000314.000003 | 3874 |

35979 7590 01/22/2014

Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Aaron Phillips, Lubbock, TX;
AMPLISINE LABS, LLC., Lubbock, TX

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

| Receipt date: 04/03/2013 | Application Number | 13708557 13708557 - GAU: 2121 |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | Filing Date | 2012-12-07 |
| **( Not for submission under 37 CFR 1.99)** | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 20040231851 | A1 | 2004-11-25 | Silvers, David | |
| | 7 | 20040088115 | A1 | 2004-05-06 | Guggari et al. | |
| | 8 | 20030182463 | A1 | 2003-09-25 | Valk, Jeffrey W. | |
| | 9 | 20030004624 | A1 | 2003-01-02 | Wilson et al. | |
| | 10 | 20020169645 | A1 | 2002-11-14 | Aronstam et al. | |
| | 11 | 20020161685 | A1 | 2002-10-31 | Dwinnell, Michael | |

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

**FOREIGN PATENT DOCUMENTS** Remove

| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] i | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|
| /CEE/ | 1 | 2008124765 | WO | | 10/08 | Lufkin Industries, Inc. | | ☐ |
| /P.A.T./ | 2 | 2008103487 | WO | | 8/08 | Schlumberger Technology Corporation et al. | | ☐ |
| /CEE/ | 3 | 2090943 | EP | | 8/09 | Acque Ingegneria S.r.l. | | ☐ |

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

Change(s) applied to document, /CEE/ 1/7/2014

EFS Web 2.1.17 ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CEE/

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (04-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| | | |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** Change(s) applied to document, /K.K.C./ 1/9/2014 | Application Number | 13/708,557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| U.S.PATENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
| | 1 | 8301386 | | 10/2012 ~~2009-10-30~~ | Redmond et al. | |
| | 2 | 7591308 | | 2009-09-22 | Bender, Robert E | |
| If you wish to add additional U.S. Patent citation information please click the Add button. | | | | | | |

| U.S.PATENT APPLICATION PUBLICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
| | 1 | 20100098507 | A1 | 2010-04-22 | Binmore, Ian Rex | |
| | 2 | 20130024026 | A1 | 2013-01-24 | Prasad, Vijaysai | |
| | 3 | 20100326654 | A1 | 2010-12-30 | Hemblade, Barry John | |
| | 4 | 20130144531 | A1 | 2013-06-06 | Johnston, Paul J. | |

EFS Web 2.1.17

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CEE/

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

35979 7590 11/29/2013
Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

| | |
|---|---|
| Josh Tucker | (Depositor's name) |
| /Josh Tucker/ | (Signature) |
| 03 January 2014 | (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

TITLE OF INVENTION: REMOTE CONTROL OF FLUID-HANDLING DEVICES

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $890 | $0 | $0 | $890 | 02/28/2014 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| EVERETT, CHRISTOPHER E | 2121 | 700-282000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 .....
2 .....
3 .....

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
AMPLISINE LABS, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY)
9502 HWY 87
LUBBOCK, TEXAS 79423

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☒ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

| | |
|---|---|
| ☐ Applicant certifying micro entity status. See 37 CFR 1.29 | NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. |
| ☐ Applicant asserting small entity status. See 37 CFR 1.27 | NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status. |
| ☐ Applicant changing to regular undiscounted fee status. | NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable. |

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Josh Tucker/ Date 03 January 2014

Typed or printed name Josh Tucker Registration No. 63809

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 13708557 |
| **Filing Date:** | 07-Dec-2012 |
| **Title of Invention:** | REMOTE CONTROL OF FLUID-HANDLING DEVICES |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| Filed as Small Entity | |

**Utility under 35 USC 111(a) Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| Utility Appl Issue Fee | 2501 | 1 | 480 | 480 |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **480** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 17816336 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | REMOTE CONTROL OF FLUID-HANDLING DEVICES |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 03-JAN-2014 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 16:52:08 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $480 |
| RAM confirmation Number | 3083 |
| Deposit Account | |
| Authorized User | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| 1 | Issue Fee Payment (PTO-85B) | fee-transmittal-flat.pdf | 636796<br>39b5434bc398a03907ba6e7b19a16252a8e51be7 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30008<br>6fae2ad39242e9a807d7f6b4aea8133fce5c7c22 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 666804 | | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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# NOTICE OF ALLOWANCE AND FEE(S) DUE

35979 7590 11/29/2013

Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

| EXAMINER |
|---|
| EVERETT, CHRISTOPHER E |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2121 | |

DATE MAILED: 11/29/2013

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

TITLE OF INVENTION: REMOTE CONTROL OF FLUID-HANDLING DEVICES

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $890 | $0 | $0 | $890 | 02/28/2014 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

**HOW TO REPLY TO THIS NOTICE:**

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



PTOL-85 (Rev. 02/11)

## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail** **Mail Stop ISSUE FEE**
**Commissioner for Patents**
**P.O. Box 1450**
**Alexandria, Virginia 22313-1450**
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

35979 7590 11/29/2013
Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

**Certificate of Mailing or Transmission**
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

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| (Depositor's name) |
| (Signature) |
| (Date) |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

TITLE OF INVENTION: REMOTE CONTROL OF FLUID-HANDLING DEVICES

| APPLN. TYPE | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | SMALL | $890 | $0 | $0 | $890 | 02/28/2014 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| EVERETT, CHRISTOPHER E | 2121 | 700-282000 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1_____
2_____
3_____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

| | |
|---|---|
| ❑ Applicant certifying micro entity status. See 37 CFR 1.29 | NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment. |
| ❑ Applicant asserting small entity status. See 37 CFR 1.27 | NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status. |
| ❑ Applicant changing to regular undiscounted fee status. | NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable. |

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

35979 7590 11/29/2013

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P.O. Box 61389
Houston, TX 77208-1389

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |
| **ART UNIT** | **PAPER NUMBER** |
| 2121 | |

DATE MAILED: 11/29/2013

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.



PTOL-85 (Rev. 02/11)

## Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## Notices of Allowance and Fee(s) Due mailed between October 1, 2013 and December 31, 2013

(Addendum to PTOL-85)

If the "Notice of Allowance and Fee(s) Due" has a mailing date on or after October 1, 2013 and before January 1, 2014, the following information is applicable to this application.

If the issue fee is being timely paid on or after January 1, 2014, the amount due is the issue fee and publication fee in effect January 1, 2014. On January 1, 2014, the issue fees set forth in 37 CFR 1.18 decrease significantly and the publication fee set forth in 37 CFR 1.18(d)(1) decreases to $0.

If an issue fee or publication fee has been previously paid in this application, applicant is not entitled to a refund of the difference between the amount paid and the amount in effect on January 1, 2014.

| Notice of Allowability | Application No. 13/708,557 | Applicant(s) PHILLIPS, AARON | |
|---|---|---|---|
| | Examiner Christopher E. Everett | Art Unit 2121 | AIA (First Inventor to File) Status No |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--***

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *10/10/2013*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-16 and 18-21*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   **Certified copies:**

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE**.

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   **Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/C. E. E./
Examiner, Art Unit 2121

## DETAILED ACTION

1. The Office Action is responsive to the communication filed on 10/10/213.

2. The present application is being examined under the pre-AIA first to invent provisions.

3. Claims 1-16 and 18-21 are pending.

### *Continued Examination Under 37 CFR 1.114*

4. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/10/2013 has been entered.

### *Allowable Subject Matter*

5. Claims 1-16 and 18-21 are allowed.

6. The following is an examiner's statement of reasons for allowance:

Claims 1-16, 18, and 21-22

Regarding claim 1, the prior art describes:

A system for remotely controlling a fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising:

- a command-center server having a data store storing multiple user accounts, each user account corresponding to a set of one or more oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, or a combination thereof, each set being operated by a different entity corresponding to the respective user account; and
- a plurality of geographically distributed site master controllers, each site master controller corresponding to a respective one of the oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, each site master controller comprising:
    - a communication module operable to communicate with a plurality of fluid-handling devices;
    - a network interface;
    - memory; and
    - one or more processors communicatively coupled to the communication module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising:
        - receiving, via the network interface, from the command-center server, a plurality of commands encoded in a first protocol to control the fluid-handling devices from a user corresponding to one of the user accounts, different commands among the plurality of commands being directed to different fluid handling devices among the plurality of fluid-handling devices;
        - for at least some of the plurality of commands, determining a plurality of different target states of a given one of the fluid-handling devices over time, wherein the respective site-master controller is operative to maintain control of the fluid handling devices in the absence of a network connection to the command-center server;

However, regarding claim 1, the prior art does not describe:

- at least translating the plurality of commands into translated commands encoded in a plurality of protocols different from the first protocol, each translated command being translated into a protocol among the plurality of protocols suitable for a fluid-handling device to which the respective command is directed, the at least some of the translated command being operative to cause a local controller of the given fluid-handling device to drive the given fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the given fluid-handling device indicative of whether the given fluid-handling device is in a targeted state; and
- sending the translated commands to respective local controllers of the respective fluid-handling devices to which the respective commands are directed.

Dependent claims 2-16, 18, and 21-22 depend from independent claim 1 and are allowable for the same reasons as described above.

Claim 19

Regarding claim 19, the prior art describes:

A tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising:

- receiving, via a network interface, from a remote user device, a plurality of commands to control a plurality of different fluid-handling devices, each of the plurality of commands being directed to a different one of the plurality of fluid-handling devices, and the plurality of commands being encoded in a first protocol;
- determining a plurality of different target states of the fluid-handling devices over time such that control of the fluid handling devices is maintained in the absence of a network connection with the remote user device;

However, regarding claim 19, the prior art does not describe:

- translating the plurality of commands into a plurality of translated commands operative to cause local controllers of the fluid-handling devices to drive the respective fluid-handling devices to different target states among the plurality of different target states, the plurality of translated commands including translated commands encoded in a plurality of different protocols, and the local controllers being responsive to the translated commands and feedback from a corresponding fluid-handling device among the plurality of different fluid handling devices, the feedback being indicative of whether the corresponding fluid-handling device is in a targeted state; and
- sending the translated commands to the local controllers.

Claim 20

Regarding claim 20, the prior art describes:

A method, comprising:

- receiving, via a network interface, from a remote user device, a plurality of commands to control fluid-handling devices, the plurality of commands being encoded in a shared protocol;
- determining a plurality of different target states of the fluid-handling devices over time such that control of the fluid handling devices is maintained;

However, regarding claim 20, the prior art does not describe:

- translating the commands into translated commands encoded in a plurality of different protocols different from the shared protocol, each translated command being encoded in a protocol among the plurality of different protocols suitable for a fluid-handling device to which the respective command is directed, the translated commands being operative to cause local controllers of the fluid-handling devices to drive a respective fluid-handling device to different target states among the plurality of different target states, the local controllers being responsive to the translated commands directed to their respective fluid-handling device and feedback from the respective fluid-handling device indicative of whether the respective fluid-handling device is in a targeted state; and
- sending the translated commands to the local controllers.

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher E. Everett whose telephone number is (571)272-2851. The examiner can normally be reached on Monday through Friday from 8:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kavita Padmanabhan can be reached on 571-272-8352. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. E. E./
Examiner, Art Unit 2121

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JP Thomesse - Annual reviews in Control, 1998 - Elsevier
... ISO/IEC-JTC 1 SC25, Trains : IEC TC9, Shipbuilding : ISO TC8, Mineral-**oil** industry : ISO ... Some fieldbuses allow a redundancy of the bus **controller**, or of the bus **control** ... 1158-3 includes services coming from WorldFIP and Profibus standards, allowing as **well** centralized access ...
Cited by 103 Related articles All 4 versions Cite

Communication systems for building automation and control [PDF] from unicauca.edu.
W Kastner, G Neugschwandtner... - Proceedings of the ..., 2005 - ieeexplore.ieee.org
... Electric heating elements are often substituted for hot water coils, especially where **oil** or gas is ... will allow efficient use of the "raw" throughput capacity available as **well** as fulfill ... than graceful degradation of functionality as systems need every sensor, actuator or **controller** to be ...
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A case study: demands on component-based development [PDF] from ivica-crnkovic
I Crnkovic, M Larsson - ... of the 22nd international conference on ..., 2000 - dl.acm.org
... A safety component is used to provide a more robust system. Another component is the **well** supervision unit which monitors the **oil wells**. ... **Well** Supervision Offshore **oil** 23 Page 3. ... POSIX worked quite **well** on **different** Unix platforms, but much less so on Windows NT. ...
Cited by 77 Related articles All 18 versions Cite

Development of a digital microfluidic platform for point of care testing [HTML] from nih.gov
P Sista, Z Hua, P Rawat, A Sudarsan, V Srinivasan... - Lab on a Chip, 2008 - pubs.rsc.org
... Filler fluid, Silicone **oil**, Hexadecane, Silicone **oil**. ... Electrical connection **between** the **controller** and the cartridge is effected **using** spring-loaded connector pins aligned to pads on the ... Splitting and merging the droplet ensures that the beads are **well** distributed within the droplet. ...
Cited by 146 Related articles All 5 versions Cite

Miniaturized flow-through PCR **with different** template types in a silicon chip thermocycler [PDF] from gene-quantific
I Schneegaß, R Bräutigam, JM Köhler - Lab on a Chip, 2001 - pubs.rsc.org
... The process temperature was controlled by an analog electronic **controller**. ... We found the mineral **oil** to be **well** suited as separation liquid for serial flow; no inhibition effects were observed in the microsystem despite the high surface to volume ratio. ...
Cited by 207 Related articles All 15 versions Cite

Applications of wireless sensor networks in the oil, gas and resources industries
MR Akhondi, A Talevski, S Carlsen... - ... (AINA), 2010 24th ..., 2010 - ieeexplore.ieee.org
... **wells** distribution and the development level of wireless communication technology, the remote monitoring and **control** system of **oil wells** introduces CDMA ... The system consists of sensor, **well** head **controller** SU, CDMA/GPRS Data Transfer Unit (DTU), **oil** production plant ...
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Truly distributed **control** systems **using** fieldbus technology [PDF] from napier.ac.uk
AV Scott, WJ Buchanan - Engineering of Computer Based ..., 2000 - ieeexplore.ieee.org
... Other, less **well** used, **control** functions include pulse input, arithmetic, dead time, splitter and ... the **controller**, and as the functions become more complex may eliminate the **controller** all together ... in custody transactions, such as gas/**oil** flow rates, values can be automatically stored ...
Cited by 20 Related articles All 6 versions Cite

An Internet-based real-time **control** engineering laboratory
JW Overstreet, A Tzes - Control Systems, IEEE, 1999 - ieeexplore.ieee.org
... During the 1997-98 aca- demic year, several of our **control** and instrumentation experi- ments within ... Subsequently, the students need to program this **controller** in C, create the DLL, embed it into ... Results **using** in-school as **well** as out-of-school connections are expected, and the ...
Cited by 280 Related articles All 4 versions Cite

A simple **device using** magnetic transportation for droplet-based PCR
T Ohashi, N Kuwana, N Harafuse, Y Togawa - Biomedical microdevices, 2007 - Springer
... A conventional PCR thermal cycler has a heating block **with wells** where tubes containing the PCR ... 8. Consequently, it is clearly demonstrated that the silicone **oil** used in this system provided ... 2001) did not work **well** for this system since droplets were adsorbed onto the reactor ...
Cited by 58 Related articles All 3 versions Cite

An overview of wireless networks in **control** and monitoring
GW Irwin, J Colandaine, WG Scanlon - Computational Intelligence, 2006 - Springer
... successfully applied to an **oil** extractor con- trol system which removes **oil** from a ... under heavy contention from **control**-only and mixed-traffic data, as **well** as its ... **multiple controller**-plant systems which performed satisfactorily, even **with** the increased contention for bandwidth on ...
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Multi-well controller
www.google.com/patents/CA2576785C?cl=en
Grant - Filed Jan 31, 2007 - Issued Jul 9, 2013 - Micheal E. Atencio - Production Control Services, Inc.
... **Translate** ... at least one **well** flow measuring **device** mounted on the wellhead flow line of ... a master **well controller** capable of communicating **with** one or more of the ... to enable communications **between** the master **well controller** and .... Gas and **oil well** production efficiency can depend on various **well** ...
Overview · Related · Discuss

System, method, and apparatus for **command** and **control** of remote ...
www.google.com/patents/WO2006116118A1?cl=en
App. - Filed Apr 21, 2006 - Published Nov 2, 2006 - Gordon Besser - Baker Hughes Incorporated
In particular, this design is **well** suited for applications such as **oil well** ... that interfaces **with** a field **device**, remote terminal unit, or **control** system that ..... a session **between** the transceiver 37 and an Iridium Earth terminal **controller** .... **with** proper transaction sequence numbers), the **command** is **translated** ...
Overview · Related · Discuss

System and method for preloading a bus **controller with command** ...
www.google.com/patents/WO2002088965A1?cl=en
App. - Filed Apr 26, 2002 - Published Nov 7, 2002 - Philip J. Ellerbrock - Philip J. Ellerbrock
The bus **controller** (14) executes a series of instructions (24), which can be ... **Translate** .... **between** a bus **controller** and at least one network **device via** the .... the bus **controller**(s) preferably issues **commands** at specific times as **well** to .... include sensors for monitoring the throttle position, the **oil** pressure, ...
Overview · Related · Discuss

Microfluidic **device** for production and collection of droplets of a ...
www.google.com/patents/EP2621631A1?cl=en
App. - Filed Oct 3, 2011 - Published Aug 7, 2013 - Marie-Claude Potier - Centre National De La Recherche Scientifique
The invention relates to a microfluidic **device** (100) for the production and collection of ... may be controlled **through** a commercially available pressure **controller**. .... Each **well** 122 of the microtiter plate 120 is adapted to hold **between** tens of ... by **translation control** means 181 of the electronic **command** unit ...
Overview · Related · Discuss

Sms based scada system
www.google.com/patents/CA2772187A1?cl=en
App. - Filed Mar 20, 2012 - Published Sep 20, 2013 - Shane M. Seitz - Dark River Systems Inc.
... **Translate** ... According to an online article accessible **via** the Wikipedia website at ... (acquiring) data on the process and sending **commands** (**control**) to the process. ... Programmable logic **controller** (PLCs) used as field **devices** ... for deployment into an **oil well** location and to provide high security, ...
Overview · Related · Discuss

Induction motor torque **control** in a pumping system
www.google.com/patents/EP2409036A2?cl=en
App. - Filed Mar 16, 2010 - Published Jan 25, 2012 - Thomas L. Beck - Unico, Inc.
A system and method are provided for **controlling** the speed of a motor driving ... **Translate** ... comparing a flux rotor **command** signal **with** the signal representing an ... **device** and one of the interface **devices**; and a supervisory **controller** .... **well** casing and immersed or partially immersed in the fluid (e.g., **oil** ...
Overview · Related · Discuss

Apparatus and methods for **controlling** and communicating **with** ...



www.google.com/patents/EP2229503B1?cl=en

Grant - Filed Aug 5, 2009 - Issued May 9, 2012 - James E. Brookes - Titan Specialities, Ltd.

**Control** and power functions are accomplished **with** voltage of ... Multiple embodiments are provided **using** a state machine as part of the electrical switch to **command** ... electrical connections **between** the pre-check **controller** and one or .... an **oil well**, casing collar locator (CCL) 12 (or any correlation **device** ...

Overview · Related · Discuss

Apparatus and methods for **controlling** and communicating **with** ...



www.google.com/patents/EP2270311A2?cl=en

App. - Filed Aug 5, 2009 - Published Jan 5, 2011 - James E. Brookes - Titan Specialities, Ltd.

**Control** and power functions are accomplished **with** voltage of different polarities ... **Translate** .... Perforating guns are used to complete an **oil** or gas **well** by creating a ... Percussion switches are mechanical **devices** that use the force of .... electrical connections **between** the pre-check **controller** and one or ...

Overview · Related · Discuss

Tractor communication/**control** and select fire perforating switch



www.google.com/patents/EP2402555B1?cl=en

Grant - Filed Jan 7, 2008 - Issued Apr 3, 2013 - James E. Brooks - Titan Specialities, Ltd.

... **Translate** ... A method of switching **between** a safe mode for tractoring and a perforating ... Percussion switches are mechanical **devices** that use the force of the ..... gun 18 along horizontal or nearly horizontal sections of an **oil well** .... Pre-Check **Controller** 48 **commands** a special internal power supply ...

Overview · Related · Discuss

Joystick controlled marine maneuvering system



www.google.com/patents/EP2328801B1?cl=en

Grant - Filed Oct 1, 2009 - Issued Jul 17, 2013 - Dave Gustin - ZF Friedrichshafen AG

a corrections processor (54) connected **with** the **command** logic unit and ... by the maneuvering system (10) and connected **between** an output shaft of the at least ... the maneuvering **controller** is responsive to the propulsion and ..... the vessel 2 as **well** as the heading of the vessel 2, in accordance **with** Figs.

Overview · Related · Discuss

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS ET AL. |
| | Examiner | Art Unit |
| | CHRISTOPHER E EVERETT | 2121 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Search of EAST using classes, text, and inventor searches | 02/26/2013 | CEE |
| Search of Google patent using text | 02/26/2013 | CEE |
| Search of Google scholar using text | 02/26/2013 | CEE |
| Search of PALM using inventor searches | 02/26/2013 | CEE |
| Search of sub-classes 700/1, 282, 275, 281, 42 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 702/6, 13, 183, 188 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-class 709/224 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 166/336, 363, 250.1 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 340/853.3, 853.2, 856.3 (text search only - see search history printout) | 02/26/2013 | CEE |
| Update of EAST and sub-class searches described above | 6/12/2013 | CEE |
| Update of EAST and sub-class searches described above | 10/25/2013 | CEE |
| Search of Google patent using text | 10/25/2013 | CEE |
| Search of Google scholar using text | 10/25/2013 | CEE |

| /C.E.E./<br>Examiner.Art Unit 2121 | |
|---|---|

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| **US Class/ CPC Symbol** | **US Subclass / CPC Group** | **Date** | **Examiner** |
| | Search of USPAT, USPGPUB, and USPAD using text searches | 10/25/2013 | CEE |

| | |
|---|---|
| /C.E.E./<br>Examiner.Art Unit 2121 | |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS, AARON |
| | **Examiner** | **Art Unit** |
| | CHRISTOPHER E EVERETT | 2121 |

| CPC | | |
|---|---|---|
| **Symbol** | **Type** | **Version** |
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| CPC Combination Sets | | | | |
|---|---|---|---|---|
| **Symbol** | **Type** | **Set** | **Ranking** | **Version** |
| | | | | |
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|---|---|---|---|
| /CHRISTOPHER E EVERETT/<br>Examiner.Art Unit 2121 | 10/25/2013 | **Total Claims Allowed:** | |
| (Assistant Examiner) | (Date) | 21 | |
| /KAVITA PADMANABHAN/<br>Supervisory Patent Examiner.Art Unit 2121 | 11/24/2013 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS, AARON |
| | **Examiner** | **Art Unit** |
| | CHRISTOPHER E EVERETT | 2121 |

| US ORIGINAL CLASSIFICATION | | INTERNATIONAL CLASSIFICATION | |
|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | NON-CLAIMED |
| 700 | 282 | G 0 5 D 7 / 00 (2006.0) | |

| CROSS REFERENCE(S) | | | | | |
|---|---|---|---|---|---|
| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | |
| 700 | 1 | 275 | 281 | 42 | |

| /CHRISTOPHER E EVERETT/<br>Examiner.Art Unit 2121<br>(Assistant Examiner) | 10/25/2013<br>(Date) | **Total Claims Allowed:**<br>21 | |
|---|---|---|---|
| /KAVITA PADMANABHAN/<br>Supervisory Patent Examiner.Art Unit 2121<br>(Primary Examiner) | 11/24/2013<br>(Date) | O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>1 |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS, AARON |
| | **Examiner** | **Art Unit** |
| | CHRISTOPHER E EVERETT | 2121 |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | | 17 | | | | | | | | | | | | |
| 2 | 2 | 17 | 18 | | | | | | | | | | | | |
| 3 | 3 | 20 | 19 | | | | | | | | | | | | |
| 4 | 4 | 21 | 20 | | | | | | | | | | | | |
| 5 | 5 | 18 | 21 | | | | | | | | | | | | |
| 6 | 6 | 19 | 22 | | | | | | | | | | | | |
| 7 | 7 | | | | | | | | | | | | | | |
| 8 | 8 | | | | | | | | | | | | | | |
| 9 | 9 | | | | | | | | | | | | | | |
| 10 | 10 | | | | | | | | | | | | | | |
| 11 | 11 | | | | | | | | | | | | | | |
| 12 | 12 | | | | | | | | | | | | | | |
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| 14 | 14 | | | | | | | | | | | | | | |
| 15 | 15 | | | | | | | | | | | | | | |
| 16 | 16 | | | | | | | | | | | | | | |

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| /CHRISTOPHER E EVERETT/<br>Examiner.Art Unit 2121 | 10/25/2013 | **Total Claims Allowed:** | |
| (Assistant Examiner) | (Date) | 21 | |
| /KAVITA PADMANABHAN/<br>Supervisory Patent Examiner.Art Unit 2121 | 11/24/2013 | O.G. Print Claim(s) | O.G. Print Figure |
| (Primary Examiner) | (Date) | 1 | 1 |

U.S. Patent and Trademark Office Part of Paper No. 20131025

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L33 | 16 | ("2004/0262008").URPN. | USPAT | OR | ON | 2013/10/25 12:32 |
| L34 | 9 | ("20040262008" \| "20050035875" \| "4701756" \| "5959547" \| "6229453" \| "6816082").PN. OR ("7148812").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/10/25 12:39 |
| L35 | 1 | ("5959547").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/10/25 12:45 |
| L36 | 4578 | 700/1,282,275,281,42.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L37 | 6150 | 702/6,13,183,188.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L38 | 20349 | 709/224.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L39 | 850 | 166/336,363,250.1.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L40 | 486 | 340/853.3,853.2,856.3.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L41 | 32148 | L36 L37 L38 L39 L40 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L42 | 177528 | (oil hydrocarbon (hydro adj2 carbon) gas) near2 (well site disposal station) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L43 | 2253717 | (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L44 | 36 | ((AARON) near2 (PHILLIPS)).INV. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/10/25 12:46 |
| L45 | 5 | ((AARON) near2 (PHILLIPS)).INV. | EPO; JPO; DERWENT | OR | ON | 2013/10/25 12:46 |

| | | | | | | |
|---|---|---|---|---|---|---|
| L46 | 0 | (AMPLISINE adj2 LABS).as. | EPO; JPO; DERWENT | OR | ON | 2013/10/25 12:46 |
| L47 | 5 | real-time and onsite and internet and communication | EPO; JPO; DERWENT | OR | ON | 2013/10/25 12:46 |
| L48 | 20 | (US-20040262008-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020112860-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L49 | 0 | L48 and (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L50 | 7 | L48 and (oil near2 water) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L51 | 4935 | (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L52 | 2501 | L51 and pump | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L53 | 917 | L52 and (oil near2 well) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L54 | 257 | L53 and (oil near2 level) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L55 | 2 | L54 and ("700"/$.ccls. "702"/$.ccls.) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L56 | 1540 | L41 and L42 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L57 | 1987225 | (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L58 | 16785 | (local autonomous independent) near2 (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L59 | 707 | L43 and L56 | US-PGPUB; | OR | ON | 2013/10/25 12:46 |

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|---|---|---|---|---|---|---|
| | | | USPAT; EPO | | | |
| L60 | 351 | L59 and L57 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L61 | 357 | L42 and L58 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L62 | 6 | L60 and L61 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L63 | 10 | L42 and L58 and L41 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L64 | 553323 | (remote internet network) near2 (control monitor control$4 monitor$4 command) | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L65 | 9948 | L64 and L42 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L66 | 117 | L65 and L58 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L67 | 166 | L44 L45 L46 L47 L49 L50 L55 L62 L63 L66 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| L68 | 166 | L67 | US-PGPUB; USPAT; EPO | OR | ON | 2013/10/25 12:46 |
| S1 | 11 | ("20020161685" \| "20020169645" \| "20030004624" \| "20030182463" \| "20040088115" \| "20040231851" \| "20050108504" \| "20060240818" \| "20080208475" \| "20100295673" \| "20120316658").PN. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/22 08:35 |
| S2 | 34 | ((AARON) near2 (PHILLIPS)).INV. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/22 08:35 |
| S3 | 5 | ((AARON) near2 (PHILLIPS)).INV. | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:35 |
| S4 | 0 | (AMPLISINE adj2 LABS).as. | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:36 |
| S5 | 5 | real-time and onsite and internet and communication | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:39 |
| S6 | 1 | ("20060149476").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:39 |

| | | | | | | |
|---|---|---|---|---|---|---|
| S7 | 1 | ("20060271299").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S8 | 1 | ("20030065447").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S9 | 1 | ("4594665").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S10 | 1 | ("20050092523").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:42 |
| S11 | 1 | ("20060047527").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:42 |
| S12 | 53 | S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/22 08:54 |
| S13 | 17 | (US-20090260829-$ or US-20020112860-$ or US-20040262008-$ or US-20070107903-$ or US-20040251030-$).did. or (US-7000693-$ or US-6420976-$ or US-7967066-$ or US-RE41173-$ or US-7148812-$ or US-6768700-$ or US-7845404-$ or US-6913083-$ or US-4636934-$ or US-5732776-$ or US-4052703-$ or US-7958938-$ or US-4755943-$).did. | EPO; JPO; DERWENT | OR | ON | 2013/02/22 09:01 |
| S14 | 1 | ("7261162").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:05 |
| S15 | 62 | ("5331318" \| "5597042" \| "5662165" \| "5706892" \| "5706896" \| "5721538" \| "5730219" \| "5732776" \| "5803167" \| "5868201" \| "5934371" \| "5941307" \| "5959547" \| "5975204" \| "5992250" \| "6006832" \| "6012015" \| "6046685" \| "6068053" \| "6075462" \| "6125938" \| "6160492" \| "6161618" \| "6176312" \| "6179057" \| "6192980" \| "6192988" \| "6209640" \| "6247536" \| "6257332" \| "6271766" \| "6276454" \| "6279660" \| "6281489" \| "6288975" \| "6296066" \| "6422315" \| "6469636" \| "6498988" \| "6622799" \| "6670880" \| "6717501" \| "6788980" \| "6801135" \| "6816082" \| "6851444").PN. OR ("7261162").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/22 09:05 |
| S16 | 1 | ("20040262008").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:05 |
| S17 | 1 | ("7148812").PN. | US- | OR | OFF | 2013/02/22 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | PGPUB; USPAT; EPO | | | 09:08 |
| S18 | 1 | ("7958938").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S19 | 1 | ("7967066").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S20 | 1 | ("7845404").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S21 | 1 | ("6913083").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:09 |
| S22 | 1 | ("20020112860").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:09 |
| S23 | 1 | ("5732776").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:10 |
| S24 | 1 | ("4052703").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:11 |
| S25 | 20 | (US-20040262008-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020112860-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:50 |
| S26 | 0 | S25 and (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:50 |
| S27 | 7 | S25 and (oil near2 water) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:51 |
| S28 | 4518 | (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:52 |
| S29 | 2295 | S28 and pump | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:53 |

| | | | | | | |
|---|---|---|---|---|---|---|
| S30 | 839 | S29 and (oil near2 well) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:53 |
| S31 | 239 | S30 and (oil near2 level) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:54 |
| S32 | 2 | S31 and ("700"/$.ccls. "702"/$.ccls.) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:54 |
| S33 | 4284 | 700/1,282,275,281,42.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| S34 | 5841 | 702/6,13,183,188.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| S35 | 18470 | 709/224.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| S36 | 767 | 166/336,363,250.1.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| S37 | 463 | 340/853.3,853.2,856.3.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| S38 | 29579 | S33 S34 S35 S36 S37 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| S39 | 168445 | (oil hydrocarbon (hydro adj2 carbon) gas) near2 (well site disposal station) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| S40 | 2119066 | (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:10 |
| S41 | 1404 | S38 and S39 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:10 |
| S42 | 1837654 | (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:11 |
| S43 | 579 | S41 and (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:11 |
| S44 | 15604 | (local autonomous independent) near2 (controller control device) near2 | US-PGPUB; | OR | ON | 2013/02/26 10:12 |

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|---|---|---|---|---|---|---|
| | | (operate operat$4 adjust drive move close) | USPAT; EPO | | | |
| S45 | 642 | S40 and S41 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| S46 | 315 | S45 and S42 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| S47 | 337 | S39 and S44 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| S48 | 6 | S46 and S47 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| S49 | 2 | ("2010/0147510").URPN. | USPAT | OR | ON | 2013/02/26 10:13 |
| S50 | 62 | ("5331318" \| "5597042" \| "5662165" \| "5706892" \| "5706896" \| "5721538" \| "5730219" \| "5732776" \| "5803167" \| "5868201" \| "5934371" \| "5941307" \| "5959547" \| "5975204" \| "5992250" \| "6006832" \| "6012015" \| "6046685" \| "6068053" \| "6075462" \| "6125938" \| "6160492" \| "6161618" \| "6176312" \| "6179057" \| "6192980" \| "6192988" \| "6209640" \| "6247536" \| "6257332" \| "6271766" \| "6276454" \| "6279660" \| "6281489" \| "6288975" \| "6296066" \| "6422315" \| "6469636" \| "6498988" \| "6622799" \| "6670880" \| "6717501" \| "6788980" \| "6801135" \| "6816082" \| "6851444").PN. OR ("7261162").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/26 10:14 |
| S51 | 11 | ("5941305" \| "5959547" \| "5978749" \| "6061603" \| "6670880").PN. OR ("6801135").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/26 10:18 |
| S52 | 10 | S39 and S44 and S38 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:21 |
| S53 | 337 | S39 and S44 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:22 |
| S54 | 203 | S53 and (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:22 |
| S55 | 387 | (local autonomous independent) and S45 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:25 |
| S56 | 381 | S55 not S54 | US-PGPUB; USPAT; | OR | ON | 2013/02/26 10:25 |

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|---|---|---|---|---|---|---|
| | | | EPO | | | |
| S57 | 501662 | (remote internet network) near2 (control monitor control$4 monitor$4 command) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:28 |
| S58 | 8886 | S57 and S39 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:29 |
| S59 | 106 | S58 and S44 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:29 |
| S60 | 44 | ("20030004624" \| "20040088115" \| "20100147510" \| "5732776" \| "7931090" \| "7967066" \| "8312320" \| "20130144531" \| "8301386" \| "20050108504" \| "20100295673" \| "20110231024" \| "6061603" \| "8386059" \| "20100098507" \| "20030182463" \| "4052703" \| "6192980" \| "7958938" \| "8373418" \| "20130024026" \| "20040231851" \| "20060240818" \| "7148812" \| "7289994" \| "20120316658" \| "20040262008" \| "7921916" \| "8131510" \| "8290737" \| "20100326654" \| "20020161685" \| "20090149969" \| "7845404" \| "8179279" \| "20020112860" \| "20050096846" \| "5149443" \| "6801135" \| "6913083" \| "20130008645" \| "20020169645" \| "20080208475" \| "7591308").PN. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/11 13:22 |
| S61 | 37 | (US-20040262008-$ or US-20020112860-$ or US-20090149969-$ or US-20100147510-$ or US-20050096846-$ or US-20110231024-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020161685-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$ or US-5149443-$ or US-8386059-$ or US-8131510-$ or US-7289994-$ or US-8373418-$ or US-8312320-$ or US-8290737-$ or US-7931090-$ or US-7921916-$ or US-6801135-$ or US-6061603-$ or US-6192980-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 07:58 |
| S62 | 0 | S61 and oscillate | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 07:58 |
| S63 | 1 | S61 and (stuck adj3 valve) | US-PGPUB; | OR | ON | 2013/06/12 07:59 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | USPAT; EPO | | | |
| S64 | 4400 | 700/1,282,275,281,42.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S65 | 5969 | 702/6,13,183,188.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S66 | 19220 | 709/224.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S67 | 804 | 166/336,363,250.1.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S68 | 475 | 340/853.3,853.2,856.3.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S69 | 30612 | S64 S65 S66 S67 S68 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S70 | 172242 | (oil hydrocarbon (hydro adj2 carbon) gas) near2 (well site disposal station) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S71 | 241 | S69 and S70 and "240" | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| S72 | 2175607 | (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| S73 | 664 | S69 and S70 and S72 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| S74 | 6 | S73 and (inoperative in-operative stuck) adj3 (valve part) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| S75 | 94 | S70 and (stuck) adj3 (valve) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:14 |
| S76 | 94 | S70 and ((stuck) adj3 (valve)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:14 |
| S77 | 109 | S70 and ((frozen froze stuck) adj3 (valve)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:19 |

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|---|---|---|---|---|---|---|
| S78 | 12 | ((move jerk oscillate move) near2 ((frozen froze stuck) adj3 (valve))) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:21 |
| S79 | 1 | ("4823749").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/06/12 08:22 |
| S80 | 1 | ("20010032518").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/06/12 10:53 |
| S81 | 35 | ((AARON) near2 (PHILLIPS)).INV. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/06/12 11:14 |
| S82 | 5 | ((AARON) near2 (PHILLIPS)).INV. | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |
| S83 | 0 | (AMPLISINE adj2 LABS).as. | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |
| S84 | 5 | real-time and onsite and internet and communication | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |
| S85 | 20 | (US-20040262008-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020112860-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S86 | 0 | S85 and (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S87 | 7 | S85 and (oil near2 water) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S88 | 4795 | (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S89 | 2432 | S88 and pump | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S90 | 889 | S89 and (oil near2 well) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S91 | 246 | S90 and (oil near2 level) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |

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|---|---|---|---|---|---|---|
| S92 | 2 | S91 and ("700"/$.ccls. "702"/$.ccls.) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S93 | 1458 | S69 and S70 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S94 | 1900176 | (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S95 | 16083 | (local autonomous independent) near2 (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S96 | 664 | S72 and S93 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S97 | 327 | S96 and S94 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S98 | 343 | S70 and S95 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S99 | 6 | S97 and S98 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S100 | 10 | S70 and S95 and S69 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S101 | 528886 | (remote internet network) near2 (control monitor control$4 monitor$4 command) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S102 | 9459 | S101 and S70 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S103 | 110 | S102 and S95 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| S104 | 158 | S81 S82 S83 S84 S86 S87 S92 S99 S100 S103 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |

**EAST Search History (Interference)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L69 | 0 | (translating plurality commands translated commands encoded plurality protocols different | US-PGPUB; | AND | ON | 2013/10/25 13:15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | from the first protocol each translated command being translated into a protocol among the plurality of protocols suitable for a fluid handling device to which the respective command is directed the at least some of the translated command being operative to cause a local controller of the given fluid-handling device to drive the given fluid-handling device to the plurality of different target states the local controller being responsive to the translated commands and feedback from the given fluid handling device indicative of whether the given fluid handling device is in a targeted state).clm. | USPAT; UPAD | | | |
| L70 | 0 | (translating plurality commands translated commands encoded plurality protocols different from the first protocol each translated command being translated into a protocol among the plurality of protocols suitable for a fluid handling device to which the respective command is directed the at least some of the translated command being operative to cause a local controller of the given fluid-handling device).clm. | US-PGPUB; USPAT; UPAD | AND | ON | 2013/10/25 13:16 |
| L71 | 0 | (sending the translated commands to respective local controllers of the respective fluid handling devices to which the respective commands are directed).clm. | US-PGPUB; USPAT; UPAD | AND | ON | 2013/10/25 13:16 |

**10/25/2013 1:16:42 PM**
**C:\Users\ceverett\Documents\EAST\Workspaces\13708557.wsp**

[PDF] Understanding SIP — [PDF] from omadata.com
D Sisalem, J Kuthan - Mobile Integrated Services (SMS) Fokus, 2001 - mirror.omadata.com
... Gateway Location, QoS, interdomain AAA*, address **translation**, IP, etc. ... SIP Addresses SIP gives you a globally reachable address. Callees bind to this address **using** SIP REGISTER method. ... Receivers need to understand x x80 and higher codes avoid conflicts **with** future HTTP ...
Cited by 16 Related articles All 46 versions Cite More

[PDF] Automatic analysis of hybrid systems — [PDF] from ist.ac.at
RH Hp - 1995 - pub.ist.ac.at
... commands generated by the **controller**. The second case study is a two-robot manufacturing system introduced by Puri Page 24. 9 ... a bit string into an analog signal **using** the so-called Manchester encoding, and a ... thesis can be applied to extract **controllers**. Page 25. 10 ...
Cited by 36 Related articles All 13 versions Cite More

[HTML] SANE: A protection architecture for enterprise networks — [HTML] from usenix.org
M Casado, T Garfinkel, A Akella, MJ Freedman... - USENIX Security ..., 2006 - usenix.org
... caching into effect, akin to SANE end hosts multiplexing multiple flows **using** a single ... analysis of an enterprise network demonstrates that only a few domain **controllers** are necessary ... possible privilege and knowledge to all parties, except to a trusted, central Domain **Controller**. ...
Cited by 125 Related articles All 32 versions Cite More

Prototyping fast, simple, secure switches for ethа — [PDF] from psu.edu
J Luo, J Pettit, M Casado, J Lockwood... - ..., 2007. HOTI 2007. ..., 2007 - ieeexplore.ieee.org
... performance computers - will lead to functionality being moved from the datapath to central **controllers** running in ... and accountability) suggests that network functions will be brought together in a single **controller**, in- cluding ... **Using** multiple hash functions to improve IP lookups. ...
Cited by 15 Related articles All 16 versions Cite

[PDF] Autonomous navigation for forest machines — [PDF] from umu.se
T Hellström - A project pre-study in the Department of Computer ..., 2002 - cs.umu.se
... At Carnegie-Mellon Robotics Institute an autonomous vehicle for cutting forage **using** vision-based ... for an Autonomous **Christmas Tree** Weeder has been initiated **with** a feasibility ... and environmental detrimental equipment, and can make mechanical weed **control** competitive to ...
Cited by 34 Related articles All 4 versions Cite More

[BOOK] Autonomous weeders for Christmas tree plantations-a feasibility study — [PDF] from unibots.co.uk
H Have, S Blackmore, S Keller, S Fountas, H Nielsen... - 2002 - unibots.co.uk
... There is a particularly great risk of damage when **using** the spring tine harrow during and just after bud breaking. ... At any rate this also concerns the hoe the less weed the easier the **control**. ... The conditions of success **with** this type of tool: • that the rigidity of the tines fits the type of ...
Cited by 14 Related articles All 17 versions Cite More

Okadaic acid and trifluoperazine enhance Agrobacterium-mediated transformation in eastern white pine
W Tang, J Lin, RJ Newton - Plant cell reports, 2007 - Springer
... PCR analy- sis was performed **with** a PTC-100TM Programmable Ther- mal **Controller** (MJ Research, San Francisco ... However, reports of success **with** white spruce (Le et al. ... of GUS-reporter gene construct was monitored from callus clones to trans- genic plants by **using** GUS as ...
Cited by 5 Related articles All 7 versions Cite

Right Time Decision of Artificial Lift Management for Fast Loop Control
S Campos, D Filho, JCF dos Santos... - ... Energy Conference and ..., 2008 - onepetro.org
... and intelligent monitoring/controlling system operating in a small Programmable Logic **Controller** (PLC) at ... system for artificial lift management, plus to extend the applications for small **controllers** to fit ... Reinforcing this scenario come the right practice of **using** just one radio to link ...
Cited by 1 Related articles Cite

THE POWER OFONEBUTTON
A IMPUPCT Suites - ieeexplore.ieee.org
... **CONTROL** OPTIONS Windows and UNIX **controller** software C library for any ANSI C compatible platform Single or multi-user ... The authors also report some of their own experiences **using** IPv6. ... We should not assume that once we write a spec, people do the right thing **with** it. ...
Cite

[BOOK] Traffic engineering and QoS optimization of integrated voice & data networks
GR Ash - 2006 - books.google.com
... and Information Exchange Requirements 1 4.5.1 Call/Session Routing (Number **Translation** to Routing ... TDO Approaches 10.5.1.1 Distributed VNET-Based TDO Approaches **with** CAC 10.5 ... 12 Dynamic Duality of Service (DDOS) 10.6.13 Session Border **Controller** (SBC) Benefits ...
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oil well controller using translated commands between controller and device

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Supervisory **control** of remote manipulation
WR Ferrell, TB Sheridan - Spectrum, IEEE, 1967 - ieeexplore.ieee.org
... Of thie man11pulator is operaited by a stepping miotor.'Ihei fects were evident in the **control** and display of the task. ... oi **oil**' contiroller isalii analog c the manipulatorarm-sco. ... 3. It is worn bty the operator oi his shoui- **well** on the portion of the task that COuLd not be atto- ...
Cited by 223 Related articles All 4 versions Cite

Modeling and **control** of magnetorheological dampers for seismic response reduction [PDF] from polimi.it
SJ Dyke, BF Spencer Jr, MK Sain... - Smart Materials and ..., 1996 - iopscience.iop.org
... consist of micron-sized, magnetically polarizable particles dispersed in a carrier medium such as mineral or silicone **oil**. ... for installation in both exterior civil infrastructure applications (eg, bridges, towers, etc) as **well** as enclosed ... The **controller** is Kc(s) = K[sI − (A − LC)] −1 ˆB (17) ...
Cited by 980 Related articles All 12 versions Cite

[BOOK] IT security for industrial **control** systems [PDF] from psu.edu
J Falco, K Stouffer, A Wavering, F Proctor - 2002 - Citeseer
... Participating industries include: electric utilities, petroleum (**oil** & gas), water, waste, chemicals ... wide information including human resources, financials, manufacturing, and distribution as **well** as connect ... eliminates the need of point-to-point wiring **between** the **controller** and each ...
Cited by 22 Related articles All 4 versions Cite More

Communication systems for building automation and **control** [PDF] from unicauca.edu.
W Kastner, G Neugschwandtner... - Proceedings of the ..., 2005 - ieeexplore.ieee.org
... Electric heating elements are often substituted for hot water coils, especially where **oil** or gas is ... will allow efficient use of the "raw" throughput capacity available as **well** as fulfill ... than graceful degradation of functionality as systems need every sensor, actuator or **controller** to be ...
Cited by 212 Related articles All 15 versions Cite

[HTML] Research Challenges for the Security of **Control** Systems. [HTML] from usenix.org
AA Cárdenas, S Amin, S Sastry - HotSec, 2008 - static.usenix.org
... Several sectors -including chemical, **oil** and gas, and water- are currently developing programs for ... must satisfy some minimum performance requirements to allow the implementation of **well** tested security ... to estimate the expected **control** signals to detect if a **controller** has been ...
Cited by 114 Related articles All 10 versions Cite More

Task-based methods for evaluating electrically stimulated antagonist muscle **controllers** [PDF] from umn.edu
WK Durfee - Biomedical Engineering, IEEE Transactions on, 1989 - ieeexplore.ieee.org
... closed-loop neural prostheses, this con- troller was chosen in part to determine how **well** an open ... pad and the short lengths of exposed tendon were periodically dripped **with** mineral **oil** to prevent ... 2.5 s of the 30 s trial) to each muscle generated by the **controller** algorithm, the ...
Cited by 21 Related articles All 5 versions Cite

3.9 SCADA—Supervisory **Control** and Data Acquisition
SA Boyer - ... Handbook, Volume Three: Process Software and ..., 2002 - books.google.com
... any further effort, he knew at the end of his walk which of the **wells** had stopped ... For equip- ment measuring government royalty volumes of gas or **oil**, there is often a requirement for 35 ... The logging is usually printed on a dedicated alarm printer as **well** as being logged into the ...
Cited by 7 Related articles Cite

OONEIDA: an open, object-oriented knowledge economy for intelligent industrial automation
VV Vyatkin, JH Christensen... - ... , IEEE Transactions on, 2005 - ieeexplore.ieee.org
... DAML+**OIL** [21] or the up-and-coming OWL [22] standard is targeted at ... range from a single **control device** for the whole system to individual embedded **controller** in each ... RMS) concept relies on reconfigurable machines and automatically reconfigurable **controllers**, as **well** as on ...
Cited by 100 Related articles All 6 versions Cite

[PDF] An architecture for heuristic factory **control** [PDF] from activewiki.net
HVD Parunak, JF White, PW Lozo, R Judd... - ... the American Control ..., 1998 - activewiki.net
... The Dispatcher can stop work on the workstation as **well** as start it. Three levels of ... As they arrive, it bases the assignment of next job to the workstation **controller** on the following factors: ... The overall objective is to maintain the ntUll bef of pallets of a given type resident **Oil** ...
Cited by 33 Related articles All 23 versions Cite More

[PDF] Practical structure design and **control** for digital clay [PDF] from gatech.edu
H Zhu, WJ Book - 2004 ASME International Mechanical ..., 2004 - imdl.gatech.edu
... Capacitance Variation (Working Fluid --- **Oil**) ... cells to a certain volume according to the cell pressure in order to achieve a specified dimension as **well** as to ... 1) Involved cell level **controller** will be notified by the surface level **controller** to: only take **commands with** certain ID# and ...
Cited by 11 Related articles All 3 versions Cite More

Create alert

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS ET AL. |
| | **Examiner** | **Art Unit** |
| | CHRISTOPHER E EVERETT | 2121 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 02/26/2013 | 06/12/2013 | 10/25/2013 | | | | | | |
| 1 | 1 | ✓ | ✓ | = | | | | | | |
| 2 | 2 | ✓ | ✓ | = | | | | | | |
| 3 | 3 | ✓ | ✓ | = | | | | | | |
| 4 | 4 | ✓ | ✓ | = | | | | | | |
| 5 | 5 | ✓ | ✓ | = | | | | | | |
| 6 | 6 | ✓ | ✓ | = | | | | | | |
| 7 | 7 | ✓ | ✓ | = | | | | | | |
| 8 | 8 | ✓ | ✓ | = | | | | | | |
| 9 | 9 | ✓ | ✓ | = | | | | | | |
| 10 | 10 | ✓ | ✓ | = | | | | | | |
| 11 | 11 | ✓ | ✓ | = | | | | | | |
| 12 | 12 | ✓ | ✓ | = | | | | | | |
| 13 | 13 | ✓ | ✓ | = | | | | | | |
| 14 | 14 | ✓ | ✓ | = | | | | | | |
| 15 | 15 | ✓ | ✓ | = | | | | | | |
| 16 | 16 | ✓ | ✓ | = | | | | | | |
| | 17 | ✓ | ✓ | - | | | | | | |
| 17 | 18 | ✓ | ✓ | = | | | | | | |
| 20 | 19 | ✓ | ✓ | = | | | | | | |
| 21 | 20 | ✓ | ✓ | = | | | | | | |
| 18 | 21 | | ✓ | = | | | | | | |
| 19 | 22 | | ✓ | = | | | | | | |

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Application of: Phillips | § | Group Art Unit: | 2121 |
| | § | | |
| | § | Confirmation No.: | 3874 |
| Serial No.: 13/708,557 | § | | |
| Filed: 12-07-2012 | § | Examiner: EVERETT, CHRISTOPHER E. | |
| | § | | |
| For: REMOTE CONTROL OF FLUID-HANDLING DEVICES | § | Atty. Docket: | 000314.000003 |
| | § | | |

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| Date | Name |

Sir:

## REQUEST FOR CONTINUED EXAMINATION

In response to the Advisory Action issued on September 6, 2013, Applicants hereby request continued examination and allowance of the pending claims.

## AMENDMENTS TO THE CLAIMS

The following is a complete listing of the claims, which replaces all previous versions and listings of the claims.

1. (currently amended) A system for remotely controlling a fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising:

a command-center server having a data store storing multiple user accounts, each user account corresponding to a set of one or more oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, or a combination thereof, each set being operated by a different entity corresponding to the respective user account; and

a plurality of geographically distributed site master controllers, each site master controller corresponding to a respective one of the oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, each site master controller comprising:

a communication module operable to communicate with a plurality of fluid-handling devices;

a network interface;

memory; and

one or more processors communicatively coupled to the communication module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, via the network interface, from the command-center server, a plurality of commands encoded in a first protocol to control the fluid-handling devices from a user corresponding to one of the user accounts, different commands among the plurality of commands being directed to different fluid handling devices among the plurality of fluid-handling devices;

for at least some of the plurality of commands, determining a plurality of different target states of a given one of the fluid-handling devices over time,

wherein the respective site-master controller is operative to maintain control of the fluid handling devices in the absence of a network connection to the command-center server;

translating the plurality of commands into translated commands encoded in a plurality of protocols different from the first protocol, each translated command being translated into a protocol among the plurality of protocols suitable for a fluid-handling device to which the respective command is directed, the at least some of the translated command being operative to cause a local controller of the given fluid-handling device to drive the given fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the given fluid-handling device indicative of whether the given fluid-handling device is in a targeted state; and

sending the translated commands to respective local controllers of the respective fluid-handling devices to which the respective commands are directed~~the local controller~~.

2. (currently amended) The system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling ~~equipment~~device obtained by sensors of the fluid-handling device; and

sending, to a remote data store, the received sensor data.

3. (previously presented) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, a password corresponding to a selected one of the user accounts;

receiving, from the user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station

coupled to the fluid-handling device of the selected one of the user accounts;

retrieving, from the data store, data responsive to the request from the user device; and

sending, to the user device, the retrieved data for presentation to the user.

4. (original) The system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid.

5. (currently amended) The system of claim 3, wherein the request is a request to view alarms issued by [[the]] a fluid-handling device among the plurality of fluid handling devices, and wherein the retrieved data comprises data indicative of the alarms.

6. (original) The system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms.

7. (previously presented) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, the command to change the state of the fluid-handling device; and

determining a network address of the network interface of the respective site master controller; and

sending the command to the network interface.

8. (currently amended) The system of claim 1, wherein at least some of the fluid-handling devices comprise[[s]] a pump, and wherein the plurality of commands comprise[[s]] a command to change a speed of the pump.

9. (currently amended) The system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with [[the]]a fluid-handling device among the plurality of fluid-handling devices, wherein translating the received commands comprises:

identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command;

identifying a command code operative to cause the component to execute the received command; and

sending to the address on the serial bus the command code.

10. (currently amended) The system of claim 1, comprising a digital-to-analog converter, wherein [[the]]a fluid-handling device among the plurality of fluid-handling devices comprises a valve responsive to an output signal of the digital-to-analog converter, and wherein translating the received commands comprises changing an output signal of the digital-to-analog converter responsive to [[the]]a received command among the plurality of received commands.

11. (currently amended) The system of claim 1, wherein receiving the commands comprises receiving the commands via a first network socket, and wherein sending the translated command comprises sending at least some of the translated commands via a second network socket.

12. (currently amended) The system of claim 1, wherein translating the commands comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command.

13. (currently amended) The system of claim 1, wherein [[the]] a fluid-handling device among the plurality of fluid handling devices includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve.

14. (currently amended) The system of claim 1, comprising one of the following coupled to the fluid-handling devices: an oil well, a salt water disposal well, a carbon-capture well, or a pump station.

15. (currently amended) The system of claim 1, wherein [[the]] a fluid-handling device among the plurality of fluid handling devices comprises a separation unit configured to separate oil from water, and wherein the command comprises a command operative to change a level of the separation unit at which oil meets water.

16. (previously presented) The system of claim 15, wherein the separation unit comprises a pump having a variable-frequency drive, and wherein the local controller is operative to adjust a frequency of the variable frequency drive until the level of the separation unit reaches a target level corresponding to the target state.

17. (canceled)

18. (previously presented) The system of claim 1, wherein each user account corresponds to one or more user names, one or more user passwords, billing information, and identifiers of one or more of the site master-controllers with which users under the corresponding account are authorized to interact.

19. (currently amended) A tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data

processing apparatus to perform operations comprising:

receiving, via a network interface, from a remote user device, a plurality of commands to control a plurality of different fluid-handling devices, each of the plurality of commands being directed to a different one of the plurality of fluid-handling devices, and the plurality of commands being encoded in a first protocol;

determining a plurality of different target states of the fluid-handling devices over time such that control of the fluid handling devices is maintained in the absence of a network connection with the remote user device;

translating the plurality of commands into a plurality of translated commands operative to cause [[a]] local controllers of the fluid-handling devices to drive the respective fluid-handling devices to ~~the plurality of~~ different target states among the plurality of different target states, the plurality of translated commands including translated commands encoded in a plurality of different protocols, and the local controllers being responsive to the translated commands and feedback from [[the]] a corresponding fluid-handling device among the plurality of different fluid handling devices, the feedback being indicative of whether the corresponding fluid-handling device is in a targeted state; and

sending the translated commands to the local controllers.

20. (currently amended) A method, comprising:

receiving, via a network interface, from a remote user device, a plurality of commands to control [[a]] fluid-handling devices, the plurality of commands being encoded in a shared protocol;

determining a plurality of different target states of the fluid-handling devices over time such that control of the fluid handling devices is maintained ~~in the absence of a network connection with the remote user device~~;

translating the commands into translated commands encoded in a plurality of different protocols different from the shared protocol, each translated command being encoded in a protocol among the plurality of different protocols suitable for a fluid-

handling device to which the respective command is directed, the translated commands being operative to cause [[a]] local controllers of the fluid-handling devices to drive [[the]] a respective fluid-handling device to ~~the plurality of~~ different target states among the plurality of different target states, the local controllers being responsive to the translated commands directed to their respective fluid-handling device and feedback from the respective fluid-handling device indicative of whether the respective fluid-handling device is in a targeted state; and

sending the translated commands to the local controllers.

21. (currently amended) The system of claim 1, wherein the system is operative to exercise two layers of control, the two layers of control including:

a first layer of control in which targeted states of the fluid handling devices are determined by a respective site master controller in response to some of the received commands; and

a second layer of control in which, for each targeted state specified by the first layer of control, the respective fluid-handling device exercises feedback control to drive the respective fluid-handling device to the respective targeted state.

22. (previously presented) The system of claim 1, wherein the system is operative to provide web-based control and monitoring of oil and gas wells to multiple account holders corresponding to the user accounts.

## REMARKS

In the Advisory Action of June 25, 2013, the Examiner maintained the rejection of claims 1-22. By this response, claims 1, 2, 5, 8, 9-15 and 19-21 are amended and claim 17 is canceled. In view of the following remarks and above amendments, Applicants respectfully request consideration and allowance of all pending claims.

Applicants respectfully submit that the pending amended claims distinguish over the art of record, as Applicant explained during a teleconference with the Examiner on October 3, 2013.

## Conclusion

Applicants respectfully submit that all pending claims should be in condition for allowance. However, if the Examiner believes certain amendments are necessary to clarify the present claims or if the Examiner wishes to resolve any other issues by way of a telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: October 10, 2013

/Joshua L. Tucker/

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Phone No. 512-494-3623

#4386947.1

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 13708557 |
| **Filing Date:** | 07-Dec-2012 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Attorney Docket Number:** | 000314.000003 |

Filed as Small Entity

## Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| Extension - 1 month with $0 paid | 2251 | 1 | 100 | 100 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Request for Continued Examination | 2801 | 1 | 600 | 600 |
| | | **Total in USD ($)** | | **700** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 17092012 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 10-OCT-2013 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 15:26:09 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $700 |
| RAM confirmation Number | 2127 |
| Deposit Account | 500259 |
| Authorized User | TUCKER, JOSHUA LAYTON |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Request for Continued Examination (RCE) | ASL003RCE10OCT2013.pdf | 797704<br>b97435b3f7e3de34792bfa1a7b5c5c07a2c7e33c | no | 3 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Request for Continued Examination (RCE) | ASL003RequestforContinuedExamination10OCT2013.pdf | 82492<br>db55e84ffa78238d27710ed2836d52e29f5eacf0 | no | 9 |
| **Warnings:** | | | | | |
| This is not a USPTO supplied RCE SB30 form. | | | | | |
| **Information:** | | | | | |
| 3 | Fee Worksheet (SB06) | fee-info.pdf | 31861<br>e9b1c9e1ef07796f5ef4c5c1663485c64438d194 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 912057 | | |

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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# REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
## (Submitted Only via EFS-Web)

| Application Number | 13708557 | Filing Date | 2012-12-07 | Docket Number (if applicable) | 000314.000003 | Art Unit | 2121 |
|---|---|---|---|---|---|---|---|
| First Named Inventor | Phillips | | | Examiner Name | Everett, Christopher E. | | |

**This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.**
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

### SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

### MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

### FEES

☐ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No _____

### SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

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| Signature of Registered U.S. Patent Practitioner | | | |
|---|---|---|---|
| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2013-10-10 |
| Name | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

# Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/708,557 | Filing Date<br>12/07/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☐ LARGE ☒ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☒ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | **195** |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 22 minus 20 = | * 2 | x $31 = | **62** |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 3 minus 3 = | * 0 | x $125 = | **0** |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | **257** |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 10/10/2013 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 21 | Minus | ** 22 | = 0 | x $40 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 3 | Minus | ***3 | = 0 | x $210 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | **0** |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | x $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/JESSICA GAYNOR/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

35979 7590 10/09/2013

Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |
| ART UNIT | PAPER NUMBER |
| 2121 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 10/09/2013 | ELECTRONIC |

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@bgllp.com

| Examiner-Initiated Interview Summary | Application No. 13/708,557 | Applicant(s) PHILLIPS, AARON | |
|---|---|---|---|
| | Examiner Christopher E. Everett | Art Unit 2121 | |

All participants (applicant, applicant's representative, PTO personnel):

(1) *Christopher E. Everett*. (3)_____.

(2) *Josh Tucker, Reg. No. 63,809*. (4)_____.

Date of Interview: *03 October 2013*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *U.S. Patent Publication No. 2004/0262008 (Deans et al.) and U.S. Patent Publication No. 2002/0161685 (Dwinnell)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

*Applicant's representative, Attorney Josh Tucker, and Examiner Christopher E. Everett discussed the technology within the patent application including the translation of commands. Applicant's representative discussed the difference between the prior art and the technology. In particular, Applicant's representative discussed how the prior art was directed to standardized communication to wells and the technology translates commands for control of devices at the wells. Applicant's representative and Examiner discussed claim 1 with respect to the overview of the technology and the cited prior art (Deans et al. and Dwinnell). Examiner suggested amending claim 1 to further describe the translation as illustrated in figure 2. No agreement was reached with respect to the proposed claim amendments. However, Examiner agreed to review proposed claim amendments before submission of the response to the Office Action*.

**Applicant recordation instructions**: It is not necessary for applicant to provide a separate record of the substance of interview.

**Examiner recordation instructions**: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

| /C. E. E./<br>Examiner, Art Unit 2121 | /Kavita Padmanabhan/<br>Supervisory Patent Examiner, Art Unit 2121 |
|---|---|

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

35979 7590 09/06/2013

Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |
| ART UNIT | PAPER NUMBER |
| 2121 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 09/06/2013 | ELECTRONIC |

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@bgllp.com

| **Advisory Action Before the Filing of an Appeal Brief** | **Application No.** 13/708,557 | **Applicant(s)** PHILLIPS, AARON | |
|---|---|---|---|
| | **Examiner** Christopher E. Everett | **Art Unit** 2121 | **AIA (First Inventor to File) Status** No |

***--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

THE REPLY FILED 26 August 2013 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance;
(2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   *Examiner Note*: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☐ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Note below.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
Claim(s) allowed: .
Claim(s) objected to: .
Claim(s) rejected: 1-22.
Claim(s) withdrawn from consideration: .

| /Kavita Padmanabhan/ Supervisory Patent Examiner, Art Unit 2121 | /C. E. E./ Examiner, Art Unit 2121 |
|---|---|

Note for 12: Applicant's arguments filed 08/26/2013 have been fully considered but they are not persuasive.

Regarding claims 19-20, the applicant argues that Deans et al. does not describe "determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device." (pages 8-9 of Applicant's response dated 08/26/2013). The Examiner respectfully disagrees. Deans et al. describes determining a plurality of different target states as described in the rejection of claims 19-20 in the final office action dated 06/25/2013 (see, e.g., Deans et al.: see description of autonomous control of the subsea portion of the well over time during service or repair of the remote connection as described in paragraphs 0035 and 0037; "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments." Paragraph 0037; "As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production." Paragraph 0035). Accordingly, applicant's arguments are not persuasive since Deans et al. describes the limitations in claims 19-20.

Regarding claims 19-20, the applicant argues that Deans et al. does not describe "receiving, via a network interface, from a remote user device, a command to control a fluid-handling device." (pages 8-9 of Applicant's response dated 08/26/2013). The Examiner respectfully disagrees. Deans et al. describes receiving control commands as described in the rejection of claims 19-20 in the final office action dated 06/25/2013 (see, e.g., Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070). Accordingly, applicant's arguments are not persuasive since Deans et al. describes the limitations in claims 19-20.

Regarding claim 13, the applicant argues that Boger et al. does not describe "wherein the fluid handling device includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve." (pages 11-12 of Applicant's response dated 08/26/2013). The Examiner respectfully disagrees. Boger et al. describes oscillating a stuck valve as described in the rejection of claim 13 in the final office action dated 06/25/2013 (see, e.g., Boger et al.: "For example, if the valve 10 sticks in a certain position (such as when there is an obstacle in the valve or a problem exists with the air 32), the controller tries to move the valve without success. Attempting to move the valve, the controller continually adjusts the BIAS towards zero." Paragraph 0077). Accordingly, applicant's arguments are not persuasive since Boger et al. describes the limitations in claim 13.

Regarding claim 17, the applicant argues that Deans et al. does not describe "translating the command into a translated commands comprises translating the command into different formats for different communication protocols for the different respective fluid handling devices." (page 12 of Applicant's response dated 08/26/2013). The Examiner respectfully disagrees. Deans et al. describes translating a command between different formats as described in the rejection of claim 17 in the final office action dated 06/25/2013 (see, e.g., Deans et al.: see description of receipt of IP packets, extraction of control information for control of a control device in a format understandable by the control device, and control of the control device accordingly as described in paragraphs 0022, 0024, 0025, and 0067; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067). Accordingly, applicant's arguments are not persuasive since Deans et al. describes the limitations in claim 17.

Regarding claim 21, the applicant argues that Deans et al. does not describe "a first layer of control in which targeted states of the fluid handling device are determined by a respective site master controller in response to the received command; and a second layer of control in which, for each targeted state specified by the first layer of control, the fluid-handling device exercises feedback control to drive the fluid-handling device to the respective targeted state." (pages 12-13 of Applicant's response dated 08/26/2013). The Examiner respectfully disagrees. Deans et al. describes the layers of control as described in the rejection of claim 21 in the final office action dated 06/25/2013 (see, e.g., Deans et al.: "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments." Paragraph 0037). Accordingly, applicant's arguments are not persuasive since Deans et al. describes the limitations in claim 21.

For at least these reasons, the rejection of the claims is maintained.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| In re Application of: Phillips | § | Group Art Unit: 2121 |
| | § | Confirmation No.: 3874 |
| Serial No.: 13/708,557 | § | Examiner: EVERETT, CHRISTOPHER E |
| Filed: 12-07-2012 | § | |
| | § | |
| For: REMOTE CONTROL OF FLUID-HANDLING DEVICES | § | Atty. Docket: 000314.000003 |
| | § | |

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CERTIFICATE OF TRANSMISSION OR MAILING
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I hereby certify that this correspondence is being transmitted by facsimile to the United States Patent and Trademark Office in accordance with 37 C.F.R. § 1.6(d), or is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4), or is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:

| August 26, 2013 | /Josh Tucker/ |
|---|---|
| Date | Name |

Sir:

**RESPONSE TO OFFICE ACTION ISSUED ON JUNE 25, 2013**

In response to the Office Action issued on June 25, 2013, Applicants remark as follows.

## AMENDMENTS TO THE CLAIMS

The following is a complete listing of the claims, which replaces all previous versions and listings of the claims.

1. (previously presented) A system for remotely controlling a fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising:

a command-center server having a data store storing multiple user accounts, each user account corresponding to a set of one or more oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, or a combination thereof, each set being operated by a different entity corresponding to the respective user account; and

a plurality of geographically distributed site master controllers, each site master controller corresponding to a respective one of the oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, each site master controller comprising:

a communication module operable to communicate with a fluid-handling device;

a network interface;

memory; and

one or more processors communicatively coupled to the communication module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, via the network interface, from the command-center server, a command to control the fluid-handling device from a user corresponding to one of the user accounts;

determining a plurality of different target states of the fluid-handling device over time, wherein the respective site-master controller is operative to maintain control of the fluid handling device in the absence of a network connection to the command-center server;

translating the command into translated commands operative to

cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in a targeted state; and

sending the translated commands to the local controller.

2. (original) The system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling equipment obtained by sensors of the fluid-handling device; and

sending, to a remote data store, the received sensor data.

3. (previously presented) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, a password corresponding to a selected one of the user accounts;

receiving, from the user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station coupled to the fluid-handling device of the selected one of the user accounts;

retrieving, from the data store, data responsive to the request from the user device; and

sending, to the user device, the retrieved data for presentation to the user.

4. (original) The system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid.

5. (original) The system of claim 3, wherein the request is a request to view alarms issued by the fluid-handling device, and wherein the retrieved data comprises data indicative of the alarms.

6. (original) The system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms.

7. (previously presented) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, the command to change the state of the fluid-handling device; and

determining a network address of the network interface of the respective site master controller; and

sending the command to the network interface.

8. (original) The system of claim 1, wherein fluid-handling device comprises a pump, and wherein the command comprises a command to change a speed of the pump.

9. (original) The system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with the fluid-handling device, wherein translating the received command comprises:

identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command;

identifying a command code operative to cause the component to execute the received command; and

sending to the address on the serial bus the command code.

10. (original) The system of claim 1, comprising a digital-to-analog converter, wherein the fluid-handling device comprises a valve responsive to an output signal of the digital-to-analog converter, and wherein translating the received command comprises changing an output signal of the digital-to-analog converter responsive to the receive command.

11. (original) The system of claim 1, wherein receiving the command comprises receiving the command via a first network socket, and wherein sending the translated command comprises sending the translated command via a second network socket.

12. (original) The system of claim 1, wherein translating the command comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command.

13. (previously presented) The system of claim 1, wherein the fluid handling device includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve.

14. (original) The system of claim 1, comprising one of the following coupled to the fluid-handling device: an oil well, a salt water disposal well, a carbon-capture well, or a pump station.

15. (previously presented) The system of claim 1, wherein the fluid-handling device comprises a separation unit configured to separate oil from water, and wherein the command comprises a command operative to change a level of the separation unit at which oil meets water.

16. (previously presented) The system of claim 15, wherein the separation unit comprises a pump having a variable-frequency drive, and wherein the local controller is

operative to adjust a frequency of the variable frequency drive until the level of the separation unit reaches a target level corresponding to the target state.

17. (previously presented) The system of claim 1, wherein:

at least one site master controller comprises a plurality of fluid-handling devices, and

translating the command into a translated commands comprises translating the command into different formats for different communication protocols for the different respective fluid handling devices. .

18. (previously presented) The system of claim 1[[7]], wherein each user account corresponds to one or more user names, one or more user passwords, billing information, and identifiers of one or more of the site master-controllers with which users under the corresponding account are authorized to interact.

19. (previously presented) A tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising:

receiving, via a network interface, from a remote user device, a command to control a fluid-handling device;

determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device;

translating the command into translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling

device is in a targeted state; and

sending the translated commands to the local controller.

20. (previously presented) A method, comprising:

receiving, via a network interface, from a remote user device, a command to control a fluid-handling device;

determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device;

translating the command into translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in a targeted state; and

sending the translated commands to the local controller.

21. (previously presented) The system of claim 1, wherein the system is operative to exercise two layers of control, the two layers of control including:

a first layer of control in which targeted states of the fluid handling device are determined by a respective site master controller in response to the received command; and

a second layer of control in which, for each targeted state specified by the first layer of control, the fluid-handling device exercises feedback control to drive the fluid-handling device to the respective targeted state.

22. (previously presented) The system of claim 1, wherein the system is operative to provide web-based control and monitoring of oil and gas wells to multiple account holders corresponding to the user accounts.

## REMARKS

In the Final Office Action of June 25, 2013, the Examiner rejected claims 1-22, all of which remain pending. In view of the following remarks, Applicants respectfully request consideration and allowance of all pending claims.

### Claim Rejections under 35 U.S.C. § 102

In the Final Office Action, the Examiner rejected claims 19-20 under 35 U.S.C. § 102(b) as anticipated by Deans (U.S. Patent Pub. 20040262008). Applicants respectfully traverse this rejection.

***Legal Precedent and Guidelines***

Anticipation under section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under section 102, a single reference must teach each and every limitation of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984). Accordingly, the Applicants need only point to a single element not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter. The prior art reference also must show the identical invention "in as complete detail as contained in the ... claim" to support a prima facie case of anticipation. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989).

***The cited reference fails to teach features recited by independent claims 19 and 20***

Claims 19 and 20 recite "determining a plurality of different target states of the fluid-handling device over time." Deans, in contrast, teaches a control system 26 that merely controls subsea instruments. In particular, Deans is silent regarding the type of

control, e.g., whether the control entails merely maintaining subsea instruments in a single, existing target state; whether the control entails merely determining a single target state for subsea instruments; or whether the control entails the particular activity recited by the claims: "determining a plurality of different target states of the fluid-handling device over time."

In the Final Office Action, the Examiner noted that paragraph 37 of Deans recites "the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments." This passage, however, merely describes feedback control (e.g., feedback control to maintain subsea instruments in an existing target state, such as a target fluid flow rate or the like), not determining a target state, let alone a determining plurality of different target states over time.

Further, in the cited passages, Deans does not teach "receiving, via a network interface, from a remote user device, a command to control a fluid-handling device," as recited by claims 19 and 20. Rather, in these passages, Deans teaches that downloaded software is executed on the communication hub. Deans, para. 38. Downloaded software is different from a received "command to control a fluid-handling device," as the software remains unexecuted until some other condition triggers execution of the software. Thus, the downloaded software of paragraph 38 of Deans is not "a command to control a fluid-handling device."

Accordingly, Deans cannot teach all of the features of claims 19 and 20, and for this reason, among others, Applicants respectfully request that the rejection be withdrawn.

**Claim Rejections under 35 U.S.C. § 103(a)**

The Examiner rejected claims 9, 10, 15-16, and 18 as obvious on the following grounds:

1) claims 1-8, 11-12, 14, 17, 18, and 21-22 as being upatentable over Deans in view of Dwinnell (US Pat. Pub. 20020161685);

2) claim 9 as being upatentable over Deans in view of Dwinnel and Silvers (US Pat. Pub. 20040231851);

3) claim 10 as being upatentable over Deans in view of Roberson (WO 2008124765);

4) claim 13 as being upatentable over Deans in view of Dwinnel and Boger (US Pat. Pub. 20010032518); and

5) claim 15-16 as being upatentable over Deans in view of Dwinnel and Varnam (US Pat. 5,149,443).

The pending claims, however, are distinct from and allowable over the art cited in these rejections for at least the reasons explained below.

***Legal Precedent and Guidelines***

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness depends on several underlying factual inquiries:

> Under §103, the scope and content of the prior art are to be determined, differences between the prior art and the claims at issue are to be ascertained, and the level of ordinary skill in the pertinent art are to be resolved. Against this background the obviousness or non-obviousness of the subject matter is to be determined. Such secondary considerations as commercial success, long-felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406, 127 S.Ct. 1727, 167 L.Ed.2d 705 (2007) (quoting *Graham v. John Deere Co.*, 383 U.S. 1, 17-18, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966)).

As explained by the Court in *KSR International Co. v. Teleflex Inc.,* "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.* at 14. In this regard, the *KSR* court stated that "it can be important to identify a reason that would have prompted a

person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does … because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *Id.* at 14-15. Furthermore, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *Id.* at 14 ("To facilitate review, this analysis should be made explicit. *See In re Kahn,* 441 F.3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

***The cited references, taken alone or in hypothetical combination, fail to teach or suggest features of independent claims 1, 19, or 20 or their dependent claims***

Independent claim 1 recites the features of claims 19 and 20 discussed above and that are absent from Deans: 1) "determining a plurality of different target states of the fluid-handling device over time"; and 2) "receiving, via the network interface, from the command-center server, a command to control the fluid-handling device." The secondary references fail to cure this deficiency, and as such, Applicants respectfully request that the rejections of claim 1, its dependent claims, and claim s 21-22 be withdrawn.

***The cited references, taken alone or in hypothetical combination, fail to teach or suggest features of independent claim 13***

The Final Office Action rejects claim 13 over Deans in view of Dwinnell and Boger. However, none of the references, even if considered in hypothetical combination, teach "wherein the fluid handling device includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve," as recited by claim 13. For this feature, the rejection relies on Boger, but the cited portion of Boger merely describes that, when a valve is stuck, "the controller continually adjusts the BIAS toward zero." Continually adjusting in one direction is not oscillating.

As such, the cited references do not teach all of the features of claim 13, and for this reason also, Applicants respectfully request allowance of claim 13.

***The cited references, taken alone or in hypothetical combination, fail to teach or suggest features of independent claim 17***

The Final Office Action rejects claim 17 over Deans in view of Dwinnell. However, none of the references, even if considered in hypothetical combination, teach "translating the command into different formats for different communication protocols for the different respective fluid handling devices," as recited by claim 17. For this feature, the rejection relies on Deans, but the cited portion of Deans merely describes decapsulating incoming IP packets, which at most refers to a single format, and is not "for the different respective fluid handling devices." Indeed, Deans and the rejection of claim 17 are silent regarding "formats for different communication protocols for the different respective fluid handling devices." As such, the cited references do not teach all of the features of claim 17, and for this reason also, Applicants respectfully request allowance of claim 17.

***The cited references, taken alone or in hypothetical combination, fail to teach or suggest features of independent claim 21***

The Final Office Action rejects claim 21 over Deans in view of Dwinnell. However, none of the references, even if considered in hypothetical combination, teach both "a first layer of control in which targeted states of the fluid handling device are determined by a respective site master controller in response to the received command; and a second layer of control in which, for each targeted state specified by the first layer of control, the fluid-handling device exercises feedback control to drive the fluid-handling device to the respective targeted state," as recited by claim 21. For this feature, the rejection relies on Deans, but the cited portion of Deans merely describes a single layer of control.

With respect to the first layer of control and the second layer of control, the rejection does not clearly map claim features to the cited references, e.g., it is not clear if the Examiner contends the "first layer of control" in Deans is the surface ship or the communication hub 28. Because claim 21 recites that the "first layer of control" determines target states "in response to the received command," Applicants presume the Examiner relies on the communication hub 28 that receives the cited IP packets as providing the first layer of control.

The communication hub 28 of Deans only has a single layer of control: the closed loop control cited by the Examiner and discussed in paragraphs 35 and 41 of Deans. Deans is absolutely silent regarding another layer of control in which targeted states of the cited closed loop control are determined. As such, the cited references do not teach a second layer of control. Thus, the references do not teach or suggest all of the features of claim 21, and for this reason also, Applicants respectfully request allowance of claim 21.

**Proposed Examiner's Amendment**

While Applicants do not agree with the rejection of the pending claims, in the interest of expediting allowance, Applicants wish to note that they would be amenable to an Examiner's amendment to incorporate the features of claims 17 and 21 into their respective parent claims and canceling claim 19 if doing so would, in the Examiner's view, place the application in condition for allowance.

**Reservation of Arguments**

Above, Applicants identify reasons why the present rejections should not be applied to the claims. This explanation, however, should not be construed as an admission that other features of the claims beyond those discussed, including the combination of claim features, are taught or suggested by the cited art, or that the rejections are otherwise proper. In the interest of brevity, Applicants have refrained from providing an exhaustive explanation of every basis for allowing the claims. Accordingly, Applicants reserve the right to identify other grounds for overcoming the present

rejections and the cited art, and Applicants reiterate that the amendments and arguments above are made without prejudice, including to rights available under the doctrine of equivalents.

**Conclusion**

Applicants respectfully submit that all pending claims should be in condition for allowance. However, if the Examiner believes certain amendments are necessary to clarify the present claims or if the Examiner wishes to resolve any other issues by way of a telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: August 26, 2013

/Josh Tucker/

Josh Tucker
Registration No. 63809
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P.O. Box 61389
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Phone No. 512-494-3623

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 16686720 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Jacqueline McVey |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 26-AUG-2013 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 16:15:32 |
| **Application Type:** | Utility under 35 USC 111(a) |

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| Submitted with Payment | no |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Response After Final Action | Resp_to_FOA_issued_25June2013_000314_000003_as_filed_26Aug2013.pdf | 158960<br>0b9947606e939b7eeab92e794e5d300670de06d0 | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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| **Total Files Size (in bytes):** | 158960 |

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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/708,557 | Filing Date<br>12/07/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☐ LARGE ☒ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT | 08/26/2013 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * 22 | Minus | ** 22 | = 0 | X $40 = | 0 |
| | Independent (37 CFR 1.16(h)) | * 3 | Minus | ***3 | = 0 | X $210 = | 0 |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | 0 |

| AMENDMENT | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|
| | Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| | Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| | ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| | ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/DEBRA R. WYATT/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

35979 7590 06/25/2013

Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |
| ART UNIT | PAPER NUMBER |
| 2121 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 06/25/2013 | ELECTRONIC |

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@bgllp.com

| Office Action Summary | Application No. 13/708,557 | Applicant(s) PHILLIPS ET AL. | |
|---|---|---|---|
| | Examiner Christopher E. Everett | Art Unit 2121 | AIA (First Inventor to File) Status No |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *6 June 2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

5)☒ Claim(s) *1-22* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-22* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some * c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Interim copies:**

a)☐ All b)☐ Some c)☐ None of the: Interim copies of the priority documents have been received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *04/03/2013 and 06/07/2013*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

1. The Office Action is responsive to the communication filed on 06/06/2013.

2. Claims 1-22 are pending.

### *Response to Amendment*

3. The amendment, filed 06/06/2013, is fully responsive.

4. The claim objections to claims 1 and 17 have been corrected and the objections have been removed.

5. The claim objections to claims 15-16 have been corrected and the objections have been removed.

6. The claim objections to claim 19 have been corrected and the objections have been removed.

7. The claim objections to claim 20 have been corrected and the objections have been removed.

### *Response to Arguments*

8. Applicant's arguments filed 06/06/2013 have been fully considered but they are not persuasive.

Regarding claims 1, 19, and 20, the applicant argues that Deans et al. does not teach "determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with

the remote user device," as recited in claim 19. (page 10 of Applicant's response dated 06/06/2013). Claims 1 and 20 include similar limitations. The Examiner respectfully disagrees. Deans et al. describes control of the fluid handling device without a network connection to the remote user device as described in the rejection of claims 1, 19, and 20 below (see, e.g., Deans et al.: "In addition, the subsea communication hub 28 can be configured to conduct **autonomous processing** of data and **control** based upon input from a single or multiple instruments." Paragraph 0037 (emphasis added)). Accordingly, applicant's arguments are not persuasive since Deans et al. describes the limitations in claims 1, 19, and 20.

Regarding claims 9, 10, 15, 16, 18, and 21-22, the applicant generically argues that claims are clearly patentable over the combination of the cited prior art (Dean et al., Silvers, Roberson et al., and Varnam). (pages 12-13 of Applicant's response dated 06/06/2013). The Examiner respectfully disagrees. The cited prior art describes the limitations of the claims as described above with respect to the independent claims and as further described below with respect to the rejections of the independent claims and claims 9, 10, 15, 16, 18, and 21-22. Accordingly, applicant's generic arguments are not persuasive since the cited prior art describes the limitations in claims 9, 10, 15, 16, 18, and 21-22.

For at least these reasons, the rejection of the claims is maintained.

### *Claim Rejections - 35 USC § 102*

9. 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 –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 19-20 are rejected under 35 U.S.C. 102(b) as being unpatentable by U.S. Patent Publication No. 2004/0262008 (Deans et al.).

Regarding claim 19, Deans et al. describes a tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising: **(Deans et al.: "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- receiving, via a network interface, from a remote user device, a command to control a fluid-handling device; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately**

**the subsea communication hub 28).” Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7)**

- determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device; **(Deans et al.: “In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments.” Paragraph 0037; “As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production.” Paragraph 0035; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**
- translating the command into translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in a targeted state; and **(Deans et al.: “The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation**

**calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; "Subsea instrumentation data can be used to affect real-time gas lift optimization at the seabed by use of closed loop control on the seabed. Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; "Closed loop control capabilities of the SMC system can be used to monitor for sand production, to adjust choke settings at the seabed, and to prevent flow line erosion and damage. Also, closed loop control capabilities of the SMC system can be used to optimize subsea/downhole separation operation, optimize chemical injection rate based upon inputs of temperature, production type, and flow rate, optimize corrosion inhibiter dosing based upon subsea corrosion monitoring devices." Paragraph 0042; paragraphs 0037, 0038, 0039, 0041, 0042, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the translated commands to the local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or**

**control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

Regarding claim 20, Deans et al. describes a method, comprising: **(Deans et al.: "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- receiving, via a network interface, from a remote user device, a command to control a fluid-handling device; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7)**determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device; **(Deans**

**et al.: "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments." Paragraph 0037; "As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production." Paragraph 0035; "Subsea instrumentation data can be used to affect real-time gas lift optimization at the seabed by use of closed loop control on the seabed. Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; "Closed loop control capabilities of the SMC system can be used to monitor for sand production, to adjust choke settings at the seabed, and to prevent flow line erosion and damage. Also, closed loop control capabilities of the SMC system can be used to optimize subsea/downhole separation operation, optimize chemical injection rate based upon inputs of temperature, production type, and flow rate, optimize corrosion inhibiter dosing based upon subsea corrosion monitoring devices." Paragraph 0042; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

- translating the command into translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in a targeted state; and **(Deans et al.: "The triggers can include increased data**

**sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0041, 0042, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the translated commands to the local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

***Claim Rejections - 35 USC § 103***

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

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1-8, 11-12, 14, 17, and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No. 2002/0161685 (Dwinnell) (cited by Applicant).

Regarding claim 1, Deans et al. describes a system for remotely controlling a fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising: **(Deans et al.: "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- a plurality of geographically distributed site master controllers, each site master controller corresponding to a respective one of the oil wells, petro water disposal or re- injection facilities, or petroleum pumping stations, each site master controller comprising: **(Deans et al.: "FIG. 1B illustrates another embodiment of the subsea monitoring and control system that has multiple subsea communication hubs 50, 52, and 54 that are coupled by a subsea network 56 to the surface facility 32. The subsea communication hubs 50, 52, and 54 each has a processor 56 as well as**

**communication equipment 58." Paragraph 0049; "As shown in FIG. 5, a communication pod includes various components, including a device connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0047, 0048, 0049, 0050, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- a communication module operable to communicate with a fluid-handling device; **(Deans et al.: "As shown in FIG. 5, a communication pod includes various components, including a device connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- a network interface; **(Deans et al.: "The pod also has a network connector 202 for connection to the subsea network 34." Paragraph 0062; paragraphs 0019, 0020, 0062, 0063, 0064; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- memory; and **(Deans et al.: "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software**

**214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in hardware without the use of software." Paragraph 0063; paragraphs 0062, 0063, 0064; figures 1, 5)**

- one or more processors communicatively coupled to the communication module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising: **(Deans et al.: "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software 214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in hardware without the use of software." Paragraph 0063; paragraphs 0062, 0063, 0064; figures 1, 5)**
  - determining a plurality of different target states of the fluid-handling device over time, wherein the respective site-master controller is operative to maintain control of the fluid handling device in the absence of a network connection to the command-center server; **(Deans et al.: "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input**

**from a single or multiple instruments." Paragraph 0037; "As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production." Paragraph 0035; "Subsea instrumentation data can be used to affect real-time gas lift optimization at the seabed by use of closed loop control on the seabed. Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; "Closed loop control capabilities of the SMC system can be used to monitor for sand production, to adjust choke settings at the seabed, and to prevent flow line erosion and damage. Also, closed loop control capabilities of the SMC system can be used to optimize subsea/downhole separation operation, optimize chemical injection rate based upon inputs of temperature, production type, and flow rate, optimize corrosion inhibiter dosing based upon subsea corrosion monitoring devices." Paragraph 0042; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

- translating the command into translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-

handling device indicative of whether the fluid-handling device is in a target state; and **(Deans et al.: "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "Subsea instrumentation data can be used to affect real-time gas lift optimization at the seabed by use of closed loop control on the seabed. Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; "Closed loop control capabilities of the SMC system can be used to monitor for sand production, to adjust choke settings at the seabed, and to prevent flow line erosion and damage. Also, closed loop control capabilities of the**

**SMC system can be used to optimize subsea/downhole separation operation, optimize chemical injection rate based upon inputs of temperature, production type, and flow rate, optimize corrosion inhibiter dosing based upon subsea corrosion monitoring devices." Paragraph 0042; paragraphs 0037, 0038, 0039, 0041, 0042, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the translated command to the local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

Bean et al. does not explicitly describe multiple user accounts as described below. However, Dwinnell teaches the multiple user accounts as described below.

- a command-center server having a data store storing multiple user accounts, each user account corresponding to a set of one or more oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, or a combination thereof, each set being operated by a different entity corresponding to the respective user account; and

**(Dwinnell: see ventures and wells as illustrated in figure 6A; "Retrieval by web site users (investors and managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with a dynamically generated web page representative of the level of access that the user's particular account possesses." Paragraph 0057; paragraphs 0015, 0017, 0020, 0053, 0054, 0056, 0057; abstract; figures 1, 6A; Dean et al.: "FIG. 6 illustrates a topside communication hub 300 that is located at the surface facility 32. The topside communication hub includes the communications components to enable the surface facility 32 to communicate with the subsea communication hub 28 over the network 34." Paragraph 0068; paragraphs 0068, 0069, 0070; figure 6)**

- receiving, via the network interface, from the command-center server, a command to control the fluid-handling device from a user corresponding to one of the user accounts; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more**

**subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7; Dwinnell: see ventures and wells as illustrated in figure 6A; "Retrieval by web site users (investors and managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with a dynamically generated web page representative of the level of access that the user's particular account possesses." Paragraph 0057; paragraphs 0015, 0017, 0020, 0053, 0054, 0056, 0057; abstract; figures 1, 6A)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, a surface facility controller connected to a plurality of subsea communication hubs, with the known techniques of Dwinnell, namely, providing information about subsea operations using user authentication, would have yielded predictable results and

resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control between the surface facility controller and the subsea communication hubs with the teachings of Dwinnell to use user authentication for access to information about subsea systems would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system (i.e., using user authentications to enable control of the subsea communication hubs via the surface facility controller of Deans et al. based on the teachings of user authentication to access subsea systems in Dwinnell).

Regarding claim 2, Deans et al. describes the system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

- receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling equipment obtained by sensors of the fluid-handling device; and **(Deans et al.: "Also, various sensors 14, 16, 18 and control devices 20 are positioned downhole in the subsea well 10. Examples of sensors 14, 16, 18 include pressure sensors, temperature sensors, flow rate sensors, shock detectors, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0021; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- sending, to a remote data store, the received sensor data. **(Deans et al.: "Periodically, or in response to some triggering event, the electronics module 206 (under control of the software 212 214 and/or processor 208) communicates the stored data through the interface 212 and the network connector 202 to the subsea network 34. The data is transferred over the subsea network 34 to the surface facility 32. Data and**

**control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; paragraphs 0062, 0063, 0064, 0065, 0066, 0069; figures 1, 1b, 5, 6, 7)**

**Claim 3**

Regarding claim 3, Deans et al. describes the system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising: **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0062, 0063, 0064, 0065, 0066, 0069; figure 1, 5, 6, 7)**

Bean et al. does not explicitly describe multiple user accounts as described below. However, Dwinnell teaches the multiple user accounts as described below.

- receiving, from a user device, a password corresponding to a selected one of the user accounts; **(Dwinnell: see users 105 logging into the system using devices as illustrated in figure 1; "Retrieval by web site users (investors and managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with**

**a dynamically generated web page representative of the level of access that the user's particular account possesses." Paragraph 0057; paragraphs 0015, 0017, 0020, 0053, 0054, 0056, 0057; abstract; figures 1, 6A)**

- receiving, from the user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station coupled to the fluid-handling device of the selected one of the user accounts; **(Deans et al.: "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0059, 0069, 0070; figures 1, 5, 6, 7; Dwinnell: "Retrieval by web site users (investors and managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with a dynamically generated web page representative of the level of**

**access that the user's particular account possesses." Paragraph 0057; paragraphs 0015, 0017, 0020, 0053, 0054, 0056, 0057; abstract; figures 1, 6A)**

- retrieving, from the data store, data responsive to the request from the user device; and sending, to the user device, the retrieved data for presentation to the user. **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**

Deans et al. and Dwinnell are combinable for the same rationale as set forth above with respect to claim 1.

Regarding claim 4, Deans et al. describes the system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid. **(Deans et al.: "Also, various sensors 14, 16, 18 and control devices 20 are positioned downhole in the subsea well 10. Examples of sensors 14, 16, 18 include pressure sensors, temperature sensors, flow rate sensors, shock detectors, and so forth." Paragraph 0019; "During operation, data acquired by sensors are received over a line at the device connector 200, with such data provided to the electronics module 206 for storing in the storage 210. Periodically, or in response to**

**some triggering event, the electronics module 206 (under control of the software 212 214 and/or processor 208) communicates the stored data through the interface 212 and the network connector 202 to the subsea network 34." Paragraph 0065; paragraphs 0019, 0020, 0021, 0063, 0064, 0065, 0066; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 5, Deans et al. describes the system of claim 3, wherein the request is a request to view alarms issued by the fluid-handling device, and wherein the retrieved data comprises data indicative of the alarms. **(Deans et al.: "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; "The subsea communication hub 28 can also be configured to conduct autonomous processing of data and pass along warnings to the subsea production control system 26, based upon preset criteria." Paragraph 0037; "The subsea communication hub 28 also has on-board diagnostic capabilities at the seabed. On-board diagnostics can be configured to send alerts to the surface facility 32 or to trigger some automated subsea event such as a downhole flow control device actuation or increased data acquisition log in rates to due flow interruptions or restarting." Paragraph 0039; "The data handling module 314 refers to a module for**

**collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0037, 0038, 0039, 0059, 0069, 0070; figures 1, 5, 6, 7)**

Regarding claim 6, Deans et al. describes the system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms. **(Deans et al.: "The subsea communication hub 28 can also be configured to conduct autonomous processing of data and pass along warnings to the subsea production control system 26, based upon preset criteria." Paragraph 0037; "The subsea communication hub 28 also has on-board diagnostic capabilities at the seabed. On-board diagnostics can be configured to send alerts to the surface facility 32 or to trigger some automated subsea event such as a downhole flow control device actuation or increased data acquisition log in rates to due flow interruptions or restarting." Paragraph 0039; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0037, 0038, 0039, 0059, 0069, 0070; figures 1, 5, 6, 7)**

Regarding claim 7, Deans et al. describes the system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising: **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data**

**associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**

- receiving, from a user device, the command to change the state of the fluid-handling device; and **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**
- determining a network address of the network interface of the respective site master controller; and **(Deans et al.: "In accordance with some embodiments of the invention, a subsea communication hub 28 has a communications interface that uses a non-proprietary communications protocol for communicating information (control and/or data) between the subsea communication hub 28 and the surface facility 32. The non-proprietary communications protocol used by the subsea communication hub 28 is a packet-based protocol that communicates data in packets exchanged between the subsea communication hub 28 and the surface facility 32. In one embodiment, the packet-based protocol is the Internet Protocol (IP). In other embodiments, other established packet-based protocols can be employed." Paragraph 0025; "Each sensor and/or control device can be considered an independent network node on an IP network, with the sensor and/or control device assigned an IP address for purposes of communications." Paragraph 0030;**

**"In addition to the payload, packet control information is inserted into each packet, including IP source and destination addresses as well as TCP control information." Paragraph 0066; paragraphs 0025, 0026, 0027, 0030, 0034, 0049, 0050, 0062, 0063, 0064, 0065, 0066; figures 1, 1B, 5)**

- sending the command to the network interface. **(Deans et al.: "The fiber optic laser in the transmitter 404 transmits optical signals down the transmit fiber 406, with the optical signals modulated to be indicative of the data or commands that are being transmitted." Paragraph 0072; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0062, 0063, 0064, 0065, 0066, 0071, 0072; figures 5, 6, 7)**

Regarding claim 8, Deans et al. describes the system of claim 1, wherein fluid-handling device comprises a pump, and wherein the command comprises a command to change a speed of the pump. **(Deans et al.: "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; "Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; paragraphs 0019, 0020, 0041, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 11, Deans et al. describes the system of claim 1, wherein receiving the command comprises receiving the command via a first network socket, and wherein sending the translated command comprises sending the translated command via a second network socket. **(Deans et al.: "The pod also has a network connector 202 for connection to the subsea network 34." Paragraph 0062; "The device connector 200 is connected to one or more cards 204, with each card associated with a particular device. Thus, for example, if there re N subsea or downhole devices that the pod is coupled to, then there would be N cards 204 provided in the pod. Alternatively, one card can be provided to communicate with multiple sensors or control devices." paragraph 0062; paragraphs 0026, 0027, 0028, 0062, 0063, 0064, 0065, 0071, 0072, 0073; figures 5, 6, 7)**

Regarding claim 12, Deans et al. describes the system of claim 1, wherein translating the command comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command. **(Deans et al.: "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34. The interface 212 includes the various layers that enable communications over the network, such as a physical layer, a data link layer (e.g., Ethernet layer), an IP layer, and a transport layer (e.g., TCP or UDP). More specifically, according to one example implementation, the interface 212 includes an Ethernet switch and an optical modem, as well as the TCP/IP stack for implementing TCP/IP communications." Paragraph 0064; paragraphs 0007, 0025, 0026, 0027, 0062, 0063, 0064; figure 5)**

Regarding claim 14, Deans et al. describes the system of claim 1, comprising one of the following coupled to the fluid-handling device: an oil well, a salt water disposal well, a carbon-capture well, or a pump station. **(Deans et al.: "artificial lifting of hydrocarbons from the wellbore" paragraph 0040; "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007, 0040; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 17, Deans et al. describes the system of claim 1, comprising:

- at least one site master controller comprises a plurality of fluid-handling devices, and **(Deans et al.: see wells in figure 1B; "in an SMC system for multiple wells" paragraph 0046; "FIG. 1B illustrates another embodiment of the subsea monitoring and control system that has multiple subsea communication hubs 50, 52, and 54 that are coupled by a subsea network 56 to the surface facility 32. The subsea communication hubs 50, 52, and 54 each has a processor 56 as well as communication equipment 58. Each subsea communication hub can be attached to either local or network-enabled sensors and/or control devices. A local sensor and/or control device is capable of communication only with the respective subsea communication hub." Paragraph 0049; figure 1B)**
- translating the command into a translated commands comprises translating the command into different formats for different communication protocols for the different respective fluid handling devices. **(Deans et al.: "In the inbound direction**

**(from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0024, 0025, 0026, 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

Claim 18:

Deans et al. does not explicitly describe user accounts as described below. However, Dwinnell teaches the user accounts as described below.

Regarding claim 18, Dwinnell describes the system of claim 1, wherein each user account corresponds to one or more user names, one or more user passwords, billing information, and identifiers of one or more of the site master-controllers with which users under the corresponding account are authorized to interact. **(Dwinnell: "Retrieval by web site users (investors and**

**managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with a dynamically generated web page representative of the level of access that the user's particular account possesses." Paragraph 0057; see authorizations as illustrated in figure 6A; "Preferably, web page 600a provides the user with a list of ventures 601 and associated remote sites 602 (e.g., oil wells) for which the advisor tool is available (e.g., oil and gas wells being currently drilled) such that the user can identify and select one or more remote sites for which he wishes to set alert parameters to receive notifications regarding the occurrence of events of interest." Paragraph 0067; "investment pages showing level of remaining investment opportunity with transactional capabilities for particular participating ventures; an online subscription page allowing for users to become members web site; prospect pages showing information relative to current of future oil wells; operator's pages showing historical and pertinent information regarding each participating operator's prior drilling activities" paragraph 0056; paragraphs 0015, 0017, 0020, 0053, 0054, 0056, 0057, 0067; abstract; figures 1, 6A)**

Deans et al. and Dwinnell are combinable for the same rationale as set forth above with respect to claim 1.

Regarding claim 21, Deans et al. describes the system of claim 1, wherein the system is operative to exercise two layers of control, the two layers of control including: **(Deans et al.: paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

- a first layer of control in which targeted states of the fluid handling device are determined by a respective site master controller in response to the received command; and **(Deans et al.: "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; paragraphs 0037, 0038, 0039, 0041, 0042, 0065, 0066, 0067; figures 1, 1b, 5)**
- a second layer of control in which, for each targeted state specified by the first layer of control, the fluid-handling device exercises feedback control to drive the fluid- handling device to the respective targeted state. **(Deans et al.: "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data**

**and control based upon input from a single or multiple instruments." Paragraph 0037; "As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production." Paragraph 0035; "Subsea instrumentation data can be used to affect real-time gas lift optimization at the seabed by use of closed loop control on the seabed. Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; "Closed loop control capabilities of the SMC system can be used to monitor for sand production, to adjust choke settings at the seabed, and to prevent flow line erosion and damage. Also, closed loop control capabilities of the SMC system can be used to optimize subsea/downhole separation operation, optimize chemical injection rate based upon inputs of temperature, production type, and flow rate, optimize corrosion inhibiter dosing based upon subsea corrosion monitoring devices." Paragraph 0042; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

**Claim 22**

Bean et al. does not explicitly describe multiple user accounts as described below. However, Dwinnell teaches the multiple user accounts as described below.

Regarding claim 22, Deans et al. and Dwinnell describe the system of claim 1, wherein the system is operative to provide web-based control and monitoring of oil and gas wells to multiple account holders corresponding to the user accounts. **(Dwinnell: "via the Internet via a**

**dynamic web page interface" abstract; "Retrieval by web site users (investors and managers) of information and data stored in the archive system 302 or the database system 303 is controlled by standard authentication and authorization protocols. Users sign up for access to certain restricted features of the dynamic web site and receive a username and password to access desired information. Once a user has received an account, he is able to login into various otherwise-restricted web pages and thus be presented with a dynamically generated web page representative of the level of access that the user's particular account possesses." Paragraph 0057; paragraphs 0015, 0016, 0017, 0020, 0043, 0053, 0054, 0056, 0057; abstract; figures 1, 6A; Deans et al.: "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0059, 0069, 0070; figures 1, 5, 6, 7)**

Deans et al. and Dwinnell are combinable for the same rationale as set forth above with respect to claim 1.

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No.

2002/0161685 (Dwinnell) (cited by Applicant) and further in view of U.S. Patent Publication No. 2004/0231851 (Silvers) (cited by Applicant).

**Claim 9:**

Deans et al. and Dwinnell do not explicitly describe a serial bus with a corresponding process as described below. However, Silvers teaches the serial bus with the corresponding process as described below.

Regarding claim 9, Silvers describes the system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with the fluid-handling device, wherein translating the received command comprises: **(Silvers: see field station as illustrated in figure 1; "Well data and production control commands are transmitted from a remote central data store to wells at a remote location with a well hopping system and method, preferably through a radio frequency (RF) network. Request packets are sent through a field station to one or more well units until it reaches the destination well unit." Abstract; "The data processor is programmed to transmit data through the internet or other suitable communication media to a field station. The field station has an internet connection, such as a satellite dish or a broad band connection, to receive data from the central data store and a converter for converting the received data, for example, into serial RS 232 format, and a transmitter to transmit the converted data to a well hopping communication system formed of two or more well units." Paragraph 0010; abstract; paragraphs 0010, 0011, 0015, 0016, 0027, 0029, 0038, 0049; figures 1, 5)**

- identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command; **(Silvers: see field station and units 12 as illustrated in figure 1; "In the practice of the invention, each of the wells is assigned a unique address and at least one well hoping path between each well and the central data store zone. Typically, each well is assigned a preferred well hopping path and one or more alternative well hopping paths in the event that one of the transmitters in the main path is not functioning." Paragraph 0016; paragraphs 0010, 0011, 0015, 0016, 0027, 0028, 0038, 0049; figures 1, 5)**
- identifying a command code operative to cause the component to execute the received command; and **(Silvers: "In another of its aspects, the invention relates to a wireless radio frequency communication system for transferring commands and data between wellheads and a central data store." Paragraph 0002; "The invention further relates to a method for communicating between wells and a remote location comprising the steps of sending from a central data store to a field station via the Internet a request data packet intended for a destination well unit, transferring the request data packet from the field station to a first well unit via radio waves, determining if the first well unit is the destination well unit, if the first well unit is not the destination well unit, hopping the request data packet along a series of at least two well units, wherein the first well unit is part of the series, until the request data packet reaches the destination well unit." Paragraph 0018; paragraphs 0010, 0011, 0015, 0016, 0018, 0038, 0049; figures 1, 5)**

- sending to the address on the serial bus the command code. **(Silvers: see sending of packet through radio frequency network as illustrated in figure 3A; see field station and units 12 as illustrated in figure 1; "transferring the request data packet from the field station to a first well unit via radio waves, determining if the first well unit is the destination well unit, if the first well unit is not the destination well unit, hopping the request data packet along a series of at least two well units, wherein the first well unit is part of the series, until the request data packet reaches the destination well unit." Paragraph 0018; paragraphs 0011, 0015, 0016, 0018, 0030, 0038, 0049; figures 1, 5)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, and the known techniques of Dwinnell, namely, providing information about subsea operations using user authentication, with the known techniques of Silvers, namely, well control and monitoring system, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automated control and maintenance of an underwater oil platform and the teachings of Dwinnell to use user authentication for access to information about subsea systems with the teachings of Silvers to automated control and monitoring of well units in an oil field with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system (i.e., controlling fluid control devices using serial bus communication and user authentication of Deans et al. based on the teachings of

user authentication to access subsea systems in Dwinnell and the teachings of using serial communication in Silvers).

14. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No. 2002/0161685 (Dwinnell) (cited by Applicant) and further in view of WO 2008/124765 (Roberson et al.) (cited by Applicant).

**Claim 10:**

Deans et al. and Dwinnell do not explicitly describe a digital to analog converter and a valve connected to the digital to analog converter as described below. However, Roberson et al. teaches the digital to analog converter and a valve connected to the digital to analog converter as described below.

Regarding claim 10, Deans et al. and Roberson et al. describe the system of claim 1, comprising

- a digital-to-analog converter, **(Roberson et al.: "one or more digital-to-analog converters (DAC) 113 for generating analog output signals and a number of digital logic output gates 114" page 18, lines 8-9; page 18, lines 5-12; figures 5, 7)**
    - wherein the fluid- handling device comprises a valve responsive to an output signal of the digital-to-analog converter, and **(Roberson et al.: "actuates or regulates a set of outputs for actuating hardware such as solenoids and variable speed motor drive circuitry." page 18, lines 6-7; page 18, lines 5-**

**12; figures 5, 7; Deans et al.: "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; "The subsea production control system 26 is responsible for providing control commands to the various subsea sensors and/or control devices or downhole sensors and/or control devices. The production control system 26 may also provide commands to wellhead components, such as xmas tree valves." Paragraph 0022; paragraphs 0019, 0020, 0022, 0041, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- wherein translating the received command comprises changing an output signal of the digital-to-analog converter responsive to the receive command. **(Roberson et al.: "providing a control signal to regulate the speed of variable speed motor 12" page 18, lines 11-12; page 18, lines 5-12; figures 5, 7; Deans et al.: "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the**

**payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, and the known techniques of Dwinnell, namely, providing information about subsea operations using user authentication, with the known techniques of Roberson et al., namely, well control and monitoring system, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automate control and maintenance of an underwater oil platform and the teachings of Dwinnell to use user authentication for access to information about subsea systems with the teachings of Roberson et al.to automated control and monitoring of pump controllers in an oil field with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system (i.e., controlling fluid control devices using digital to analog converters and user authentication of Deans et al. based on the teachings of user authentication to access subsea systems in Dwinnell and the teachings of using digital to analog converters in Roberson et al.).

15. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No.

2002/0161685 (Dwinnell) (cited by Applicant) and further in view of U.S. Patent Publication No. 2001/0032518 (Boger et al.).

**Claim 13:**

Deans et al. and Dwinnell do not explicitly describe the oscillating a target position of a stuck valve as described below. However, Boger et al. teaches the oscillating a target position of a stuck valve as described below.

Regarding claim 13, Boger et al. describes the system of claim 1, wherein the fluid handling device includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve. **(Boger et al.: "Problems often occur when the controller is constantly adjusting the BIAS to keep it correct. For example, if the valve 10 sticks in a certain position (such as when there is an obstacle in the valve or a problem exists with the air 32), the controller tries to move the valve without success. Attempting to move the valve, the controller continually adjusts the BIAS towards zero. Once the valve 10 becomes unstuck, the BIAS (which is at or near zero) is wrong. The controller must then adjust the BIAS to its proper position, which may take a long time." Paragraph 0077; paragraphs 0003, 0004, 0076, 0077, 0132, 0133, 0147, 0227; figure 1; Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, and the known techniques of Dwinnell, namely, providing information about subsea operations using user authentication, with the known techniques of Boger et al., namely, a valve positioner system with routines for maintenance, calibration, and adjustment, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automated control and maintenance of an underwater oil platform and the teachings of Dwinnell to use user authentication for access to information about subsea systems with the teachings of Boger et al. to oscillate positions of a stuck valve with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system for oil well processing (i.e., controlling fluid control devices using user authentication by oscillating a stuck valve of Deans et al. based on the teachings of user authentication to access subsea systems in Dwinnell and the teachings of oscillating a valve in Boger et al.).

16. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No. 2002/0161685 (Dwinnell) (cited by Applicant) and further in view of U.S. Patent No. 5,149,443 (Varnam).

Claim 15:

Deans et al. and Dwinnell do not explicitly describe a separation unit as described below. However, Varnam teaches the separation unit as described below.

Regarding claim 15, Varnam describes the system of claim 1, wherein the fluid-handling device comprises a separation unit configured to separate oil from water, and wherein the command comprises a command operative to change a level of the separation unit at which oil meets water. **(Varnam: "The nozzle, which is powered by a turbine, effectively induces oil or an oil-water mixture into the nozzle and through a conduit that leads from the nozzle to a series of separation tanks that from a part of an oil-water separation sub-system that is indicated generally by the numeral 22." Col. 4, lines 43-48; "In effect, these sensors sense and measure the specific gravity of the liquid in the vicinity of each sensor. This specific gravity information is utilized by the computer logic control system 20 of the present invention to control valves 206 and 215. As particularly illustrated in FIG. 1, since the oil's specific gravity is less than water, oil will tend to settle about the top portions of the respective tanks 200. The object of the oil-water separation process is to expel oil of a threshold concentration through the oil outlet control valve 215 and to expel water or a high water-low oil mixture concentration through the bottom control valve 206 that joins water outlet line 208. The respective sensors 222 and 224 are effective to control the discharge of water from the respective tank. Thus, the sensors 222 and 224 are operative to effectuate the control of the oil outlet control valve 215 to assure that oil of a threshold concentration is discharged from the final tank." Col. 8, line 65 through col. 9, line 14; col. 4, lines 59-62; col. 12, lines 43-67; figures 7, 8, 10)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, and the known techniques of Dwinnell, namely, providing information about subsea operations using user authentication, with the known techniques of Varnam, namely, an oil recovery system using an oil and water separation unit, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automated control and maintenance of an underwater oil platform and the teachings of Dwinnell to use user authentication for access to information about subsea systems with the teachings of Varnam to separate water and oil using a pumping system with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system for oil well processing (i.e., controlling fluid control devices including an oil and water separation unit using user authentication of Deans et al. based on the teachings of user authentication to access subsea systems in Dwinnell and the teachings of controlling an oil and water separation unit using a controller in Varnam).

Claim 16:

Deans et al. and Dwinnell do not explicitly describe a pump and control of the pump as described below. However, Varnam teaches the pump and control of the pump as described below.

Regarding claim 16, Deans et al. and Varnam describe the system of claim 15,

- wherein the separation unit comprises a pump having a variable-frequency drive, and **(Varnam: see water pump and/or oil pump as illustrated in figure 8; increase water pump speed and/or increase oil pump speed as illustrated in figure 10; col. 11, line 65 through col. 12, line 3; col. 12, lines 9-15; col. 12, lines 43-64; figures 1, 7, 8, 10)**
- wherein the local controller is operative to adjust a frequency of the variable frequency drive until the level of the separation unit reaches a target level corresponding to the target state. **(Varnam: see controller 156 as illustrated in figure 8; "Finally, the oil recovery system of the present invention includes a computer logic control system 20 that controls the nozzle sub-system 18 as well as the oil-water separation sub-system 22." Col. 4, lines 59-62; col. 4, lines 55-58; col. 11, line 65 through col. 12, line 3; col. 12, lines 9-15; col. 12, lines 43-64; figures 1, 7, 8, 10; Deans et al.: "As shown in FIG. 5, a communication pod includes various components, including a device connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Deans et al., Dwinnell, and Varnam are combinable for the same rationale as set forth above with respect to claim 15.

***Conclusion***

17. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher E. Everett whose telephone number is (571)272-2851. The examiner can normally be reached on Monday through Friday from 8:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kavita Padmanabhan can be reached on 571-272-8352. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. E. E./
Examiner, Art Unit 2121

| Notice of References Cited | Application/Control No. 13/708,557 | Applicant(s)/Patent Under Reexamination PHILLIPS ET AL. | |
|---|---|---|---|
| | Examiner Christopher E. Everett | Art Unit 2121 | Page 1 of 1 |

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| | B | US- | | | |
| | C | US- | | | |
| | D | US- | | | |
| | E | US- | | | |
| | F | US- | | | |
| | G | US- | | | |
| | H | US- | | | |
| | I | US- | | | |
| | J | US- | | | |
| | K | US- | | | |
| | L | US- | | | |
| | M | US- | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | Classification |
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**NON-PATENT DOCUMENTS**

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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13/708,557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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|---|---|---|---|---|---|---|
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| | 1 | 8301386 | | 2009-10-30 | Redmond et al. | |
| | 2 | 7591308 | | 2009-09-22 | Bender, Robert E | |
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| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CEE/

| Receipt date: 06/07/2013 | Application Number | 13/708,557 13708557 - GAU: 2121 |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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|---|---|---|---|---|---|---|
| | 5 | 20130008645 | | 2013-01-10 | Wetzel, Rodney J. | |

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**EXAMINER SIGNATURE**

| Examiner Signature | /Christopher E. Everett/ | Date Considered | 06/11/2013 |
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.



ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /CEE/

| Receipt date: 06/07/2013 | Application Number | 13/708,557 13708557 - GAU: 2121 |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2013-06-07 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**



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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
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| | 13708557 | PHILLIPS ET AL. |
| | Examiner | Art Unit |
| | CHRISTOPHER E EVERETT | 2121 |

| CPC- SEARCHED | | |
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| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
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| Symbol | Date | Examiner |
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| US CLASSIFICATION SEARCHED | | | |
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| Class | Subclass | Date | Examiner |
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| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| Search of EAST using classes, text, and inventor searches | 02/26/2013 | CEE |
| Search of Google patent using text | 02/26/2013 | CEE |
| Search of Google scholar using text | 02/26/2013 | CEE |
| Search of PALM using inventor searches | 02/26/2013 | CEE |
| Search of sub-classes 700/1, 282, 275, 281, 42 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 702/6, 13, 183, 188 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-class 709/224 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 166/336, 363, 250.1 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 340/853.3, 853.2, 856.3 (text search only - see search history printout) | 02/26/2013 | CEE |
| Update of EAST and sub-class searches described above | 6/12/2013 | CEE |

| INTERFERENCE SEARCH | |
|---|---|
| /C.E.E./<br>Examiner.Art Unit 2121 | |

| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
|---|---|---|---|
| | | | |

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| /C.E.E./<br>Examiner.Art Unit 2121 | |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS ET AL. |
| | Examiner | Art Unit |
| | CHRISTOPHER E EVERETT | 2121 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 02/26/2013 | 06/12/2013 | | | | | | | |
| | 1 | ✓ | ✓ | | | | | | | |
| | 2 | ✓ | ✓ | | | | | | | |
| | 3 | ✓ | ✓ | | | | | | | |
| | 4 | ✓ | ✓ | | | | | | | |
| | 5 | ✓ | ✓ | | | | | | | |
| | 6 | ✓ | ✓ | | | | | | | |
| | 7 | ✓ | ✓ | | | | | | | |
| | 8 | ✓ | ✓ | | | | | | | |
| | 9 | ✓ | ✓ | | | | | | | |
| | 10 | ✓ | ✓ | | | | | | | |
| | 11 | ✓ | ✓ | | | | | | | |
| | 12 | ✓ | ✓ | | | | | | | |
| | 13 | ✓ | ✓ | | | | | | | |
| | 14 | ✓ | ✓ | | | | | | | |
| | 15 | ✓ | ✓ | | | | | | | |
| | 16 | ✓ | ✓ | | | | | | | |
| | 17 | ✓ | ✓ | | | | | | | |
| | 18 | ✓ | ✓ | | | | | | | |
| | 19 | ✓ | ✓ | | | | | | | |
| | 20 | ✓ | ✓ | | | | | | | |
| | 21 | | ✓ | | | | | | | |
| | 22 | | ✓ | | | | | | | |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L3 | 37 | (US-20040262008-$ or US-20020112860-$ or US-20090149969-$ or US-20100147510-$ or US-20050096846-$ or US-20110231024-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020161685-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$ or US-5149443-$ or US-8386059-$ or US-8131510-$ or US-7289994-$ or US-8373418-$ or US-8312320-$ or US-8290737-$ or US-7931090-$ or US-7921916-$ or US-6801135-$ or US-6061603-$ or US-6192980-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 07:58 |
| L4 | 0 | 3 and oscillate | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 07:58 |
| L5 | 1 | 3 and (stuck adj3 valve) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 07:59 |
| L6 | 4400 | 700/1,282,275,281,42.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L7 | 5969 | 702/6,13,183,188.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L8 | 19220 | 709/224.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L9 | 804 | 166/336,363,250.1.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L10 | 475 | 340/853.3,853.2,856.3.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| L11 | 30612 | L6 L7 L8 L9 L10 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L12 | 172242 | (oil hydrocarbon (hydro adj2 carbon) gas) near2 (well site disposal station) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L13 | 241 | L11 and L12 and "240" | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:10 |
| L14 | 2175607 | (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| L15 | 664 | L11 and L12 and L14 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| L16 | 6 | L15 and (inoperative in-operative stuck) adj3 (valve part) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:11 |
| L17 | 94 | L12 and (stuck) adj3 (valve) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:14 |
| L18 | 94 | L12 and ((stuck) adj3 (valve)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:14 |
| L19 | 109 | L12 and ((frozen froze stuck) adj3 (valve)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:19 |
| L20 | 12 | ((move jerk oscillate move) near2 ((frozen froze stuck) adj3 (valve))) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 08:21 |
| L21 | 1 | ("4823749").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/06/12 08:22 |
| L22 | 1 | ("20010032518").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/06/12 10:53 |
| L23 | 35 | ((AARON) near2 (PHILLIPS)).INV. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/06/12 11:14 |
| L24 | 5 | ((AARON) near2 (PHILLIPS)).INV. | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |
| L25 | 0 | (AMPLISINE adj2 LABS).as. | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |
| L26 | 5 | real-time and onsite and internet and communication | EPO; JPO; DERWENT | OR | ON | 2013/06/12 11:14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| L27 | 20 | (US-20040262008-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020112860-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L28 | 0 | L27 and (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L29 | 7 | L27 and (oil near2 water) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L30 | 4795 | (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L31 | 2432 | L30 and pump | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L32 | 889 | L31 and (oil near2 well) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L33 | 246 | L32 and (oil near2 level) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L34 | 2 | L33 and ("700"/$.ccls. "702"/$.ccls.) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L35 | 1458 | L11 and L12 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L36 | 1900176 | (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L37 | 16083 | (local autonomous independent) near2 (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L38 | 664 | L14 and L35 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L39 | 327 | L38 and L36 | US-PGPUB; USPAT; | OR | ON | 2013/06/12 11:14 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | EPO | | | |
| L40 | 343 | L12 and L37 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L41 | 6 | L39 and L40 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L42 | 10 | L12 and L37 and L11 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L43 | 528886 | (remote internet network) near2 (control monitor control$4 monitor$4 command) | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L44 | 9459 | L43 and L12 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L45 | 110 | L44 and L37 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |
| L46 | 158 | L23 L24 L25 L26 L28 L29 L34 L41 L42 L45 | US-PGPUB; USPAT; EPO | OR | ON | 2013/06/12 11:14 |

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**C:\Users\ceverett\Documents\EAST\Workspaces\13708557.wsp**

| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| | 1 | 20120316658 | A1 | 2012-12-13 | Glew, Daniel John | |
| | 2 | 20100295673 | A1 | 2010-11-25 | Ahmad, Tahir | |
| | 3 | 20080208475 | A1 | 2008-08-28 | Karr et al. | |
| | 4 | 20060240818 | A1 | 2006-10-26 | McCoy et al. | |
| | 5 | 20050108504 | A1 | 2005-05-19 | Cowin et al. | |



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| Receipt date: 04/03/2013 | Application Number | 13708557 13708557 - GAU: 2121 |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (**Not for submission under 37 CFR 1.99**) | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 20040231851 | A1 | 2004-11-25 | Silvers, David | |
| | 7 | 20040088115 | A1 | 2004-05-06 | Guggari et al. | |
| | 8 | 20030182463 | A1 | 2003-09-25 | Valk, Jeffrey W. | |
| | 9 | 20030004624 | A1 | 2003-01-02 | Wilson et al. | |
| | 10 | 20020169645 | A1 | 2002-11-14 | Aronstam et al. | |
| | 11 | 20020161685 | A1 | 2002-10-31 | Dwinnell, Michael | |

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|---|---|---|---|---|---|---|---|---|
| /CEE/ | 1 | 2008124765 | WO | | | Lufkin Industries, Inc. | | ☐ |
| /CEE/ | 2 | 2008103487 | WO | | | Schlumberger Technology Corporation et al. | | ☐ |
| /CEE/ | 3 | 2090943 | EP | | | Acque Ingegneria S.r.l. | | ☐ |

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| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| /CEE/ | 1 | BALL, BILL, "Oilfield Water-Oil-Solids Separation," High-Tech Consultants, September 19, 2005, pages 1-17, HTC, Inc..Bixby, OK, US. | ☐ |
| /CEE/ | 2 | "SCADALynx - the ultimate solution for oil and gas production intelligence," @eLynx Technologies, LLC, 2011, <www. eLynx Tech.com,> 2011, page 1, US. | ☐ |
| /CEE/ | 3 | "iSCADA Gas Well Support," <www.vipondcontrols.ca/index+com_content&view+article&id=142:iscada-gas-well-support,> September 2, 2012, Pages 1-2, Calgary, Alberta, Canada. | ☐ |
| /CEE/ | 4 | "Field Data Capture for Oil and Gas, "Merrick -Oil & Gas Technology Solutions, <www.merricksystems.com/oil-and-gas-software/field-operations-management/evin.html?phpMyAdmin...,> September 2, 2012, Pages 1-4, Houston, Texas, US. | ☐ |
| /CEE/ | 5 | VIPOND, DARRYL, "Cloud Computing for the Oil and Gas Industry," Vipon Controls, <www.automation.com/content/cloud-computing-for-the-oil-and-gas-industry,> 9/2/12, Pages 1-4, US. | ☐ |
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|---|---|---|---|
| Examiner Signature | /Christopher E. Everett/ | Date Considered | 06/11/2013 |

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| Receipt date: 04/03/2013 | Application Number | 13708557 13708557 - GAU: 2121 |
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| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (**Not for submission under 37 CFR 1.99**) | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2013-04-04 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**



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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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| | Application Number | 13/708,557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| **U.S.PATENTS** | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
| | 1 | 8301386 | | 2009-10-30 | Redmond et al. | |
| | 2 | 7591308 | | 2009-09-22 | Bender, Robert E | |
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| **U.S.PATENT APPLICATION PUBLICATIONS** | | | | | | |
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| | 1 | 20100098507 | A1 | 2010-04-22 | Binmore, Ian Rex | |
| | 2 | 20130024026 | A1 | 2013-01-24 | Prasad, Vijaysai | |
| | 3 | 20100326654 | A1 | 2010-12-30 | Hemblade, Barry John | |
| | 4 | 20130144531 | A1 | 2013-06-06 | Johnston, Paul J. | |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13/708,557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 5 | 20130008645 | | 2013-01-10 | Wetzel, Rodney J. | |

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13/708,557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2013-06-07 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 13708557 |
| **Filing Date:** | 07-Dec-2012 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| Filed as Small Entity | |

**Utility under 35 USC 111(a) Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| Submission- Information Disclosure Stmt | 2806 | 1 | 90 | 90 |
| | | **Total in USD ($)** | | **90** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 15975844 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 07-JUN-2013 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 12:27:28 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $90 |
| RAM confirmation Number | 10059 |
| Deposit Account | 500259 |
| Authorized User | TUCKER, JOSHUA LAYTON |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | AMP003IDS07JUN2013.pdf | 33242<br>ce0cc178b31dc80a0e41beda6e5921a2722 7411a | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| This is not an USPTO supplied IDS fillable form | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30038<br>d4d121153e5b27f8fc0dfb9ee721c13ab0b8 53f0 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 63280 | | |

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**<u>New Applications Under 35 U.S.C. 111</u>**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**<u>National Stage of an International Application under 35 U.S.C. 371</u>**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**<u>New International Application Filed with the USPTO as a Receiving Office</u>**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | | |
|---|---|---|---|
| In re Application of: | | § | |
| Phillips | | § | Group Art Unit: 2121 |
| | | § | Confirmation No.: 3874 |
| Serial No.: | 13/708,557 | § | Examiner: EVERETT, CHRISTOPHER E |
| Filed: | 12-07-2012 | § | |
| | | § | |
| For: | REMOTE CONTROL OF FLUID-HANDLING DEVICES | § | Atty. Docket: 000314.000003 |

Mail Stop Amendment
Commissioner for Patents
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Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION OR MAILING
37 C.F.R. 1.8

I hereby certify that this correspondence is being transmitted by facsimile to the United States Patent and Trademark Office in accordance with 37 C.F.R. § 1.6(d), or is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4), or is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:

| June 6, 2013 | /Josh Tucker/ |
|---|---|
| Date | Name |

Sir:

**AMENDMENT AND RESPONSE**
**TO OFFICE ACTION ISSUED ON MARCH 7, 2013**

In response to the Office Action issued on March 7, 2013, Applicants amend and remark as follows.

***Authorization for Extensions of Time and Payment of Fees***

In accordance with 37 C.F.R. § 1.136, Applicants hereby provide a general authorization to treat this and any future reply requiring an extension of time as incorporating a request thereof. The Commissioner is authorized to charge any additional fees that may be required to the credit card listed on the attached PTO-2038. However, if the PTO-2038 is missing, if the amount listed thereon is insufficient, or if the amount is unable to be charged to the credit card for any other reason, the Commissioner is authorized to charge Deposit Account No. 50-0259, referencing the above attorney docket number.

**AMENDMENTS TO THE CLAIMS**

The following is a complete listing of the claims, which replaces all previous versions and listings of the claims.

1. (currently amended) A system for remotely controlling a fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising:

a command-center server having a data store storing multiple user accounts, each user account corresponding to a set of one or more oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, or a combination thereof, each set being operated by a different entity corresponding to the respective user account; and

a plurality of geographically distributed site master controllers, each site master controller corresponding to a respective one of the oil wells, petro water disposal or re-injection facilities, or petroleum pumping stations, each site master controller comprising:

a~~n input/output~~ communication module operable to communicate with a fluid-handling device;

a network interface;

memory; and

one or more processors communicatively coupled to the communication ~~input/output~~ module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, via the network interface, from ~~a remote user device~~the command-center server, a command to ~~change a state of~~ control the fluid-handling device ~~to a target state~~ from a user corresponding to one of the user accounts;

determining a plurality of different target states of the fluid-handling device over time, wherein the respective site-master controller is operative to maintain control of the fluid handling device in the absence of a network connection to

the command-center server;

translating the ~~received~~ command into ~~a~~ translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling ~~equipment~~ device to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in ~~the~~ a targeted state; and

sending the translated commands to the local controller.

2. (original) The system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling equipment obtained by sensors of the fluid-handling device; and

sending, to a remote data store, the received sensor data.

3. (currently amended) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, a password corresponding to a selected one of the user accounts;

receiving, from ~~a~~ the user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station coupled to the fluid-handling device of the selected one of the user accounts;

retrieving, from the data store, data responsive to the request from the user device; and

sending, to the user device, the retrieved data for presentation to the user.

4. (original) The system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the

fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid.

5. (original) The system of claim 3, wherein the request is a request to view alarms issued by the fluid-handling device, and wherein the retrieved data comprises data indicative of the alarms.

6. (original) The system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms.

7. (currently amended) The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, the command to change the state of the fluid-handling device; and

determining a network address of the network interface of the respective site master controller; and

sending the command to the network interface.

8. (original) The system of claim 1, wherein fluid-handling device comprises a pump, and wherein the command comprises a command to change a speed of the pump.

9. (original) The system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with the fluid-handling device, wherein translating the received command comprises:

identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command;

identifying a command code operative to cause the component to execute the

received command; and

sending to the address on the serial bus the command code.

10. (original) The system of claim 1, comprising a digital-to-analog converter, wherein the fluid-handling device comprises a valve responsive to an output signal of the digital-to-analog converter, and wherein translating the received command comprises changing an output signal of the digital-to-analog converter responsive to the receive command.

11. (original) The system of claim 1, wherein receiving the command comprises receiving the command via a first network socket, and wherein sending the translated command comprises sending the translated command via a second network socket.

12. (original) The system of claim 1, wherein translating the command comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command.

13. (currently amended) The system of claim 1, wherein the fluid handling device includes a stuck valve, and wherein the plurality of different target states oscillate a target position of the stuck valve to loosen the stuck valve. ~~local controller comprises a processor operative to execute the translated command after losing a network connection to the network interface and before the fluid-handling device is in the target state.~~

14. (original) The system of claim 1, comprising one of the following coupled to the fluid-handling device: an oil well, a salt water disposal well, a carbon-capture well, or a pump station.

15. (currently amended) The system of claim 1, wherein the fluid-handling device comprises a~~n oil/water~~ separation unit configured to separate oil from water, and wherein

the command comprises a command operative to change a level of the ~~oil/water~~ separation unit at which oil meets water.

16. (currently amended) The system of claim 15, wherein the ~~oil/water~~ separation unit comprises a pump having a variable-frequency drive, and wherein the local controller is operative to adjust a frequency of the variable frequency drive until the level of the ~~oil/water~~ separation unit reaches a target level corresponding to the target state.

17. (currently amended) The system of claim 1, wherein:

at least one site master controller comprises a plurality of fluid-handling devices, and

translating the command into a translated commands comprises translating the command into different formats for different communication protocols for the different respective fluid handling devices. ~~comprising:~~

~~a remote server coupled to the network interface via the Internet;~~

~~a plurality of oil-wells, petro-water disposal or re-injection facilities, or petroleum pumping station, each oil well, petro-water disposal or re-injection facility, or petroleum pumping station coupled to a corresponding one of a plurality of systems, each respective system being in communication with the remote server via the Internet and comprising:~~

~~a respective input/output module operable to communicate with a respective fluid-handling device;~~

~~a respective network interface;~~

~~a respective memory; and~~

~~a respective set of one or more processors communicatively coupled to the respective input/output module, the respective network interface, and the respective memory, wherein the respective memory stores instructions that when executed by the respective processors cause the respective processors to effectuate steps comprising:~~

~~receiving, via the respective network interface, from the remote user device, a respective command to change a respective state of the respective fluid-~~

~~handling device to a respective target state;~~

~~translating the received respective command into a respective translated command operative to cause a respective local controller of the respective fluid-handling device to drive the respective fluid-handling equipment to the respective target state; and~~

~~sending the respective translated command to the respective local controller~~.

18. (currently amended) The system of claim 1[[7]], wherein each user account corresponds to one or more user names, one or more user passwords, billing information, and identifiers of one or more of the site master-controllers with which users under the corresponding account are authorized to interact~~the remote server comprises a user account data store storing data associating each of the respective systems with a single user account distinct from a plurality of other user accounts in the data store~~.

19. (currently amended) A tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising:

receiving, via ~~the~~ a network interface, from a remote user device, a command to ~~change a state of the~~control a fluid-handling device ~~to a target state~~;

determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device;

translating the ~~received~~ command into ~~a~~ translated commands operative to cause a local controller of the fluid-handling device to drive the fluid-handling device ~~equipment~~ to the plurality of different target states, the local controller being responsive to the translated commands and feedback from the fluid-handling device indicative of whether the fluid-handling device is in ~~the~~ a targeted state; and

sending the translated commands to the local controller.

20. (currently amended) A method, comprising:

receiving, via ~~the~~ a network interface, from a remote user device, a command to control a ~~change a state of the~~ fluid-handling device ~~to a target state~~;

determining a plurality of different target states of the fluid-handling device over time such that control of the fluid handling device is maintained in the absence of a network connection with the remote user device;

translating the ~~received~~ command into ~~a~~ translated command**s** operative to cause a local controller of the fluid-handling device to drive the fluid-handling device ~~equipment~~ to the plurality of different target state**s**, the local controller being responsive to the translated command**s** and feedback from the fluid-handling device indicative of whether the fluid-handling device is in ~~the~~ a targeted state; and

sending the translated command**s** to the local controller.

21. (new) The system of claim 1, wherein the system is operative to exercise two layers of control, the two layers of control including:

a first layer of control in which targeted states of the fluid handling device are determined by a respective site master controller in response to the received command; and

a second layer of control in which, for each targeted state specified by the first layer of control, the fluid-handling device exercises feedback control to drive the fluid-handling device to the respective targeted state.

22. (new) The system of claim 1, wherein the system is operative to provide web-based control and monitoring of oil and gas wells to multiple account holders corresponding to the user accounts.

## REMARKS

In the Office Action of March 7, 2013, the Examiner rejected claims 1-20 and objected to claim 1, 15-17, and 19-20. By this response, Applicants amend claims 1, 3, 7, 13, and 15-20 and add new claims 21 and 22. The amendments do not add new matter and are supported by at least paragraphs 18, 21, 26, 27, 44, and figure 1 of the pending application. Upon entry of these amendments, claims 1-22 are pending in the present application and are believed to be in condition for allowance. In view of the foregoing amendments and the following remarks, Applicants respectfully request consideration and allowance of all pending claims.

### Claim Objections

In the Office Action, the Examiner objected to claims 1, 15-17, and 19-20. Applicants respectfully submit that each of these objections are addressed by the present amendments and request withdrawal of the objections.

### Claim Rejections under 35 U.S.C. § 102

In the Office Action, the Examiner rejected claims 1-8, 11-14, 17, and 19-20 under 35 U.S.C. § 102(b) as anticipated by Deans (U.S. Patent Pub. 20040262008). Applicants respectfully traverse this rejection.

#### *Legal Precedent and Guidelines*

Anticipation under section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985). For a prior art reference to anticipate under section 102, every element of the claimed invention must be identically shown in a single reference. *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under section 102, a single reference must teach each and every limitation of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984). Accordingly, the Applicants need only point to a single element not found in the cited

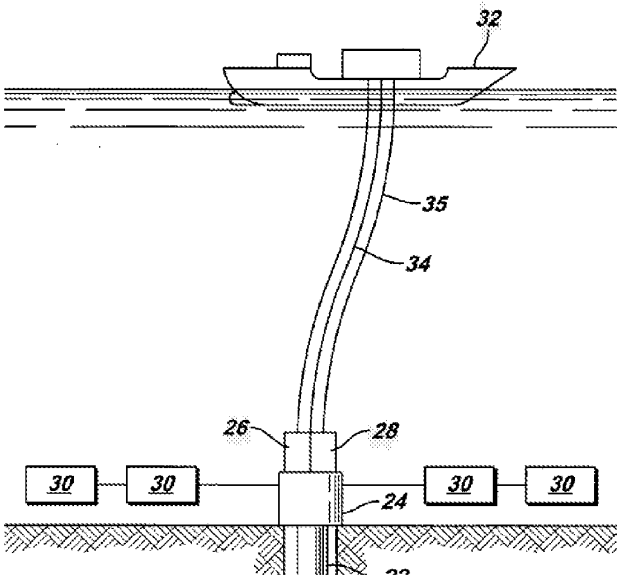
reference to demonstrate that the cited reference fails to anticipate the claimed subject matter. The prior art reference also must show the identical invention "in as complete detail as contained in the … claim" to support a prima facie case of anticipation. *Richardson v. Suzuki Motor Co*., 868 F.2d 1226, 1236, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989).

***The cited reference fails to teach features recited by independent claims 1, 19, and 20***

Claims 1, 19, and 20 recite "determining a plurality of different target states of the fluid-handling device over time, wherein [/such that] the respective site-master controller is operative to maintain control of the fluid handling device in the absence of a network connection to the command-center server." Deans, in contrast, teaches a control system 26 that remains in communication with a surface facility 32 and does not disclose that the control system 26 can "maintain control of the fluid handling device in the absence of a network connection."

As shown by figure 1 below, Deans teaches two sub-sea pods 26 and 28 that communicate with the surface facility 32. In Deans, the pod 26 is referred to as a control system, and the pod 28 is referred to as a subsea communication hub. Deans, paragraph 20. The communication hub 28, as noted in the rejection, can be removed from the system while Deans control system 26 continues to operate. Office Action, page 15 (citing Deans paragraphs 35, 37, etc).

FIG. 1




However, Deans' control system 26 remains in communication with the surface facility 32, even when the communication hub 28 is removed or disabled. Pod 26 has its own connection, independent of pod 28. Deans, paragraphs 24, 25, and 31. Specifically, Deans explains that pod 26 communicates with a proprietary format, and pod 28 communication with a non-proprietary format. *See* Deans, paragraphs 24 and 25. Thus, even when communication hub 28 is removed or disabled, control system 26 remains connected to, and in communication with, the surface facility 32 to exercise control.

As such, the cited features of Dean's system do not "determin[e] a plurality of different target states of the fluid-handling device over time, wherein the respective site-master controller is operative to maintain control of the fluid handling device in the absence of a network connection to the command-center server." In view of this distinction, Applicants respectfully request that the rejection be withdrawn.

**Claim Rejections under 35 U.S.C. § 103(a)**

The Examiner rejected claims 9, 10, 15-16, and 18 as obvious on the following grounds:

1) claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over Deans in view of Silvers (US Pat. Pub. 20040231851);

2) claims 10 and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Deans in view of Roberson (PCT Pub. WO 2008/124765); and

3) claim 15 and 16 were rejected under 35 U.S.C. 103(a) as being unpatentable over Deans in view of Varnam (US Pat. 5,149,443).

The pending claims, however, are distinct from and allowable over the art cited in these rejections for at least the reasons explained below.

***Legal Precedent and Guidelines***

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness depends on several underlying factual inquiries:

> Under §103, the scope and content of the prior art are to be determined, differences between the prior art and the claims at issue are to be ascertained, and the level of ordinary skill in the pertinent art are to be resolved. Against this background the obviousness or non-obviousness of the subject matter is to be determined. Such secondary considerations as commercial success, long-felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. *KSR Int'l Co. v. Teleflex Inc.,* 550 U.S. 398, 406, 127 S.Ct. 1727, 167 L.Ed.2d 705 (2007) (quoting *Graham v. John Deere Co*., 383 U.S. 1, 17-18, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966)).

As explained by the Court in *KSR International Co. v. Teleflex Inc.,* "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.* at 14. In this regard, the *KSR* court stated that "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does … because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will

be combinations of what, in some sense, is already known." *Id.* at 14-15. Furthermore, the *KSR* court did not diminish the requirement for objective evidence of obviousness. *Id.* at 14 ("To facilitate review, this analysis should be made explicit. *See In re Kahn,* 441 F.3d 977, 988 (CA Fed. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness").

***The cited references, taken alone or in hypothetical combination, fail to teach or suggest features of dependent claims 9, 10, 15-16, and 18***

Dependent claims 9, 10, 15-16, and 18 depend from claim 1 and, as such, incorporate the features of claim 1. Thus, for at least the reasons discussed above with reference to claim 1, claims 9, 10, 15-16, and 18 are allowable.

**New Claims**

New claims 21 and 22 depend from claim 1 and for at least the same reasons as noted above, are allowable over the cited art. Further, claim 21 finds support in at least paragraphs 21 and 26-27 and, as such, does not add new matter. And claim 22 finds support in at least paragraph 18 and does not add new matter.

**Reservation of Arguments**

Above, Applicants identify reasons why the present rejections should not be applied to the claims. This explanation, however, should not be construed as an admission that other features of the claims beyond those discussed, including the combination of claim features, are taught or suggested by the cited art, or that the rejections are otherwise proper. In the interest of brevity, Applicants have refrained from providing an exhaustive explanation of every basis for allowing the claims. Accordingly, Applicants reserve the right to identify other grounds for overcoming the present rejections and the cited art, and Applicants reiterate that the amendments and arguments

above are made without prejudice, including to rights available under the doctrine of equivalents.

**Conclusion**

Applicants respectfully submit that all pending claims should be in condition for allowance. However, if the Examiner believes certain amendments are necessary to clarify the present claims or if the Examiner wishes to resolve any other issues by way of a telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

Date: June 6, 2013

/Josh Tucker/

Josh Tucker
Registration No. 63809
Bracewell & Giuliani LLP.
P.O. Box 61389
Houston, TX 77208-1389
Phone No. 512-494-3623

#4311525.1

| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 13708557 |
| **Filing Date:** | 07-Dec-2012 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Attorney Docket Number:** | 000314.000003 |
| Filed as Large Entity | |

**Utility under 35 USC 111(a) Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| Claims in Excess of 20 | 1202 | 2 | 80 | 160 |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **160** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 15958883 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker |
| **Filer Authorized By:** | |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 06-JUN-2013 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 14:54:07 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $160 |
| RAM confirmation Number | 1353 |
| Deposit Account | 500259 |
| Authorized User | TUCKER, JOSHUA LAYTON |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Amendment/Req. Reconsideration-After Non-Final Reject | AMP003ResponseNonFinalOA06JUN2013.pdf | 178239<br>40a73ee1aa8fb9c53a12fa26f94780fbf4145049 | no | 14 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 29915<br>3c3398e2bb7482b0490a389824fd5b3916a7d612 | no | 2 |
| **Warnings:** | | | | | |
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**New Applications Under 35 U.S.C. 111**
**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/SB/06 (09-11)
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| PATENT APPLICATION FEE DETERMINATION RECORD<br>Substitute for Form PTO-875 | Application or Docket Number<br>13/708,557 | Filing Date<br>12/07/2012 | ☐ To be Mailed |
|---|---|---|---|

**ENTITY**: ☒ LARGE ☐ SMALL ☐ MICRO

## APPLICATION AS FILED – PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | RATE ($) | FEE ($) |
|---|---|---|---|---|
| ☐ BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

AMENDMENT **06/06/2013**

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 22 | Minus | ** 20 | = 2 | X $80 = | 160 |
| Independent (37 CFR 1.16(h)) | * 3 | Minus | ***3 | = 0 | X $420 = | 0 |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | **160** |

AMENDMENT

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | |
| | | | | | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/TAMMY L. ACREE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/SB/08a (01-10)
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| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| **U.S.PATENTS** | | | | | | Remove |
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| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
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| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
| | 1 | 20120316658 | A1 | 2012-12-13 | Glew, Daniel John | |
| | 2 | 20100295673 | A1 | 2010-11-25 | Ahmad, Tahir | |
| | 3 | 20080208475 | A1 | 2008-08-28 | Karr et al. | |
| | 4 | 20060240818 | A1 | 2006-10-26 | McCoy et al. | |
| | 5 | 20050108504 | A1 | 2005-05-19 | Cowin et al. | |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 20040231851 | A1 | 2004-11-25 | Silvers, David | |
| | 7 | 20040088115 | A1 | 2004-05-06 | Guggari et al. | |
| | 8 | 20030182463 | A1 | 2003-09-25 | Valk, Jeffrey W. | |
| | 9 | 20030004624 | A1 | 2003-01-02 | Wilson et al. | |
| | 10 | 20020169645 | A1 | 2002-11-14 | Aronstam et al. | |
| | 11 | 20020161685 | A1 | 2002-10-31 | Dwinnell, Michael | |

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| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] i | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2008124765 | WO | | | Lufkin Industries, Inc. | | ☐ |
| | 2 | 2008103487 | WO | | | Schlumberger Technology Corporation et al. | | ☐ |
| | 3 | 2090943 | EP | | | Acque Ingegneria S.r.l. | | ☐ |

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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
| | 1 | BALL, BILL, "Oilfield Water-Oil-Solids Separation," High-Tech Consultants, September 19, 2005, pages 1-17, HTC, Inc..Bixby, OK, US. | ☐ |
| | 2 | "SCADALynx - the ultimate solution for oil and gas production intelligence," @eLynx Technologies, LLC, 2011, <www. eLynx Tech.com,> 2011, page 1, US. | ☐ |
| | 3 | "iSCADA Gas Well Support," <www.vipondcontrols.ca/index+com_content&view+article&id=142:iscada-gas-well-support,> September 2, 2012, Pages 1-2, Calgary, Alberta, Canada. | ☐ |
| | 4 | "Field Data Capture for Oil and Gas, "Merrick -Oil & Gas Technology Solutions, <www.merricksystems.com/oil-and-gas-software/field-operations-management/evin.html?phpMyAdmin...,> September 2, 2012, Pages 1-4, Houston, Texas, US. | ☐ |
| | 5 | VIPOND, DARRYL, "Cloud Computing for the Oil and Gas Industry," Vipon Controls, <www.automation.com/content/cloud-computing-for-the-oil-and-gas-industry,> 9/2/12, Pages 1-4, US. | ☐ |

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| EXAMINER SIGNATURE | | | |
|---|---|---|---|
| Examiner Signature | | Date Considered | |

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

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☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2013-04-04 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

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| Electronic Patent Application Fee Transmittal | |
|---|---|
| **Application Number:** | 13708557 |
| **Filing Date:** | 07-Dec-2012 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Attorney Docket Number:** | 000314.000003 |
| Filed as Small Entity | |

**Utility under 35 USC 111(a) Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| Extension - 1 month with $0 paid | 2251 | 1 | 100 | 100 |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **100** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 15415510 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 03-APR-2013 |
| **Filing Date:** | 07-DEC-2012 |
| **Time Stamp:** | 11:17:16 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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| Submitted with Payment | yes |
| Payment Type | Credit Card |
| Payment was successfully received in RAM | $100 |
| RAM confirmation Number | 8555 |
| Deposit Account | 500259 |
| Authorized User | TUCKER, JOSHUA LAYTON |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) | |

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| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Non Patent Literature | AMP003NPL01.pdf | 1413870<br>ed7bc0436e0f057b9c0d87a8ad003f71e86eaac4 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Non Patent Literature | AMP003NPL02.pdf | 224032<br>eedc26f412b4c3b68608b9f87f3d7f9b1ed9468e | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Non Patent Literature | AMP003NPL05.pdf | 102916<br>0f110a97a74cf6e1e8515f172073e9e80f620003 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Non Patent Literature | AMP003NPL04.pdf | 479390<br>8c73c7d8edff515bfa54b25ae4d296e7fc47203d | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Non Patent Literature | AMP003NPL03.pdf | 13370618<br>436556906f25d6e1344676eab2be9e55d9c270a6 | no | 17 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Foreign Reference | AMP003FP01.pdf | 8451141<br>ee2a1a2a2a54ba8f7169ae7844bddd5851897062 | no | 52 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Foreign Reference | AMP003FP02.pdf | 5729819<br>41e139d8eef8e426bde8421548801efaf869e958 | no | 44 |
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| 9 | Information Disclosure Statement (IDS) Form (SB08) | AMP003IDS.pdf | 613484<br>6483c9a4faff79f0e9eb6d62a65b19e13b380bc4 | no | 5 |
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| 10 | Fee Worksheet (SB06) | fee-info.pdf | 30025<br>c5080c735dda4c658038ebaf4818fab1d150cad1 | no | 2 |
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(54) Title: DRILLING COLLABORATION INFRASTRUCTURE

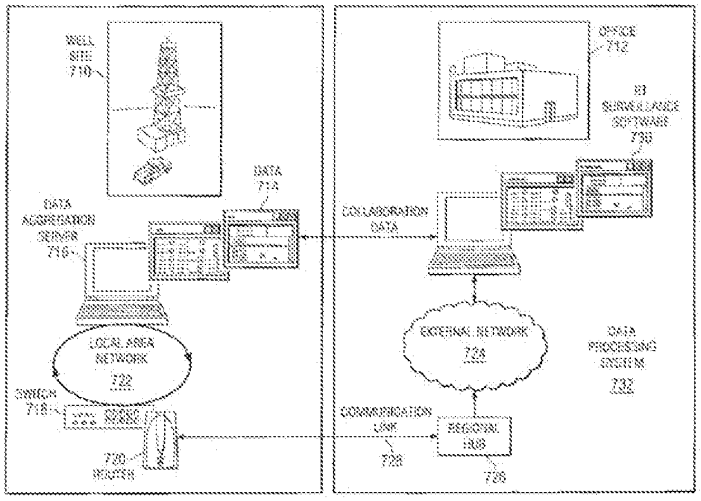



*FIG. 7*

(57) Abstract: Methods and systems facilitate collaboration between users at an oil well site (710) and users at a remote location (712). Multiple types of oil well data (714) are collected (1010) at the oil well site (710) to form aggregated data. The aggregated data is stored (1020) in a data aggregation server (716) at the oil well site (710). Users at the oil well site (710) and users at the remote location (712) are allowed to access (1040) the aggregated data on the data aggregation server (716) using a standard data format.

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# DRILLING COLLABORATION INFRASTRUCTURE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention:

The present invention relates to methods, systems, and apparatuses for use in oil well construction and/or drilling projects. In particular, the present invention provides methods, systems, and apparatuses for establishing an infrastructure to facilitate collaboration between oil well construction and drilling project team members at disparate locations.

### 2. Background of the Invention:

Oil wells today are characterized at one end of the spectrum by complex wells in high-cost environments, such as an offshore environment, with less experienced personnel and resources available. At the other end of the spectrum are low-cost, high-volume environments, such as an onshore environment, with very specific and repeating processes. Overlaying this spectrum are significant advances in information technology coupled with rapid progress in rig automation technology.

For both of the above types of well environments, remote operations support activities are attracting significant attention and investment. This is due at least in part to recognition by more companies of the need to be able to react in "real time" relative to an increasing number of drilling measurements. The remote operations support activities may include, for example, revised work processes based on improved upfront models as well as plans that are more integrated with the actual well construction process.

In a typical oil well construction or drilling project where remote operations support is provided, certain members of the project team are located at the rig site, such as an offshore site, where various types of data are collected and numerous site-specific decisions are made. Other project team members provide operations support from a remote location, such as an onshore site, including monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process. Communication and data transfer between the two locations are typically provided through a standard wired and/or wireless link, such as a satellite link.

The team members at the two disparate locations should be able to collaborate closely and work together efficiently, particularly in high-technology development projects. However, applying conventional information technology to oil well construction or drilling projects can

pose special problems that do not otherwise occur or are less significant in a typical office environment. Further, complications are expected to arise going forward as additional measurements are acquired. Predictive models are increasingly used together with more complete monitoring of rig activities, a higher degree of rig automation, fewer people on site, and greater remote support from both service companies and oil company sites.

Accordingly, despite recent advances, there is a need in oil well construction and/or drilling projects for more efficient collaboration between project team members. In particular, there is a need for an infrastructure that can facilitate closer collaboration between such project team members at disparate locations.

## SUMMARY OF THE INVENTION

In view of the above problems, an object of the present invention is to provide methods, apparatuses and systems for establishing an infrastructure to facilitate collaboration between oil well construction and drilling project team members at disparate locations while eliminating or minimizing the impact of the problems and limitations described.

Methods and systems facilitate collaboration between users at an oil well site and users at a remote location. Multiple types of oil well data are collected at the oil well site to form aggregated data. The aggregated data is stored in a data aggregation server at the oil well site. Users at the oil well site and the users at the remote location are allowed to access the aggregated data on the data aggregation server using a standard data format.

Additionally, a local copy of the aggregated data can be stored on a local server at the remote location. Users at the remote location can then access the aggregated data on the local server.

The users at the oil well site can access the multiple types of oil well data via one or more private virtual local area networks. Each local area network allows a different level of access to the multiple types of oil well data.

The users at the remote location access the multiple types of oil well data via a satellite communication link.

An operations support center at the remote location allows the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

The users at the oil well site and the users at the remote location can access the multiple types of oil well data using a Web-based viewer or an interactive viewer.

The oil well site can be an offshore site and the remote location is an onshore location.

Other objects, features and advantages of the present invention will become apparent to those of skill in art by reference to the figures, the description that follows and the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

**FIGS. 1A-1D** depict simplified, representative, schematic views of an oilfield having subterranean formation containing reservoir therein and depicting various oilfield operations being performed on the oilfield;

**FIGS. 2A-2D** are graphical depictions of examples of data collected by the tools of **FIGS. 1A-1D**, respectively;

**FIG. 3** is a schematic view, partially in cross section of an oilfield having data acquisition tools positioned at various locations along the oilfield for collecting data of the subterranean formation;

**FIG. 4** is a schematic view of well site, depicting a drilling operation, such as the drilling operation of **FIG. 1B**, of an oilfield in detail;

**FIG. 5** is a schematic view of a system for performing a drilling operation of an oilfield;

**FIG. 6** is an example of an oil well construction and/or drilling project where remote operations support according to the prior art;

**FIG. 7** is a general layout for an oil well construction and/or drilling collaboration infrastructure as shown according to an illustrative embodiment;

**FIG. 8** is a general layout for multiple rig collaboration according to an illustrative embodiment;

**FIG. 9** is an exemplary network that may be used in a collaboration infrastructure according to an illustrative embodiment; and

**FIG. 10** is a flowchart illustrating the method steps for providing a collaboration infrastructure is shown according to an illustrative embodiment.

## DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description of the preferred embodiments and other embodiments of the invention, reference is made to the accompanying drawings. It is to be understood that those of skill in the art will readily see other embodiments and changes may be made without departing from the scope of the invention.

**FIGS. 1A-1D** depict simplified, representative, schematic views of oilfield **100** having subterranean formation **102** containing reservoir **104** therein and depicting various oilfield operations being performed on the oilfield. **FIG. 1A** depicts a survey operation being performed by a survey tool, such as seismic truck **106a**, to measure properties of the subterranean formation. The survey operation is a seismic survey operation for producing sound vibrations. In **FIG. 1A**, one such sound vibration, sound vibration **112** generated by source **110**, reflects off horizons **114** in earth formation **116**. A set of sound vibration, such as sound vibration **112** is received in by sensors, such as geophone-receivers **118**, situated on the earth's surface. In response to receiving these vibrations, geophone receivers **118** produce electrical output signals, referred to as data received **120** in **FIG. 1A**.

In response to the received sound vibration(s) **112** representative of different parameters (such as amplitude and/or frequency) of sound vibration(s) **112**, geophones **118** produce electrical output signals containing data concerning the subterranean formation. Data received **120** is provided as input data to computer **122a** of seismic truck **106a**, and responsive to the input data, computer **122a** generates seismic data output **124**. This seismic data output may be stored, transmitted or further processed as desired, for example by data reduction.

**FIG. 1B** depicts a drilling operation being performed by drilling tools **106b** suspended by rig **128** and advanced into subterranean formations **102** to form well bore **136**. Mud pit **130** is used to draw drilling mud into the drilling tools via flow line **132** for circulating drilling mud through the drilling tools, up well bore **136** and back to the surface. The drilling mud is usually filtered and returned to the mud pit. A circulating system may be used for storing, controlling, or filtering the flowing drilling muds. The drilling tools are advanced into the subterranean formations **102** to reach reservoir **104**. Each well may target one or more reservoirs. The drilling tools are preferably adapted for measuring downhole properties using logging while drilling tools. The logging while drilling tool may also be adapted for taking core sample **133** as shown, or removed so that a core sample may be taken using another tool.

Surface unit **134** is used to communicate with the drilling tools and/or offsite operations. Surface unit **134** is capable of communicating with the drilling tools to send commands to the drilling tools, and to receive data therefrom. Surface unit **134** is preferably provided with computer facilities for receiving, storing, processing, and/or analyzing data from the oilfield. Surface unit **134** collects data generated during the drilling operation and produces data output **135** which may be stored or transmitted. Computer facilities, such as those of the surface unit, may be positioned at various locations about the oilfield and/or at remote locations.

Sensors S, such as gauges, may be positioned about the oilfield to collect data relating to various oilfield operations as described previously. As shown, sensor S is positioned in one or more locations in the drilling tools and/or at rig **128** to measure drilling parameters, such as weight on bit, torque on bit, pressures, temperatures, flow rates, compositions, rotary speed, and/or other parameters of the oilfield operation. Sensors S may also be positioned in one or more locations in the circulating system.

The data gathered by sensors S may be collected by surface unit **134** and/or other data collection sources for analysis or other processing. The data collected by sensors S may be used alone or in combination with other data. The data may be collected in one or more databases and/or transmitted on or offsite. All or select portions of the data may be selectively used for analyzing and/or predicting oilfield operations of the current and/or other well bores. The data may be historical data, real time data, or combinations thereof. The real time data may be used in real time, or stored for later use. The data may also be combined with historical data or other inputs for further analysis. The data may be stored in separate databases, or combined into a single database.

The collected data may be used to perform analysis, such as modeling operations. For example, the seismic data output may be used to perform geological, geophysical, and/or reservoir engineering. The reservoir, well bore, surface, and/or process data may be used to perform reservoir, well bore, geological, geophysical, or other simulations. The data outputs from the oilfield operation may be generated directly from the sensors, or after some preprocessing or modeling. These data outputs may act as inputs for further analysis.

The data may be collected and stored at surface unit **134**. One or more surface units may be located at oilfield **100**, or connected remotely thereto. Surface unit **134** may be a single unit, or a complex network of units used to perform the necessary data management functions throughout the oilfield. Surface unit **134** may be a manual or automatic system. Surface unit **134** may be operated and/or adjusted by a user.

Surface unit **134** may be provided with transceiver **137** to allow communications between surface unit **134** and various portions of oilfield **100** or other locations. Surface unit **134** may also be provided with or functionally connected to one or more controllers for actuating mechanisms at oilfield **100**. Surface unit **134** may then send command signals to oilfield **100** in response to data received. Surface unit **134** may receive commands via the transceiver or may itself execute commands to the controller. A processor may be provided to analyze the data (locally or remotely), make the decisions and/or actuate the controller. In this manner, oilfield **100** may be selectively adjusted based on the data collected. This technique may be used to optimize portions of the oilfield operation, such as controlling drilling, weight on bit, pump rates, or other parameters. These adjustments may be made automatically based on computer protocol, and/or manually by an operator. In some cases, well plans may be adjusted to select optimum operating conditions, or to avoid problems.

**FIG. 1C** depicts a wireline operation being performed by wireline tool **106c** suspended by rig **128** and into well bore **136** of **FIG. 1B**. Wireline tool **106c** is preferably adapted for deployment into a well bore for generating well logs, performing downhole tests and/or collecting samples. Wireline tool **106c** may be used to provide another method and apparatus for to collect information about the subterranean formations. Wireline tool **106c** of **FIG. 1C** may, for example, have an explosive, radioactive, electrical, or acoustic energy source **144** that sends and/or receives signals to surrounding subterranean formations **102** and fluids therein.

Wireline tool **106c** may be operatively connected to, for example, geophones **118** and computer **122a** of seismic truck **106a** of **FIG. 1A**. Wireline tool **106c** may also provide data to surface unit **134**. Surface unit **134** collects data generated during the wireline operation and produces data output **135** that may be stored or transmitted. Wireline tool **106c** may be positioned at various depths in the well bore to provide a survey or other information relating to the subterranean formation.

Sensors S, such as gauges, may be positioned about oilfield **100** to collect data relating to various oilfield operations as described previously. As shown, the sensor S is positioned in wireline tool **106c** to measure downhole parameters which relate to, for example porosity, permeability, fluid composition and/or other parameters of the oilfield operation.

**FIG. 1D** depicts a production operation being performed by production tool **106d** deployed from a production unit or Christmas tree **129** and into completed well bore **136** of **FIG. 1C** for drawing fluid from the downhole reservoirs into surface facilities **142**. Fluid flows from

reservoir **104** through perforations in the casing (not shown) and into production tool **106d** in well bore **136** and to surface facilities **142** via a gathering network **146**.

Sensors S, such as gauges, may be positioned about oilfield **100** to collect data relating to various oilfield operations as described previously. As shown, the sensor S may be positioned in production tool **106d** or associated equipment, such as Christmas tree **129**, gathering network **146**, surface facility **142**, and/or the production facility, to measure fluid parameters, such as fluid composition, flow rates, pressures, temperatures, and/or other parameters of the production operation.

While only simplified well site configurations are shown, it will be appreciated that the oilfield may cover a portion of land, sea, and/or water locations that hosts one or more well sites. Production may also include injection wells (not shown) for added recovery. One or more gathering facilities may be operatively connected to one or more of the well sites for selectively collecting downhole fluids from the well site(s).

While **FIGS. 1B-1D** depict tools used to measure properties of an oilfield, it will be appreciated that the tools may be used in connection with non-oilfield operations, such as mines, aquifers, storage, or other subterranean facilities. Also, while certain data acquisition tools are depicted, it will be appreciated that various measurement tools capable of sensing parameters, such as seismic two-way travel time, density, resistivity, production rate, etc., of the subterranean formation and/or its geological formations may be used. Various sensors S may be located at various positions along the well bore and/or the monitoring tools to collect and/or monitor the desired data. Other sources of data may also be provided from offsite locations.

The oilfield configuration of **FIGS. 1A-1D** is intended to provide a brief description of an example of an oilfield usable with the present invention. Part, or all, of oilfield **100** may be on land, water, and/or sea. Also, while a single oilfield measured at a single location is depicted, the present invention may be utilized with any combination of one or more oilfields, one or more processing facilities and one or more well sites.

**FIGS. 2A-2D** are graphical depictions of examples of data collected by the tools of **FIGS. 1A-1D**, respectively. **FIG. 2A** depicts seismic trace **202** of the subterranean formation of **FIG. 1A** taken by seismic truck **106a**. Seismic trace **202** may be used to provide data, such as a two-way response over a period of time. **FIG. 2B** depicts core sample **133** taken by drilling tools **106b**. Core sample **133** may be used to provide data, such as a graph of the density, porosity, permeability, or other physical property of the core sample over the length of the core. Tests for density and viscosity may be performed on the fluids in the core at varying pressures

and temperatures. **FIG. 2C** depicts well log **204** of the subterranean formation of **FIG. 1C** taken by wireline tool **106c**. The wireline log typically provides a resistivity or other measurement of the formation at various depts. **FIG. 2D** depicts a production decline curve or graph **206** of fluid flowing through the subterranean formation of **FIG. 1D** measured at surface facilities **142**. The production decline curve typically provides the production rate Q as a function of time t.

The respective graphs of **FIGS. 2A-2C** depict examples of static measurements that may describe or provide information about the physical characteristics of the formation and reservoirs contained therein. These measurements may be analyzed to better define the properties of the formation(s) and/or determine the accuracy of the measurements and/or for checking for errors. The plots of each of the respective measurements may be aligned and scaled for comparison and verification of the properties.

**FIG. 2D** depicts an example of a dynamic measurement of the fluid properties through the well bore. As the fluid flows through the well bore, measurements are taken of fluid properties, such as flow rates, pressures, composition, etc. As described below, the static and dynamic measurements may be analyzed and used to generate models of the subterranean formation to determine characteristics thereof. Similar measurements may also be used to measure changes in formation aspects over time.

**FIG. 3** is a schematic view, partially in cross section of oilfield **300** having data acquisition tools **302a**, **302b**, **302c** and **302d** positioned at various locations along the oilfield for collecting data of the subterranean formation **304**. Data acquisition tools **302a-302d** may be the same as data acquisition tools **106a-106d** of **FIGS. 1A-1D**, respectively, or others not depicted. As shown, data acquisition tools **302a-302d** generate data plots or measurements **308a-308d**, respectively. These data plots are depicted along the oilfield to demonstrate the data generated by the various operations.

Data plots **308a-308c** are examples of static data plots that may be generated by data acquisition tools **302a-302d**, respectively. Static data plot **308a** is a seismic two-way response time and may be the same as seismic trace **202** of **FIG. 2A**. Static plot **308b** is core sample data measured from a core sample of formation **304**, similar to core sample **133** of **FIG. 2B**. Static data plot **308c** is a logging trace, similar to well log **204** of **FIG. 2C**. Production decline curve or graph **308d** is a dynamic data plot of the fluid flow rate over time, similar to graph **206** of **FIG. 2D**. Other data may also be collected, such as historical data, user inputs, economic information, and/or other measurement data and other parameters of interest.

Subterranean structure **304** has a plurality of geological formations **306a-306d**. As shown, this structure has several formations or layers, including shale layer **306a**, carbonate layer **306b**, shale layer **306c** and sand layer **306d**. Fault **307** extends through shale layer **306a** and carbonate layer **306b**. The static data acquisition tools are preferably adapted to take measurements and detect characteristics of the formations.

While a specific subterranean formation with specific geological structures is depicted, it will be appreciated that the oilfield may contain a variety of geological structures and/or formations, sometimes having extreme complexity. In some locations, typically below the water line, fluid may occupy pore spaces of the formations. Each of the measurement devices may be used to measure properties of the formations and/or its geological features. While each acquisition tool is shown as being in specific locations in the oilfield, it will be appreciated that one or more types of measurement may be taken at one or more locations across one or more oilfields or other locations for comparison and/or analysis.

The data collected from various sources, such as the data acquisition tools of **FIG. 3**, may then be processed and/or evaluated. Typically, seismic data displayed in static data plot **308a** from data acquisition tool **302a** is used by a geophysicist to determine characteristics of the subterranean formations and features. Core data shown in static plot **308b** and/or log data from well log **308c** are typically used by a geologist to determine various characteristics of the subterranean formation. Production data from graph **308d** is typically used by the reservoir engineer to determine fluid flow reservoir characteristics. The data analyzed by the geologist, geophysicist and the reservoir engineer may be analyzed using modeling techniques. Examples of modeling techniques are described in US5992519, WO2004049216, WO1999/064896, US6313837, US2003/0216897, US7248259, US20050149307 and US2006/0197759. Systems for performing such modeling techniques are described, for example, in issued US7248259, the entire contents of which is hereby incorporated by reference.

**FIG. 4** is a schematic view of well site **400**, depicting a drilling operation, such as the drilling operation of **FIG. 1B**, of an oilfield in detail. Well site **400** includes drilling system **402** and surface unit **404**. In the illustrated embodiment, borehole **406** is formed by rotary drilling in a manner that is well known. Those of ordinary skill in the art given the benefit of this disclosure will appreciate, however, that the present invention also finds application in drilling applications other than conventional rotary drilling (*e.g.*, mud-motor based directional drilling), and is not limited to land-based rigs.

Drilling system **402** includes drill string **408** suspended within borehole **406** with drill bit **410** at its lower end. Drilling system **402** also includes the land-based platform and derrick assembly **412** positioned over borehole **406** penetrating subsurface formation F. Assembly **412** includes rotary table **414**, kelly **416**, hook **418**, and rotary swivel **419**. The drill string **408** is rotated by rotary table **414**, energized by means not shown, which engages kelly **416** at the upper end of the drill string. Drill string **408** is suspended from hook **418**, attached to a traveling block (also not shown), through kelly **416** and rotary swivel **419** which permits rotation of the drill string relative to the hook.

Drilling system **402** further includes drilling fluid or mud **420** stored in pit **422** formed at the well site. Pump **424** delivers drilling fluid **420** to the interior of drill string **408** via a port in swivel **419**, inducing the drilling fluid to flow downwardly through drill string **408** as indicated by directional arrow **424**. The drilling fluid exits drill string **408** via ports in drill bit **410**, and then circulates upwardly through the region between the outside of drill string **408** and the wall of borehole **406**, called annulus **426**. In this manner, drilling fluid lubricates drill bit **410** and carries formation cuttings up to the surface as it is returned to pit **422** for recirculation.

Drill string **408** further includes bottom hole assembly (BHA) **430**, generally referenced, near drill bit **410** (in other words, within several drill collar lengths from the drill bit). Bottom hole assembly **430** includes capabilities for measuring, processing, and storing information, as well as communicating with surface unit **404**. Bottom hole assembly **430** further includes drill collars **428** for performing various other measurement functions.

Sensors S are located about well site **400** to collect data, preferably in real time, concerning the operation of well site **400**, as well as conditions at well site **400**. Sensors S of **FIG. 3** may be the same as sensors S of **FIGS. 1A-D**. Sensors S of **FIG. 3** may also have features or capabilities, of monitors, such as cameras (not shown), to provide pictures of the operation. Sensors S, which may include surface sensors or gauges, may be deployed about the surface systems to provide information about surface unit **404**, such as standpipe pressure, hookload, depth, surface torque, rotary rpm, among others. In addition, sensors S, which include downhole sensors or gauges, are disposed about the drilling tool and/or well bore to provide information about downhole conditions, such as well bore pressure, weight on bit, torque on bit, direction, inclination, collar rpm, tool temperature, annular temperature and toolface, among others. The information collected by the sensors and cameras is conveyed to the various parts of the drilling system and/or the surface control unit.

Drilling system **402** is operatively connected to surface unit **404** for communication therewith. Bottom hole assembly **430** is provided with communication subassembly **452** that communicates with surface unit **404**. Communication subassembly **452** is adapted to send signals to and receive signals from the surface using mud pulse telemetry. Communication subassembly **452** may include, for example, a transmitter that generates a signal, such as an acoustic or electromagnetic signal, which is representative of the measured drilling parameters. Communication between the downhole and surface systems is depicted as being mud pulse telemetry, such as the one described in U.S. Patent No. 5,517,464, assigned to the assignee of the present invention. It will be appreciated by one of skill in the art that a variety of telemetry systems may be employed, such as wired drill pipe, electromagnetic or other known telemetry systems.

Typically, the well bore is drilled according to a drilling plan that is established prior to drilling. The drilling plan typically sets forth equipment, pressures, trajectories and/or other parameters that define the drilling process for the well site. The drilling operation may then be performed according to the drilling plan. However, as information is gathered, the drilling operation may need to deviate from the drilling plan. Additionally, as drilling or other operations are performed, the subsurface conditions may change. The earth model may also need adjustment as new information is collected.

**FIG. 5** is a schematic view of system **500** for performing a drilling operation of an oilfield. As shown, system **500** includes surface unit **502** operatively connected to well site **504**, servers **506** operatively linked to surface unit **502**, and modeling tool **508** operatively linked to servers **506**. As shown, communication links **510** are provided between well site **504**, surface unit **502**, servers **506**, and modeling tool **508**. A variety of links may be provided to facilitate the flow of data through the system. The communication links may provide for continuous, intermittent, one-way, two-way, and/or selective communication throughout system **500**. The communication links may be of any type, such as wired, wireless, etc.

Well site **504** and surface unit **502** may be the same as the well site and surface unit of **FIG. 3**. Surface unit **502** is preferably provided with an acquisition component **512**, controller **514**, display unit **516**, processor **518** and transceiver **520**. Acquisition component **512** collects and/or stores data of the oilfield. This data may be data measured by the sensors S of the well site as described with respect to **FIG. 3**. This data may also be data received from other sources. Controller **514** is enabled to enact commands at oilfield **500**. Controller **514** may be provided with actuation means that can perform drilling operations, such as steering, advancing, or

otherwise taking action at the well site. Drilling operations may also include, for example, acquiring and analyzing oilfield data, modeling oilfield data, managing existing oilfields, identifying production parameters, maintenance activities, or any other actions. Commands may be generated based on logic of processor **518**, or by commands received from other sources. Processor **518** is preferably provided with features for manipulating and analyzing the data. The processor may be provided with additional functionality to perform oilfield operations.

Display unit **516** may be provided at well site **504** and/or remote locations for viewing oilfield data. The oilfield data displayed may be raw data, processed data, and/or data outputs generated from various data. The display is preferably adapted to provide flexible views of the data, so that the screens depicted may be customized as desired.

Transceiver **520** provides a means for providing data access to and/or from other sources. Transceiver **520** also provides a means for communicating with other components, such as servers **506**, well site **504**, surface unit **502**, and/or modeling tool **508**.

Server **506** may be used to transfer data from one or more well sites to modeling tool **508**. As shown, server **506** includes onsite servers **522**, remote server **524**, and third party server **526**. Onsite servers **522** may be positioned at well site **504** and/or other locations for distributing data from surface unit **502**. Remote server **524** is positioned at a location away from oilfield **504** and provides data from remote sources. Third party server **526** may be onsite or remote, but is operated by a third party, such as a client.

Servers **506** are preferably capable of transferring drilling data, such as logs, drilling events, trajectory, and/or other oilfield data, such as seismic data, historical data, economics data, or other data that may be of use during analysis. The type of server is not intended to limit the invention. Preferably system **500** is adapted to function with any type of server that may be employed.

Servers **506** communicate with modeling tool **508** as indicated by communication links **510** there between. As indicated by the multiple arrows, servers **506** may have separate communication links with modeling tool **508**. One or more of the servers of servers **506** may be combined or linked to provide a combined communication link.

Servers **506** collect a wide variety of data. The data may be collected from a variety of channels that provide a certain type of data, such as well logs. The data from servers **506** is passed to modeling tool **508** for processing. Servers **506** may be used to store and/or transfer data.

Modeling tool **508** is operatively linked to surface unit **502** for receiving data therefrom. In some cases, modeling tool **508** and/or server(s) **506** may be positioned at well site **504**. Modeling tool **508** and/or server(s) **506** may also be positioned at various locations. Modeling tool **508** may be operatively linked to surface unit **502** via server(s) **506**. Modeling tool **508** may also be included in or located near surface unit **502**.

Modeling tool **508** includes interface **503**, processing unit **532**, modeling unit **548**, data repository **534** and data rendering unit **536**. Interface **503** communicates with other components, such as servers **506**. Interface **503** may also permit communication with other oilfield or non-oilfield sources. Interface **503** receives the data and maps the data for processing. Data from servers **506** typically streams along predefined channels which may be selected by interface **503**. As depicted in **FIG. 5**, interface **503** selects the data channel of server(s) **506** and receives the data. Interface **503** also maps the data channels to data from well site **504**. The data may then be passed to the processing unit of modeling tool **508**. Preferably, the data is immediately incorporated into modeling tool **508** for real-time sessions or modeling. Interface **503** creates data requests (for example surveys, logs, and risks), displays the user interface, and handles connection state events. It also instantiates the data into a data object for processing.

Processing unit **532** includes formatting modules **540**, processing modules **542**, coordinating modules **544**, and utility modules **546**. These modules are designed to manipulate the oilfield data for real-time analysis.

Formatting modules **540** are used to conform data to a desired format for processing. Incoming data may need to be formatted, translated, converted or otherwise manipulated for use. Formatting modules **540** are configured to enable the data from a variety of sources to be formatted and used so that it processes and displays in real time.

As shown, formatting modules **540** include components for formatting the data, such as a unit converter and the mapping components. The unit converter converts individual data points received from interface **530** into the format expected for processing. The format may be defined for specific units, provide a conversion factor for converting to the desired units, or allow the units and/or conversion factor to be defined. To facilitate processing, the conversions may be suppressed for desired units.

The mapping component maps data according to a given type or classification, such as a certain unit, log mnemonics, precision, max/min of color table settings, etc. The type for a given set of data may be assigned, particularly when the type is unknown. The assigned type and

corresponding map for the data may be stored in a file (e.g. XML) and recalled for future unknown data types.

Coordinating modules **544** orchestrate the data flow throughout modeling tool **508**. The data is manipulated so that it flows according to a choreographed plan. The data may be queued and synchronized so that it processes according to a timer and/or a given queue size. The coordinating modules include the queuing components, the synchronization components, the management component, modeling tool **508** mediator component, the settings component and the real-time handling component.

The queuing module groups the data in a queue for processing through the system. The system of queues provides a certain amount of data at a given time so that it may be processed in real time.

The synchronization component links certain data together so that collections of different kinds of data may be stored and visualized in modeling tool **508** concurrently. In this manner, certain disparate or similar pieces of data may be choreographed so that they link with other data as it flows through the system. The synchronization component provides the ability to selectively synchronize certain data for processing. For example, log data may be synchronized with trajectory data. Where log samples have a depth that extends beyond the well bore, the samples may be displayed on the canvas using a tangential projection so that, when the actual trajectory data is available, the log samples will be repositioned along the well bore. Alternatively, incoming log samples that are not on the trajectory may be cached so that, when the trajectory data is available, the data samples may be displayed. In cases where the log sample cache fills up before the trajectory data is received, the samples may be committed and displayed.

The settings component defines the settings for the interface. The settings component may be set to a desired format and adjusted as necessary. The format may be saved, for example, in an extensible markup language (XML) file for future use.

The real-time handling component instantiates and displays the interface and handles its events. The real-time handling component also creates the appropriate requests for channel or channel types, and handles the saving and restoring of the interface state when a set of data or its outputs is saved or loaded.

The management component implements the required interfaces to allow the module to be initialized by and integrated for processing. The mediator component receives the data from the interface. The mediator caches the data and combines the data with other data as necessary.

For example, incoming data relating to trajectories, risks, and logs may be added to wellbores stored in modeling tool **508**. The mediator may also merge data, such as survey and log data.

Utility modules **546** provide support functions to the drilling system. Utility modules **546** include the logging component and the user interface (UI) manager component. The logging component provides a common call for all logging data. This module allows the logging destination to be set by the application. The logging module may also be provided with other features, such as a debugger, a messenger, and a warning system, among others. The debugger sends a debug message to those using the system. The messenger sends information to subsystems, users, and others. The information may or may not interrupt the operation and may be distributed to various locations and/or users throughout the system. The warning system may be used to send error messages and warnings to various locations and/or users throughout the system. In some cases, the warning messages may interrupt the process and display alerts.

The user interface manager component creates user interface elements for displays. The user interface manager component defines user input screens, such as menu items, context menus, toolbars, and settings windows. The user manager may also be used to handle events relating to these user input screens.

Processing module **542** is used to analyze the data and generate outputs. Processing module **542** includes the trajectory management component.

The trajectory management component handles the case when the incoming trajectory information indicates a special situation or requires special handling. The trajectory management component could therefore handle situations where the data pertains to depths that are not strictly increasing or the data indicates that a sidetrack borehole path is being created. For example, when a sample is received with a measured depth shallower than the hole depth, the trajectory module determines how to process the data. The trajectory module may ignore all incoming survey points until the MD exceeds the previous MD on the well bore path, merge all incoming survey points below a specified depth with the existing samples on the trajectory, ignore points above a given depth, delete the existing trajectory data and replace it with a new survey that starts with the incoming survey station, create a new well and set its trajectory to the incoming data, add incoming data to this new well, and prompt the user for each invalid point. All of these options may be exercised in combinations and can be automated or set manually.

Data repository **534** stores the data for modeling unit **548**. The data is preferably stored in a format available for use in real-time. The data is passed to data repository **534** from the processing component. It can be persisted in the file system (e.g., as an XML File) or in a

database. The system determines which storage is the most appropriate to use for a given piece of data and stores the data there in a manner which enables automatic flow of the data through the rest of the system in a seamless and integrated fashion. It also facilitates manual and automated workflows – such as modeling, geological, and geophysical – based upon the persisted data.

Data rendering unit **536** provides one or more displays for visualizing the data. Data rendering unit **536** may contain a 3D canvas, a well section canvas or other canvases as desired. Data rendering unit **536** may selectively display any combination of one or more canvases. The canvases may or may not be synchronized with each other during display. The display unit is preferably provided with mechanisms for actuating various canvases or other functions in the system.

While specific components are depicted and/or described for use in the modules of modeling tool **508**, it will be appreciated that a variety of components with various functions may be used to provide the formatting, processing, utility, and coordination functions necessary to provide real-time processing in modeling tool **508**. The components and/or modules may have combined functionalities.

Modeling unit **548** performs the key modeling functions for generating complex oilfield outputs. Modeling unit **548** may be a conventional modeling tool capable of performing modeling functions, such as generating, analyzing, and manipulating earth models. The earth models typically contain exploration and production data, such as that shown in **FIG. 1**. In the following detailed description of the preferred embodiments and other embodiments of the invention, reference is made to the accompanying drawings. It is to be understood that those of skill in the art will readily see other embodiments and changes may be made without departing from the scope of the invention.

**FIG. 6** illustrates an example of an oil well construction and/or drilling project where remote operations support is provided according to the prior art. Rig site **610** is a well site, such as well site **400** of **FIG. 4**, and can be an offshore well site. Collection of various types of data and site-specific decisions occur at rig site **610**. To perform these data collection and decision making activities, certain members of a project team are located at rig site **610**.

Operation support center **620** is generally remotely located from rig site **610**. Other project team members at Operation support center **620** provide operations support from, including but not limited to, monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process that is occurring at rig site **610**.

Communication link **630** provides communication and data transfer between rig site **610** and operation support center **620**. Communication and data transfer provided by communication link **630** between rig site **610** and operation support center **620** are typically implemented through a standard wired and/or wireless communication link, which can be, but is not limited to a satellite link.

The different illustrative embodiments recognize that in the arrangement of **FIG. 6**, team members at rig site **610** and team members at operation support center **620** are disparately located, but need to be able to collaborate closely and work together efficiently, particularly in high-technology development projects. However, applying conventional information technology infrastructure to oil well construction and/or drilling projects can pose special problems that do not otherwise occur or are less significant in a typical office environment. Further complications arise as additional measurements are acquired (particularly surface measurements) and predictive models are increasingly used together with more complete monitoring of rig activities, a higher degree of rig automation, fewer people on site, and greater remote support from both service companies and oil company sites. The different illustrative embodiments recognize that the infrastructure provided in **FIG. 6** is therefore unable to provide the required infrastructure for facilitating efficient sharing of data between project team members in oil well construction and/or drilling projects.

Referring now to **FIG. 7**, a general layout for an oil well construction and/or drilling collaboration infrastructure is shown according to an illustrative embodiment. The infrastructure of **FIG. 7** connects project team members at well site **710**, which can be well site **400** of **FIG. 4**, with project team members at office **712**. Office **712** is a location remotely located from well site **710**. Office **712** can be an actual office structure; however, office **712** is not limited to such a structure. Office **712** can be any location remote from well site **710** capable of providing operations support for a drilling process that is occurring at well site **710**. The operations support can include, but is not limited to, monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process that is occurring at well site **710**.

The infrastructure of **FIG. 7** allows the project team members at well site **710** two groups to communicate and exchange data with the project team members at office **712**. Data **714** is collected from multiple vendors at the well site **710** by using data aggregation server **716** that securely stores the data. Data **714** can include, but is not limited to mud logging data, logging-while-drilling data, monitoring-while-drilling data, rig sensor data, and other data that can be collected at a well site. Data aggregation server **716**, which may include multiple servers to form a set of data aggregation servers, is connected to a switch **718** and router **720**. Together, switch **718** and router **720** provide a

network for collecting and accessing the data at well site **710**. The network provided by switch **718** and router **720** may be any suitable network known to those having ordinary skill in the art, and can include a wired or wireless local area network **722**. Local area network **722** is, in turn, connected to an external network **724**, such as the Internet via communication link **728**, which can be a satellite link. Regional hub **726** can provide a communication link between various well sites. Project team members at office **712** may then connect to data aggregation server **716** over external network **724** to access data **714** on data aggregation server **716**.

Office **712** can include an operation support center, such as operation support center **620** of **FIG. 6**. The operation support center may be set up in a predefined area at Office **712** to provide space and computing equipment for project team members to work. Project team members at office **712** conduct various activities at the operations support center in support of the project team members at well site **710**.

In a typical arrangement, surveillance engineers at office **712** are provided with real-time surveillance of various activities taking place at well site **710**. The surveillance may be conducted using real-time surveillance software **730** running on data processing system **732** at the operations support center of office **712** and at well site **710**. The collaboration infrastructure facilities shown in **FIG. 7** allow for closer collaboration between the project team members at well site **710** and the project team members at office **712**.

Referring now to **FIG. 8**, a general layout for multiple rig collaboration infrastructures is shown according to an illustrative embodiment. Well sites **810**, **812**, and **814** can be a well site such as well site **710** of **FIG. 7**. The replication of collaboration infrastructures at multiple rigs in a given oilfield allows multiple well sites to be remotely supported from a single operations support center, such as the operation support center at office **712** of **FIG. 7**. Project team members at the various well sites **810**, **812**, and **814** may then work together using the collaboration infrastructure to manage the overall drilling process for an entire oilfield asset, thereby providing huge potential increases in efficiency across the entire asset.

The collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment may be used regardless of whether the wells are being drilled in a high-volume, low-cost land environment or a high-cost, low-volume offshore environment. While drilling projects are typically is part of a multi-location "virtual" team, the illustrative collaboration infrastructure facilitates cooperation between the various personnel involved, including an asset management team in office **816**, a company man on a rig at well sites **810**, **812**, and **814**, rig contractors and other vendors on the rig at well sites **810**, **812**, and **814**, and engineers and support personnel located at

both locations. In preferred embodiments, the collaboration infrastructure communicates between well sites **810**, **812**, and **814** and office **816** via regional hub **818**, which can be regional hub **726** of **FIG. 7**. The collaboration infrastructure uses enterprise class components coupled with processes and support institutions commensurate with the challenges and difficulties of an oil well environment.

In general, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment provide a secure, hosted, managed solution with efficient global data access and backup and recovery services for all data.

The collaboration infrastructure at the rig at well sites **810**, **812**, and **814**, aggregates data from a variety of information sources into aggregated data **820**, **822**, and **824**. These sources can include, but are not limited to, information from a rig contractor, mud logger data, measurements-while-drilling data, logging-while-drilling data, information received from a company man, data from pore pressure monitoring, drilling optimization information, and episodic data, such as including wireline data, cementing data, and drill-string testing data.

The collaboration infrastructure also preferably provides real-time access to aggregated data **820**, **822**, and **824** by the collaboration team regardless of their location at either well sites **810**, **812**, and **814** or office **816**. Aggregated data **820**, **822**, and **824** can be accessed in real-time by processes such as web-based viewers, interactive viewers, import to analysis applications, and handheld access.

The collaboration infrastructure can also facilitate communication between collaboration team members at similar or identical sites, such as between rig team members of a single well site, such as one of well sites **810**, **812**, and **814**. The collaboration infrastructure, therefore, can provide a number of application and/or functions, such as, for example, electronic chat applications, instant message applications, shared data analysis, fax, reporting, email, and voice over internet protocol communication. The collaboration infrastructure can additionally provide other applications such as, but not limited to, wired and/or wireless local area networks, video monitoring, facsimile receipt and transmission, private network access, links to sub networks, hazardous area and other real-time displays, integration of personal digital assistants, remote administration, and remote monitoring and support.

The collaboration infrastructure also provides various security features to limit access to aggregated data **820**, **822**, and **824**. The various security features in one illustrative embodiment can include, but are not limited to, a firewall, a security patch management, personalized access control,

hazardous area certification, bandwidth allocation and Quality of Service (QoS), and the ability to track malicious activity.

At office **816**, the collaboration infrastructure of **FIG. 8** preferably provides flexible deployment internal and external to a corporate network (i.e., hosted), ease of integration with existing company infrastructure, access to multiple rigs at well sites **810**, **812**, and **814** as required, sufficient viewing area and real-time displays, rapid assimilation of aggregated data **820**, **822**, and **824**, and ease of context switching. The collaboration infrastructure of **FIG. 8** also preferably provides real-time access to aggregated data **820**, **822**, and **824** by the remote team at office **816**. Real-time access to aggregated data **820**, **822**, and **824** can include, but is not limited to, web-based viewers, interactive viewers, import to analysis applications, and handheld access. Inter-communication between remote team members at office **816** is also preferably provided, including chat, instant messaging, shared data analysis, facsimile, reporting, email, and voice-over-internet protocol communication. Other services provided by the collaboration infrastructure may include wired and/or wireless local area networks, video monitoring, Personal Digital Assistants, Flexible Administration (Remote/Local), and Flexible Monitoring and Support (Remote/Local). As for security, the collaboration infrastructure preferably provides a firewall, security patch management, access control, hazardous area certification, bandwidth allocation and Quality of Service (QoS), and can easily conform to client environment.

Many of the above features can be delivered using small office/home office (SOHO) equipment with very little management or configuration. However, in order to provide a secure, managed and extensible local area network that can provide the required features, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment, use enterprise class router and switch.

With respect to the aggregation of aggregated data **820**, **822**, and **824** and access to this at office **816**, although there are many possible infrastructure solutions for data aggregation, one illustrative embodiment utilizes data aggregation servers **826**, **828**, and **830** on individual rigs at well sites **810**, **812**, and **814**. Locating data aggregation servers **826**, **828**, and **830** on individual rigs at well sites **810**, **812**, and **814** provides benefits that outweigh most logistics issues. For example, data aggregation servers **826**, **828**, and **830** at the rig provide an interface to the various vendor systems on the rig and also provide local access to aggregated data **820**. Locating data aggregation servers **826**, **828**, and **830** at the rig eliminates potential traffic across a communication link, such as communication link **728** of **FIG. 7**, from the rig to office **816**. If the data aggregation servers **826**, **828**, and **830** were located remotely from the rig, such as at office **816**, team members

at well site **810** would have to access data aggregation servers **826**, **828**, and **830** through the via the relatively scarce and expensive bandwidth of the communication link, such as communication link **728** of **FIG. 7**.

Data aggregation servers **826**, **828**, and **830** aggregate data together to create aggregated data **820** in a way that aggregated data **820** can be viewed and analyzed using a consistent set of tools. That is, aggregated data **820** is not limited strictly to the native tools and software environments provided by the various vendors.

Data aggregation servers **826**, **828**, and **830** combine aggregated data **820**, **822**, **824** into a consistent and vendor neutral data delivery format. By using the data aggregation servers **826**, **828**, and **830** to aggregate the data into a standard repository with a standard set of analysis tools, the value of the data is immediately enhanced. Time that was previously spent analyzing data in the so that the data can be prepared and implemented into a usable format is eliminated. Therefore, all of the data collected on rigs at well sites **810**, **812**, and **814** can be utilized. With the different illustrative embodiments, data is not simply eliminated because of the complexity of learning the different tools from each vendor or for each data type.

By limiting the transmission of aggregated data **820**, **822**, and **824**, the load across communication link, such as communication link **728** of **FIG. 7**, can be reduced. For example, if aggregated data **820**, **822**, and **824** is strictly collected at the rig and stored locally at well sites **810**, **812**, and **814**, then remote users at office 816 are forced to access aggregated data **820**, **822**, and **824** through the high latency and potentially scarce bandwidth of the satellite connection to the rig, such as communication link **728** of **FIG. 7**. By contrast, if aggregated data **820**, **822**, and **824** is only stored onshore, such as at office **816**, users on rigs at well sites **810**, **812**, and **814** must retrieve aggregated data **820**, **822**, and **824** from the onshore location in order to use it effectively.

Locating the data aggregation servers **826**, **828**, and **830** on a rig at well sites **810**, **812**, and **814** allows for controlled and facilitated access to aggregated data **820**, **822**, and **824**. In one illustrative embodiment, data to form aggregated data **820**, **822**, and **824** may be collected into the data aggregation server at the rig and transmitted to the remote team at office **816** only once, to be stored at local storage **832**. Users at a rig at one of well sites **810**, **812**, and **814** may access aggregated data **820** in real time locally on data aggregation server **826** and users onshore may access aggregated data **820** from local storage **832** at office **816**, thus minimizing the traffic over the satellite communication link, such as communication link **728** of **FIG. 7**, or other rig connectivity. Local storage **832** is a data storage medium that locally mirrors data that is stored at data aggregation server **826**. Local storage **832** can be any persistent or non-persistent type storage, such

as for example, but not limited to, magnetic memory such as hard disk drives, removable disks, optical storage, such as CD-ROMs and DVD-ROMs, as well as semiconductor type storage, such as random access memory chips, read only memory chips, and flash memory. This bifurcated storage of aggregated data **820** helps eliminate contention for connectivity and bandwidth between office **816** and well sites **810**, **812**, and **814**.

Combining data from well sites **810**, **812**, and **814** into aggregated data **820**, **822**, and **824** requires collecting data from a variety of vendors and systems and using various data sharing standards available for rigs. In one illustrative embodiment, the data collaboration infrastructure of **FIG. 8** acquires data in a standard data format. The standard data format can be, for example, but is not limited to, the Wellsite Information Transfer Standard (WITS) format, the WITSML format, or the markup language based evolution of the Wellsite Information Transfer Standard format.

In one illustrative embodiment, data aggregation server **826** includes a standard qualification process **830** for new vendors. Standard qualification process **830** is a software process that maps previously collected sample Wellsite Information Transfer Standard data with associated data descriptions. Once data is mapped, the mapped data is stored in a knowledge base so that data from that vendor may be acquired and comprehended anywhere. Mapped data obtained from the standard qualification process **830** can be transferred between well sites **810**, **812**, **814** and office **816** to extend the comprehension of the acquired data.

Referring now to **FIG. 9**, an exemplary network that may be used in a collaboration infrastructure is shown according to an illustrative embodiment. Network **900** of **FIG. 9** is the network between the various components of the collaboration infrastructure of **FIGs. 6-8**.

Voice-over-internet protocol is enabled by wired internet protocol telephones **910-912** and wireless internet protocol telephone **914**. Internet protocol telephones **910-912** connect to enterprise class router **916**. Enterprise class router **916** provides access from internet protocol telephones **910-912**, and other networked devices, to off-site voice over internet protocol telephone servers. Enterprise class router **916** can also provide access to a foreign exchange service, a foreign exchange office, or a local exchange in order to enable telephone communication to the rig. Wireless internet protocol telephone **914** wirelessly connects to hub **918**. Hub **918** is connected to enterprise class switch **920**. Enterprise class switch **920** is connected to enterprise class router **916**.

Enterprise class wireless local area network controller (local area network controller) **922** is also connected to enterprise class switch **920**. Enterprise class wireless local area network controller **922** provides the rig with system-wide wireless local area network functions, such as for example, but not limited to, security policies, intrusion prevention, RF management, quality of

service (QoS), and mobility. Users can wirelessly connect to the network of **FIG. 9** through the use of wireless personal digital assistant **936**, or through a wireless ethernet card installed into a data processing system.

The network of **FIG. 9** can also connect with various terminals running proprietary or public software systems for monitoring of data from the well site, or predicting operations of the well site operations based on aggregated data. Terminals can also be provided for connecting to various public and private networks. These terminals can include, but are not limited to, InterACT™ terminal **924**, Hazardous Substance Process Management terminal **926**, PTK Local Viewer terminal **928**, siNET terminal **930**, and internet terminal **932**. A site administrator can connect to the infrastructure using an administration access terminal **934**.

In some embodiments, in order to access the data and services on the rig, access external connectivity, and use global resources to improve the performance of the team, users on the rig are segmented according to their requirements and access to resources are limited unless access is required and approved. This may be accomplished by categorizing users according to their requirements and permissions and then using virtual local area networks (VLANs) to accommodate and constrain each group. For example, one group of users may need access to data on the rig and other users on the rig, but do not need or want Internet access for security reasons (the "Rig Access users"). Another group of users may require Internet access, but do not require, nor are allowed to access resources on the rig (the "Internet Access users"). Still another group of users may need access to the Internet as well as all rig resources (the "Full Access users").

To accommodate the above user groups, wired virtual local area networks may be set up for each group to provide the access goals defined. For example, a first virtual local area network may be set up for the Rig Access users and will connect certain ports on the switch labeled "Rig Access" to the specific port on the rig labeled "Rig Server." A second virtual local area network for the Internet Access users may be set up that connects certain other ports on the switch to the router and onto the external Internet connection. Still further, a third virtual local area network may be set up that connects still other ports on the switch to both the Rig Server and Router ports. The defined access goals can be implemented by limiting physical access to the switch. Physical access to the switch can be controlled by plugging users into the specific ports assigned to their level of capability.

For a wireless local area network, a similar network scheme is created, except, instead of ports on the switch, the user selects the network they are allowed to connect to by a unique log-in identification. Each unique log-in identification is associated with a virtual local area network

connecting to the specific resources allowed. The log-in identification can be associated with assignment to the virtual local area networks using any known data structures and methods. For example, team members belonging to a Rig Access group would have a first level of access that allows for connection to a Rig Access network. Team members belonging to an Internet Access group would have a second level of access that allows for connection to an Internet Access network. Each different level of access is an authorization to use or access various systems and components of the infrastructure. Team members that are allowed full access would have a third level of access that allows for connection to the Full Access network. Access to each network can be controlled through passwords, or by association of the unique log-in identification with a certain level of access.

In addition to the standard virtual local area networks to control access, the network setup of **FIG. 9** may connect to dedicated subnets set up on the rig for the various vendors. Various data processing systems collecting data during mud logging might be connected together on a simple local area network. By creating a virtual local area network dedicated to bringing data from those data processing systems performing mud logging to the a rig access local area network, traffic through only the mud logging network can be limited to only traffic required for communication with the mud logging data processing systems. Alternatively, a second network card having its own internet protocol address could be inserted for connecting the mud logging subnet to the rig access local area network. However, such a solution would require additional hardware and configuration within one of the mud logging data processing systems, and further runs the risk of exposing those mud logging data processing systems to external access or viruses.

The network of **FIG. 9** manages the use of scarce bandwidth resources, such as the external Internet link, to prioritize the traffic on that link. The network of **FIG. 9** can give bandwidth priority to critical data delivery, which is the primary reason for having external access. Critical data is data which is critical to drilling operations, that is not accessible from another location, such as office **816** of **FIG. 8**. Critical data delivery along with voice communications are provided at least a minimum certain allocated bandwidth. Whenever critical data delivery or voice communication is in use, they would be assured of having at least that minimum certain allocated bandwidth. The bandwidth allocation may be accomplished by such methods as, for example, but not limited to, using a quality of service and bandwidth filtering on the router. Additionally, the router can also monitor bandwidth consumption to determine what processes or users are utilizing the available bandwidth.

In general, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiments ensure wireless connectivity around the area where the equipment rack is located and on a rig floor. If total coverage on the rig is desirable, a site survey to design the placement, number, and type of access points and antennas required for full coverage can be performed. The access points may be placed on the rig with a wire connecting each one back to the switch. These access points may be powered locally by a power injector close to where they are mounted, or powered over Ethernet through the cable connecting them to the switch. Rather than connecting each access point by cable to the switch, the access points can be deployed in a grid or mesh where the first access point is wired to the switch, the second access point connects wirelessly to that access point, and the third connects wirelessly to the second, and so forth. Some mesh access points have only one radio so when they are deployed in a mesh, they can only operate in half duplex (i.e. they can only receive or transmit at any given time, but not both). Some access points have two radios so that they can operate in full duplex and transmit and receive at the same time. In order to provide good quality VOIP through the wireless local area network, the collaboration infrastructure methods, systems, and apparatuses of the invention use access points with two radios, or the access point may also be wired back to the switch. Mesh access points operating in half duplex may not give the necessary quality of service for good quality voice.

The collaboration infrastructure methods, systems, and apparatuses of the invention can also support video monitoring on the rig via video cameras, including wireless video cameras certified for hazardous areas. The output from these cameras can be tailored for the available bandwidth and the application requirements. The size of the picture, the resolution and the frequency of the updates can be reduced to accommodate the available bandwidth for transmission and storage.

Once a user has access to the Internet, they are free to initiate client based virtual private network sessions with the virtual private network gateways set up to access their company's private network. Each user may be securely connected back to their company's internal network. In addition, router based virtual private networks may be connected that would be more permanent and could allow specific subnets on the rig to be linked as if they were connected into their private networks.

As for VOIP, there are many ways to do VOIP today, that provide varying levels of reliability, clarity and flexibility. Each of these levels of service may have application in certain situations. The collaboration infrastructure methods, systems, and apparatuses of the invention are flexible enough to support all of them in appropriate situations, as described below.

The lowest level of VOIP allows communication from computer to computer using a microphone and the sound card in the computer. This capability is typically available for free using Net Meeting or one of several available free VOIP services. This level can be workable if a decent headphone or microphone is provided, but the quality is typically not very good.

The next level is a paid service where the user can connect from their computer to a phone by using the gateway that connects the Internet, to the public switched telephone network. This provides additional capability, however the quality is still subject to the quality of the network connection.

The third level of VOIP uses an analog phone connected to the router and a call manager remotely routes calls from the network to the public switched telephone network. In order to connect the phone to the router, a special card that does the analog to digital conversion is required, as well as, the router must have sufficient digital signal processing capability to compress and massage large volumes of digital information for transmission. If the remote connectivity provider for the rig also provides the call manager, then it is also providing the link from the rig to the hub and can provide the call gateway at the hub that links to the phone network. In that case, the service provider controls the whole path from the rig to the phone network and can prioritize the voice traffic in order to provide high quality voice. The reliability of the voice in this configuration would be much higher than in the previous cases, but of course is still limited by the bandwidth, latency, and quality of the remote network link. A major benefit of this configuration is that the solution can also support FAX, which is still a very popular way for transmitting images and documents.

Finally, the highest quality level of VOIP service involves the use of IP phones connected directly to the rig local area network. This level requires the use of more expensive digital IP phones connected directly to the network. These phones may be harder to get in the event of a failure or damage to the phone, which is another attraction to the previous level where an analog phone can be found in almost any consumer electronics store. This level of service requires a remote call manager like the third level, and this option can be a fairly expensive component of the infrastructure. This level can also support the new WIFI IP phones that connect to the wireless local area network on the rig and provide mobile communications. However, supporting VOIP on the wireless local area network, it has implications on how the wireless local area network is implemented, as discussed above. Another consideration when deciding which level of VOIP to implement is the issue of resilience of the phones on the rig during a remote connectivity outage. There are certain features in the router that can support local phone functions on the rig even if the

remote call manager cannot be reached. This feature is called Survivable Remote Site Telephony (SRST) and is an additional cost for the infrastructure at the rig.

The collaboration infrastructure methods, systems, and apparatuses of the invention also account for issues related to hazardous area certification. For example, with respect to rig cabling, there are generally two acceptable ways to cable Ethernet on a rig. The first is to use shielded and armored cable for runs on the rig. This type of cable is certified and is protected from being cut by the armor. The shielding provides noise protection to keep electrical and RF noise from degrading the signal. The second is an acceptable way is to use isolation barriers at each end of the Ethernet cable that limit the amount of power that can be used to transmit the signal. These barriers are available commercially and should be used any time a standard Cat 5 cable is run around a rig.

There are also several issues with wireless communications or related to wireless communications. First, any wireless installation must be capable of shutting down completely during explosive operations such as perforating or certain stuck pipe manipulations. While it is very difficult to eliminate all RF sources during these operations, any precaution that can be taken to minimize risk should be taken. Thus, for example, the collaboration infrastructure methods, systems, and apparatuses of the invention provide formal notification to rig management (e.g., company man, driller, etc.) that wireless connectivity is in operation and that it needs to be turned off during these hazardous operations.

Second are hazardous issues related to clients of the wireless networks. These clients must be certified if they are used in the hazardous areas. There are Zone 1 certified PDAs and rig floor displays available for this purpose. Also, these clients are RF sources and the collaboration infrastructure methods, systems, and apparatuses of the invention require them to be powered off during the hazardous operations on the rig. Just as all cell phones are turned off during explosive operations, so must WIFI clients be powered off.

Wireless access points may be used that are certified such that they cannot provide enough energy through their antenna and thus cannot cause an explosion. Similarly, certified antennas may also be used that can be connected to any access point in a pressurized or safe area and then run outside into the hazardous area.

There are many aspects of IT security that are also accounted for by the collaboration infrastructure methods, systems, and apparatuses of the invention. For example, there are several major activities required to protect any server connected to the Internet. This is especially true if the server is using Microsoft operating systems and tools, but is equally true for any server. First, the collaboration infrastructure methods, systems, and apparatuses of the invention ensure that security

patches are applied in a consistent way. Critical security patches protect the system from vulnerabilities that can be exploited by malicious hackers. Typically these patches are released monthly and should be applied in a timely manner. Of course, it is possible that some patches may break some software and are therefore tested before they are deployed in a production environment.

Second is virus protection. Servers on the rig must be set up to automatically update their .dat files on a regular basis and maintain their protection against new viruses being developed daily.

Third is firewall and access protection. The collaboration infrastructure methods, systems, and apparatuses of the invention preferably provide firewall protection via an external firewall appliance. To this end, enterprise class routers can provide firewall protection as well as a detailed control of who can access a server, from where, and on which ports and services. In addition, depending on the operating system deployed, there are software firewalls available that can provide some protection from attacks. Many Internet service providers and remote connectivity providers can also provide "clean" Internet access and protect customers from port scans and other malicious activity by having their own firewalls and security systems.

Servers on rigs will require some level of remote administration. The collaboration infrastructure methods, systems, and apparatuses of the invention preferably implement this administration through a series of options on Microsoft systems, including, but not limited to, Microsoft® Remote Terminal Server, NetMeeting® Remote Desktop Sharing, available from Microsoft Corporation, Timbuktu®, available from Netopia, Inc., RealVNC, available from RealVNC, Ltd., and PCAnywhere® available from Symantec, Corp. Any of these packages allow an administrator to take control of the machine remotely. Each has certain performance and security benefits and issues. In addition to these packages, administration can also be done using Web access to the server. Still other administration can be better done through a command line. All these packages may be susceptible to intermittent network issues and sometimes it will be necessary to reboot the server to clear crashed or hung services. This can be done through a command line using telnet and the like if the Windows interface is hung. There are a number of commercial and shareware packages available that provide these types of services on Windows computers. Remote administration through commercially available appliances that can provide out of band access to the server in the event of network outage or the need to power off and restart the server is also contemplated by the collaboration infrastructure methods, systems, and apparatuses of the invention.

Referring now to **FIG. 10**, a flowchart illustrating the method steps for providing a collaboration infrastructure is shown according to an illustrative embodiment. Process **1000** facilitates the infrastructure of **FIG. 8**.

Process **1000** begins by collecting multiple types of oil well data at the oil well site to form an aggregated data (step **1010**). Process **1000** then stores the aggregated data in a data aggregation server at the oil well site (step **1020**).

Process **1000** then stores a local copy of the aggregated data on a local server at the remote location (step **1030**). Process **1000** then allows a first user at the oil well site and a second user at the remote location to access the aggregated data on the data aggregation server using a standard data format (step **1040**).

Process **1000** allows the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center (step **1050**). Process **1000** allows the users at the remote location to access the aggregated data on the local server (step **1060**), with the process terminating thereafter.

The collaboration infrastructure methods, systems, and apparatuses of the invention also provide real-time monitoring to ensure problems with the infrastructure are detected before they delay drilling operations, and to facilitate fast and straightforward troubleshooting. Monitoring is also performed to provide objective measures of whether the infrastructure is delivering the service levels agreed in any contract.

In one implementation, commercially available basic server monitoring is used to provide early detection of problems related to server load, disk space, memory consumption or other common problems related to server management. To this end, commercial tools are available that can give early warning of disk space issues or processor overload.

Network monitoring is also performed to detect network abuse or configuration issues or even hardware failures causing reduced performance. Network monitoring can identify bottlenecks or problems due to viruses or worms, or other compromises of the security of the infrastructure. Monitoring the wireless network can detect rogue access points, unauthorized users or outages, or connectivity issues with the access points.

The collaboration infrastructure methods, systems, and apparatuses of the invention also perform application monitoring in order to measure the overall effectiveness of the infrastructure and detect problems with data delivery before users or applications are affected.

Furthermore, as drilling rigs are operating around-the-clock and teams need to collaborate together during critical periods regardless of the time of day or night, a solid support hierarchy must

be in place. To this end, the collaboration infrastructure methods, systems, and apparatuses of the invention also provide an around-the-clock help desk that can take phone calls, log issues in an issue tracking system, and either resolve the issue or escalate it to the appropriate resource. Detailed troubleshooting procedures implemented by the collaboration infrastructure methods, systems, and apparatuses of the invention allow this first line of support to begin resolution immediately and effectively route the problem for resolution as needed.

A second line of support involves network and remote connectivity support or a dedicated engineer assigned to the rig. The second line of support is invoked if the first line of support is unable to resolve the issue, but it can be determined that connectivity is the cause. If the problem is still unresolved, then it is escalated to the remote connectivity vendor.

Remote connectivity from the rig to the remote location is required in order for the virtual team to communicate. In one implementation, the collaboration infrastructure methods, systems, and apparatuses of the invention provide this remote connectivity via mobile satellite connections that offer varying amounts of bandwidth as required. These mobile satellite connections can typically provide Internet access or direct access to a private corporate network.

In addition to satellite, other solutions based on wireless technologies like WiMax and long range WiFi may also be used to provide broadband connectivity to the rig. These alternative solutions have the benefits of potentially lower bandwidth charges and higher ultimate throughput as well as reduced latency due to the lack of satellite hops.

Although the foregoing is provided for purposes of illustrating, explaining and describing certain embodiments of the invention in particular detail, modifications and adaptations to the described methods, systems and other embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of the invention.

## CLAIMS

What is claimed is:

1. A method of facilitating collaboration between users at an oil well site and users at a remote location, comprising:

collecting multiple types of oil well data at the oil well site to form an aggregated data;

storing the aggregated data in a data aggregation server at the oil well site; and

allowing a first user at the oil well site and a second user at the remote location to access the aggregated data on the data aggregation server using a standard data format.

2. The method of claim 1, further comprising:

conforming the aggregated data to the standard data format in a data repository;

storing a local copy of the aggregated data on a local server at the remote location; and allowing the users at the remote location to access the aggregated data on the local server.

3. The method according to claim 1, wherein the users at the oil well site access the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

4. The method according to claim 1, wherein the users at the remote location access the multiple types of oil well data via a satellite communication link.

5. The method according to claim 1, further comprising providing an operations support center at the remote location and allowing the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

6. The method according to claim 1, wherein the users at the oil well site and the users at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

7. The method according to claim 1, wherein the oil well site is an offshore site and the remote location is an onshore location.

8. A system for facilitating collaboration between users at an oil well site and users at a remote location, comprising:

a set of data aggregation servers configured to collect multiple types of oil well data at the oil well site, wherein the set of data aggregation servers is configured to store the multiple types of oil well data as aggregated data;

a first set of subsystems configured to conform the aggregated data to a standard data format in a data repository; and

a second set of subsystems configured to allow a first user at the oil well site and a second user at the remote location to access the aggregated data using the standard data format.

9. The system according to claim 8, wherein the first user at the oil well site accesses the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

10. The system according to claim 8, wherein the second user at the remote location accesses the multiple types of oil well data via a secured satellite connection.

11. The system according to claim 8, further comprising:

an operations support center located at the remote location, wherein the operations support center comprises a third set of subsystems configured to allow a third user at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

12. The system according to claim 8, further comprising a fourth set of subsystems certified for use at the oil well site for hazardous areas, wherein the fourth set of subsystems includes computing and communication equipment.

13. The system according to claim 8, wherein the first user at the oil well site and the users at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

14. The system according to claim 8, wherein the oil well site is an offshore site and the remote location is an onshore location.

15. An oil rig located at a well site for facilitating collaboration between users at the well site and users at a remote location, the oil rig comprising:

a drilling tool advanced into a subterranean formation with geological structures and reservoirs therein;

a set of data aggregation servers configured to collect multiple types of oil well data at the oil well site, wherein at least one data aggregation server is configured to store the multiple types of oil well data as aggregated data;

a first set of subsystems configured to conform the aggregated data to a standard data format in a data repository; and

a second set of subsystems configured to allow a first user at the oil well site and a second user at the remote location to access the aggregated data using the standard data format.

16. The oil rig of claim 15, wherein the first user at the oil well site accesses the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

17. The oil rig of claim 15, wherein the second user at the remote location accesses the multiple types of oil well data via a secured satellite connection.

18. The oil rig of claim 15, further comprising

a third set of subsystems certified for use at the oil well site for hazardous areas, the at least one subsystem including computing and communication equipment.

19. The oil rig of claim 15, wherein the first user at the oil well site and the second user at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

20. The oil rig of claim 15, wherein the oil well site is an offshore site and the remote location is an onshore location.

21. A method for controlling a drilling operation for an oilfield, the oilfield having a wellsite with a drilling tool advanced into a subterranean formation with geological structures and reservoirs therein, comprising:

collecting multiple types of oil well data at the oil well site to form an aggregated data;

storing the aggregated data in a data aggregation server at the oil well site; allowing a first user at the oil well site and a second user at a remote location to access the aggregated data on the data aggregation server using a standard data format; and

controlling drilling operations based on the aggregated data.

22. The method of claim 21, further comprising:

storing a local copy of the aggregated data on a local server at the remote location; and

allowing the second user at the remote location to access the aggregated data on the local server.

23. The method according to claim 21, wherein the users at the oil well site access the multiple types of oil well data via a set of private virtual local area networks and wherein each private virtual local area network in the set of private virtual local area networks allows a different level of access to the multiple types of oil well data.

24. The method according to claim 21, wherein the second user at the remote location accesses the multiple types of oil well data via a satellite communication link.

25. The method according to claim 21, further comprising providing an operations support center at the remote location and allowing the second user at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

26. The method according to claim 21, wherein the users at the oil well site and the second user at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

27. The method according to claim 21, wherein the oil well site is an offshore site and the remote location is an onshore location.

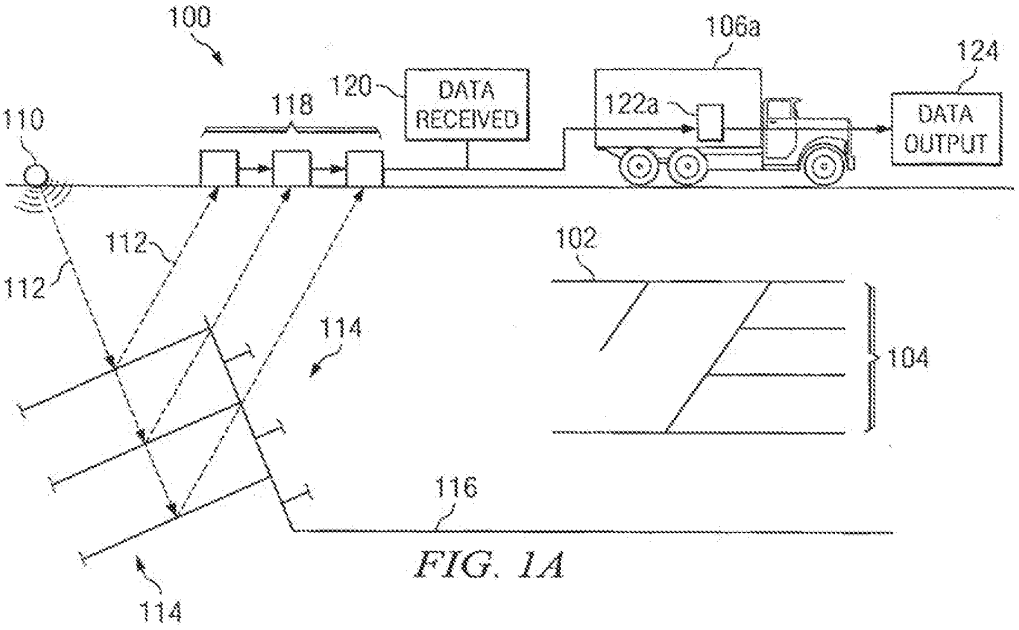

100
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DATA RECEIVED
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DATA OUTPUT
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112
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114

FIG. 1A

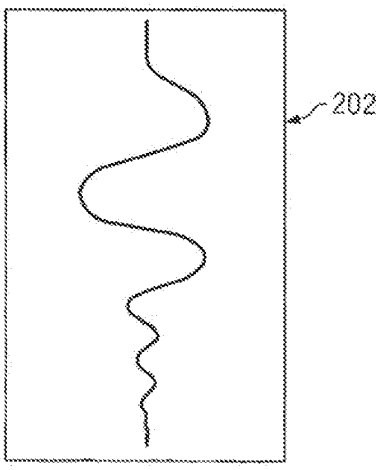

202

FIG. 2A

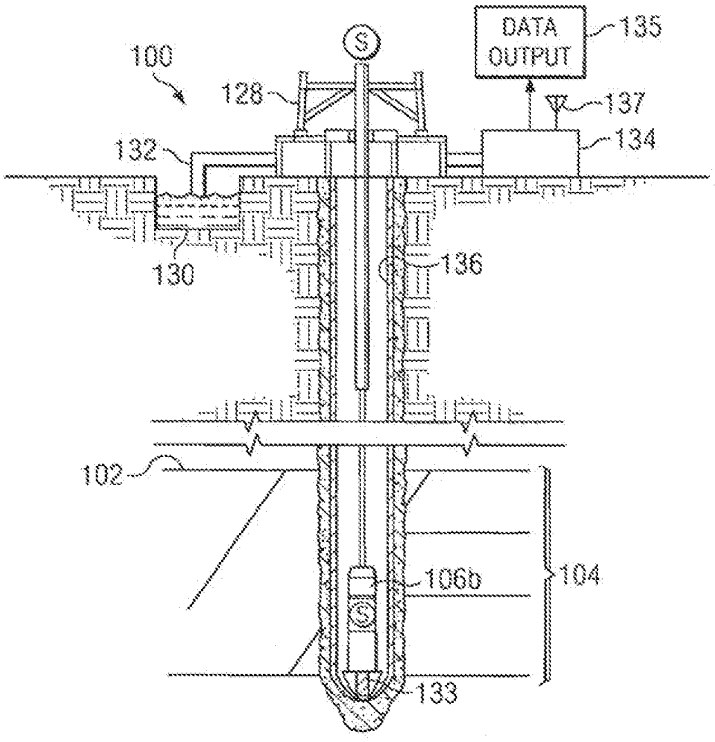

DATA
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133

FIG. 1B

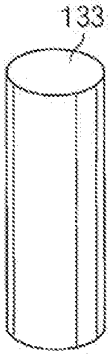

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FIG. 2B

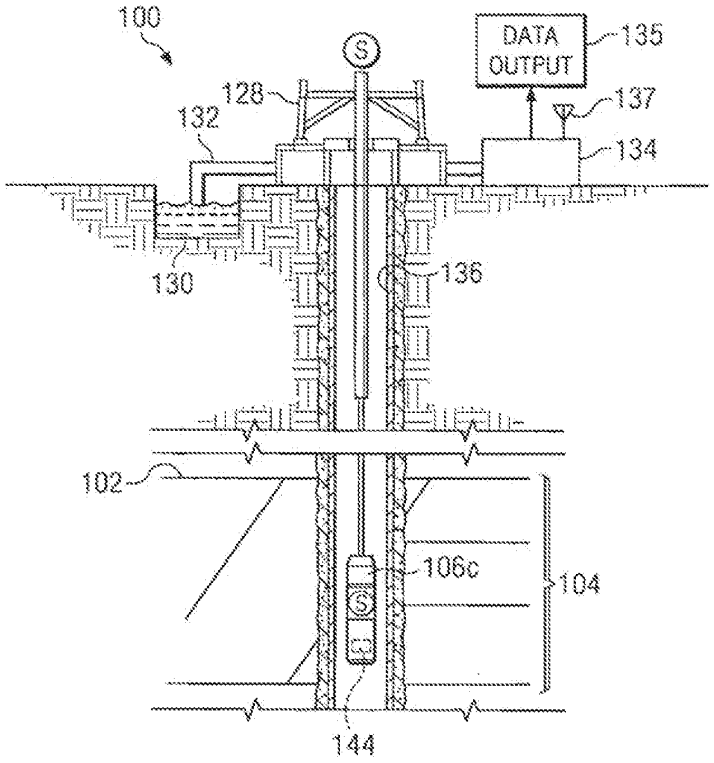

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DATA OUTPUT
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137
134
130
136
102
106c
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144

FIG. 1C

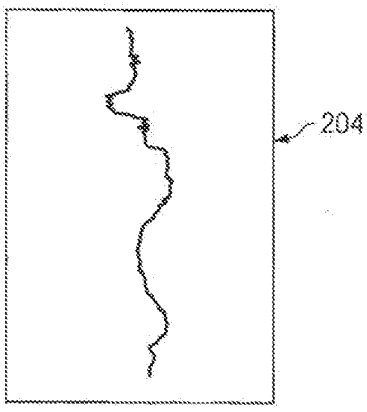

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FIG. 2C

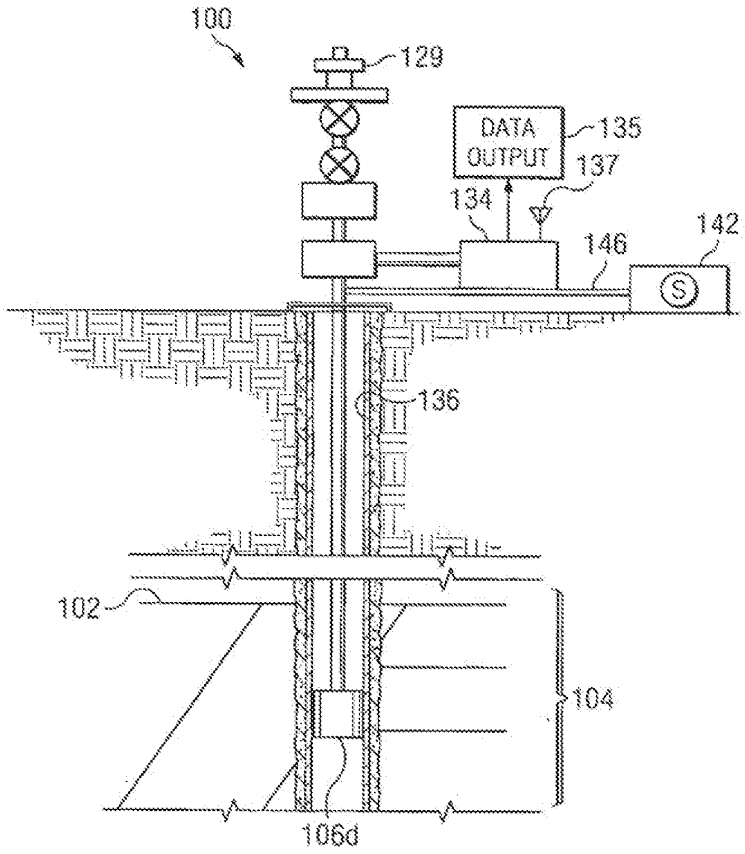

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DATA OUTPUT
135
137
134
142
146
S
136
102
104
106d

FIG. 1D

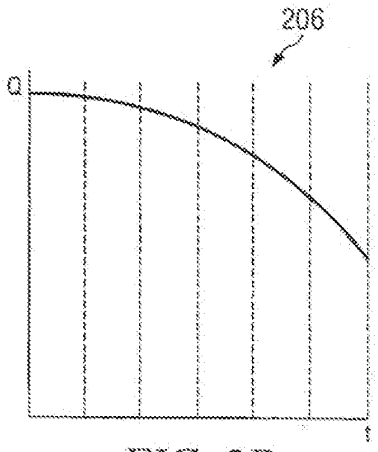

206
Q
t

FIG. 2D

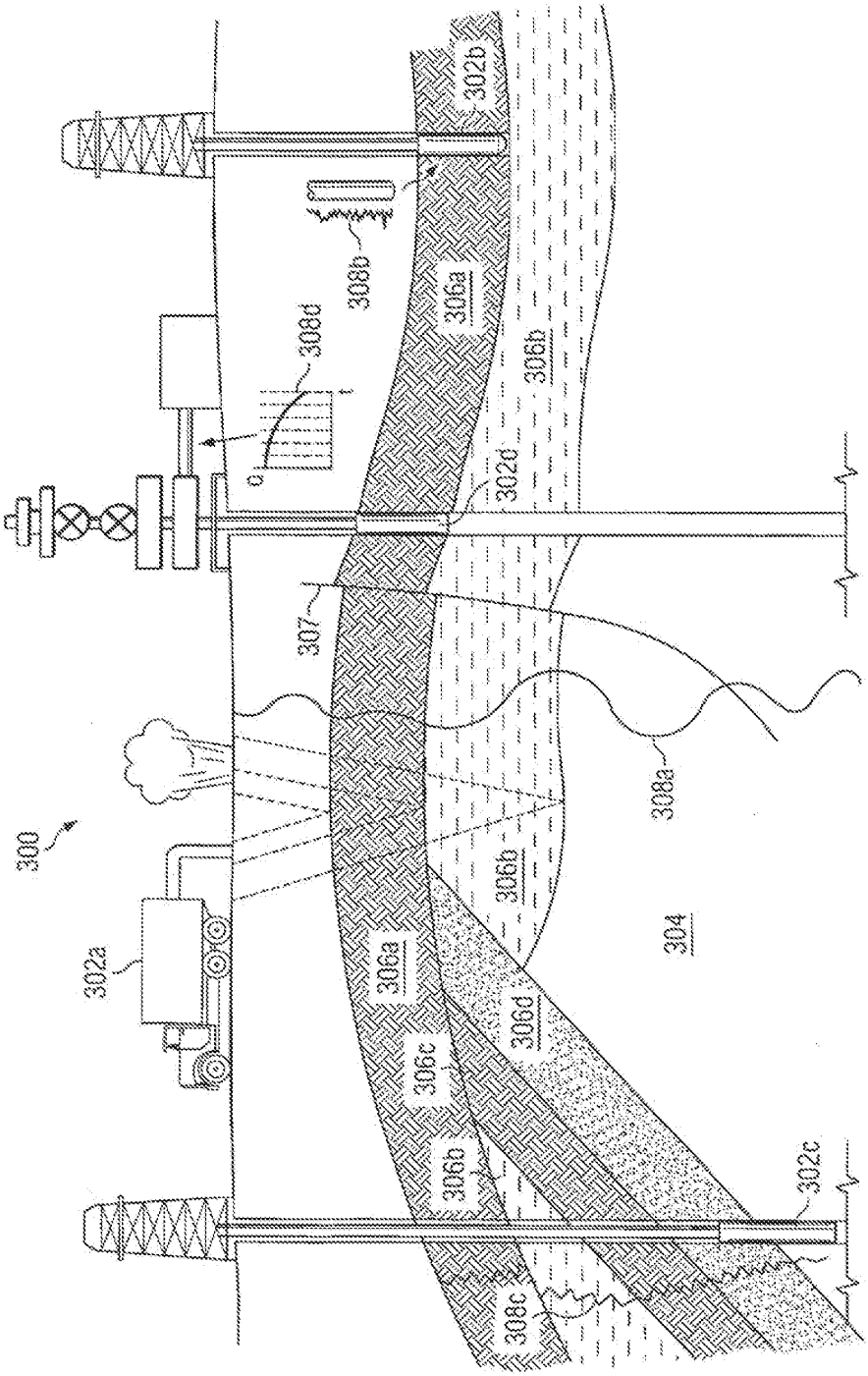

300
302a
302b
302c
302d
304
306a
306b
306c
306d
307
308a
308b
308c
308d
0
1

FIG. 3

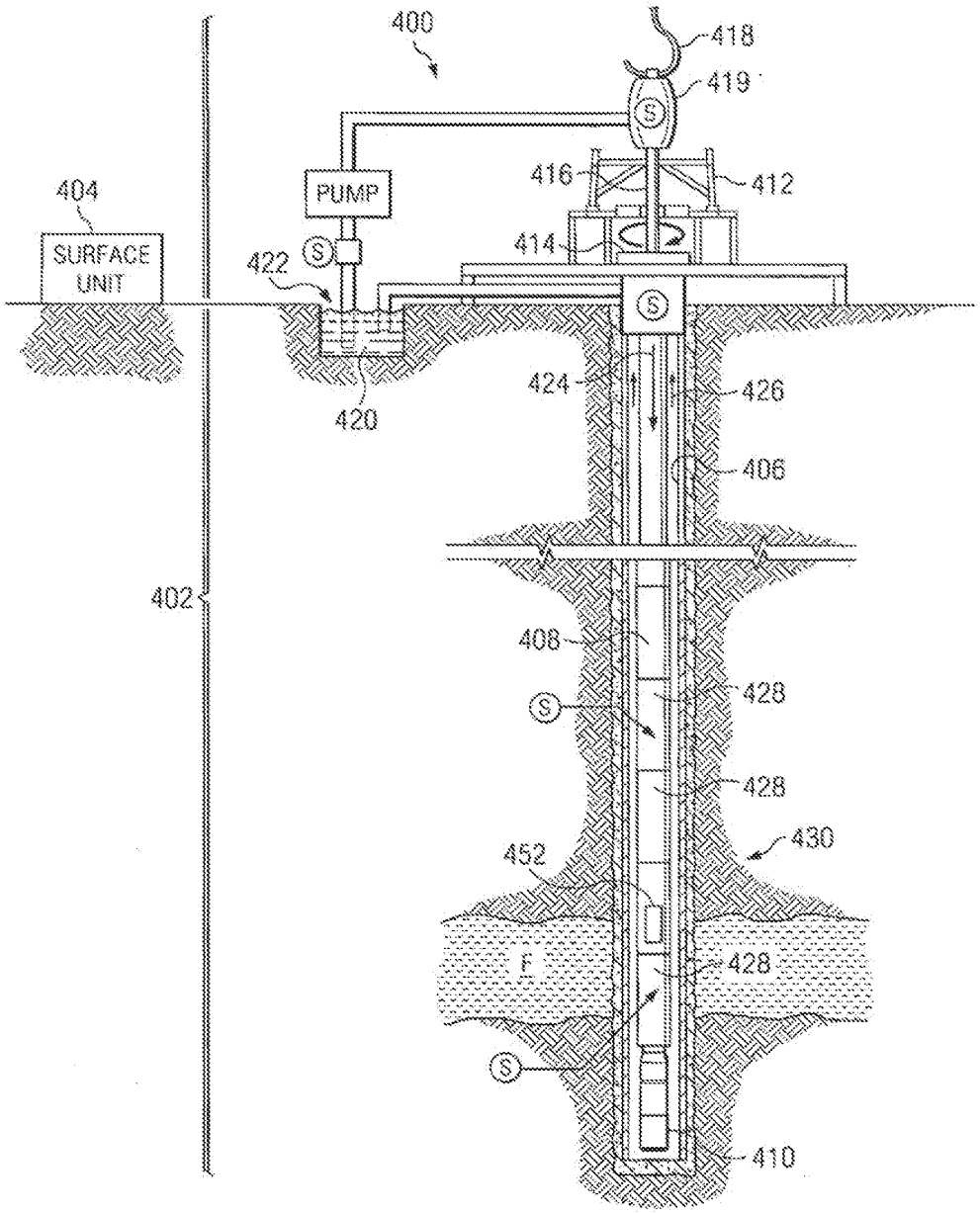

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418
419
S
416
412
PUMP
404
SURFACE UNIT
414
422
S
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402
408
S
428
428
430
452
F
428
S
410

FIG. 4

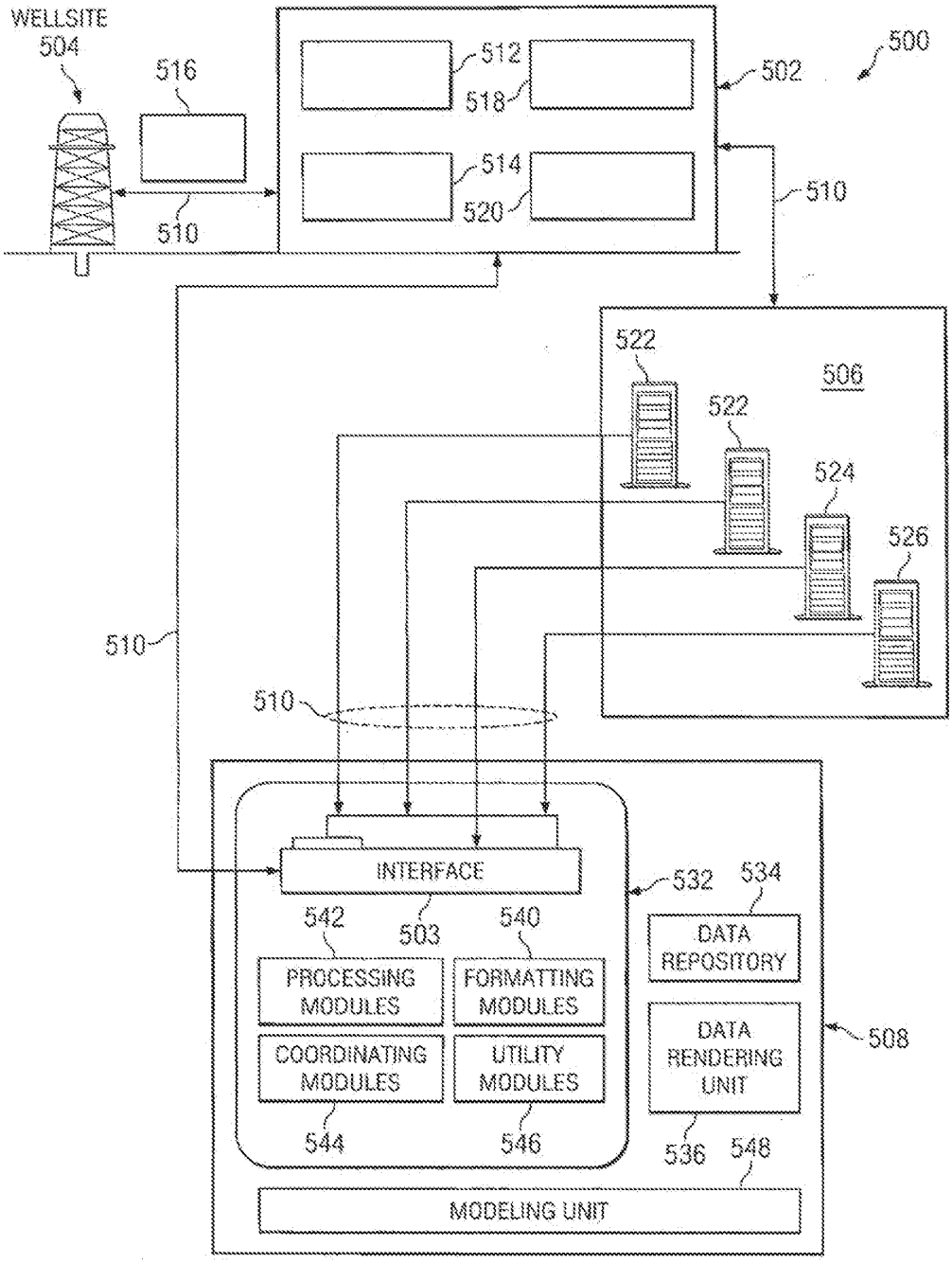

WELLSITE
504
516
512
518
502
500
514
520
510
510
522
506
522
524
526
510
510
INTERFACE
532
534
542
503
540
DATA
REPOSITORY
PROCESSING
MODULES
FORMATTING
MODULES
COORDINATING
MODULES
UTILITY
MODULES
DATA
RENDERING
UNIT
508
544
546
536
548
MODELING UNIT

*FIG. 5*

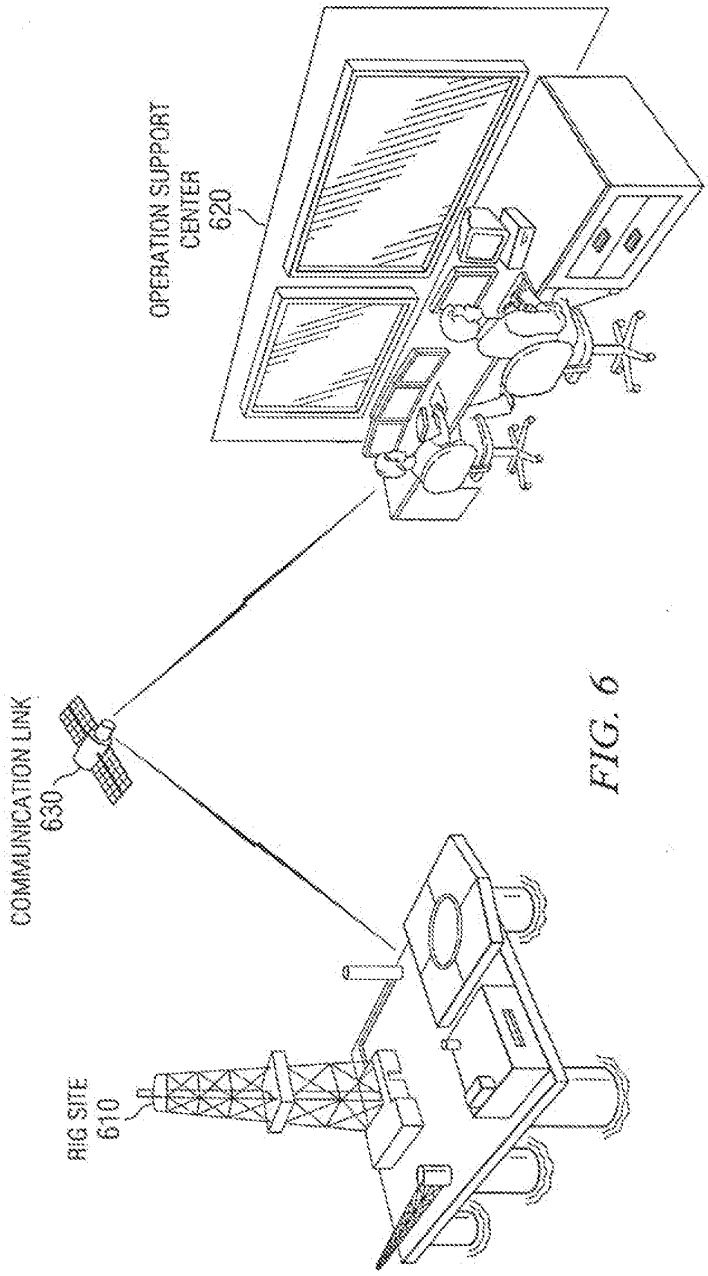

OPERATION SUPPORT CENTER
620
COMMUNICATION LINK
630
RIG SITE
610

FIG. 6

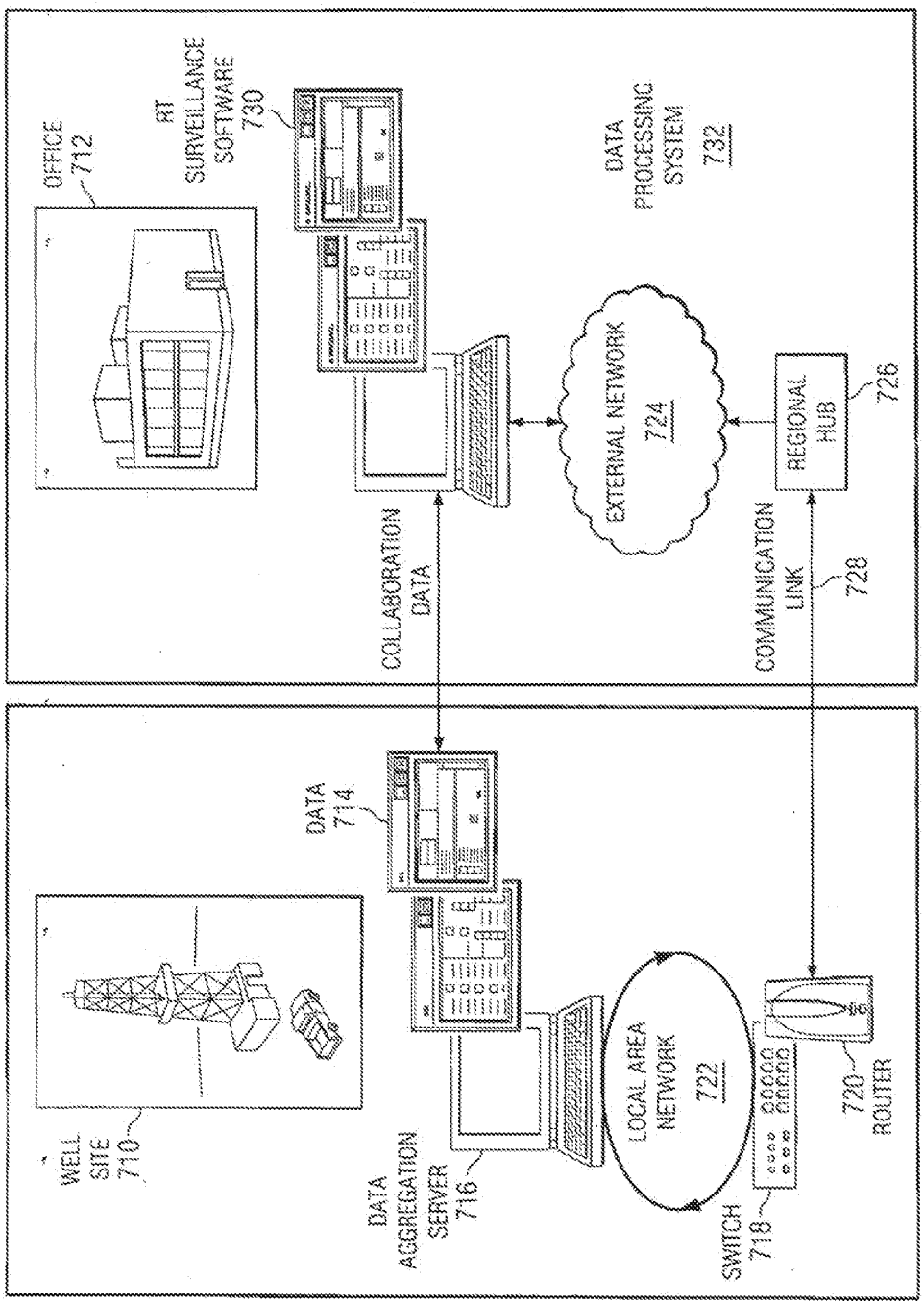

OFFICE
712
RT
SURVEILLANCE
SOFTWARE
730
DATA
PROCESSING
SYSTEM
732
EXTERNAL NETWORK
724
REGIONAL
HUB
726
COLLABORATION
DATA
COMMUNICATION
LINK
728
DATA
714
WELL
SITE
710
DATA
AGGREGATION
SERVER
716
LOCAL AREA
NETWORK
722
SWITCH
718
720
ROUTER

FIG. 7

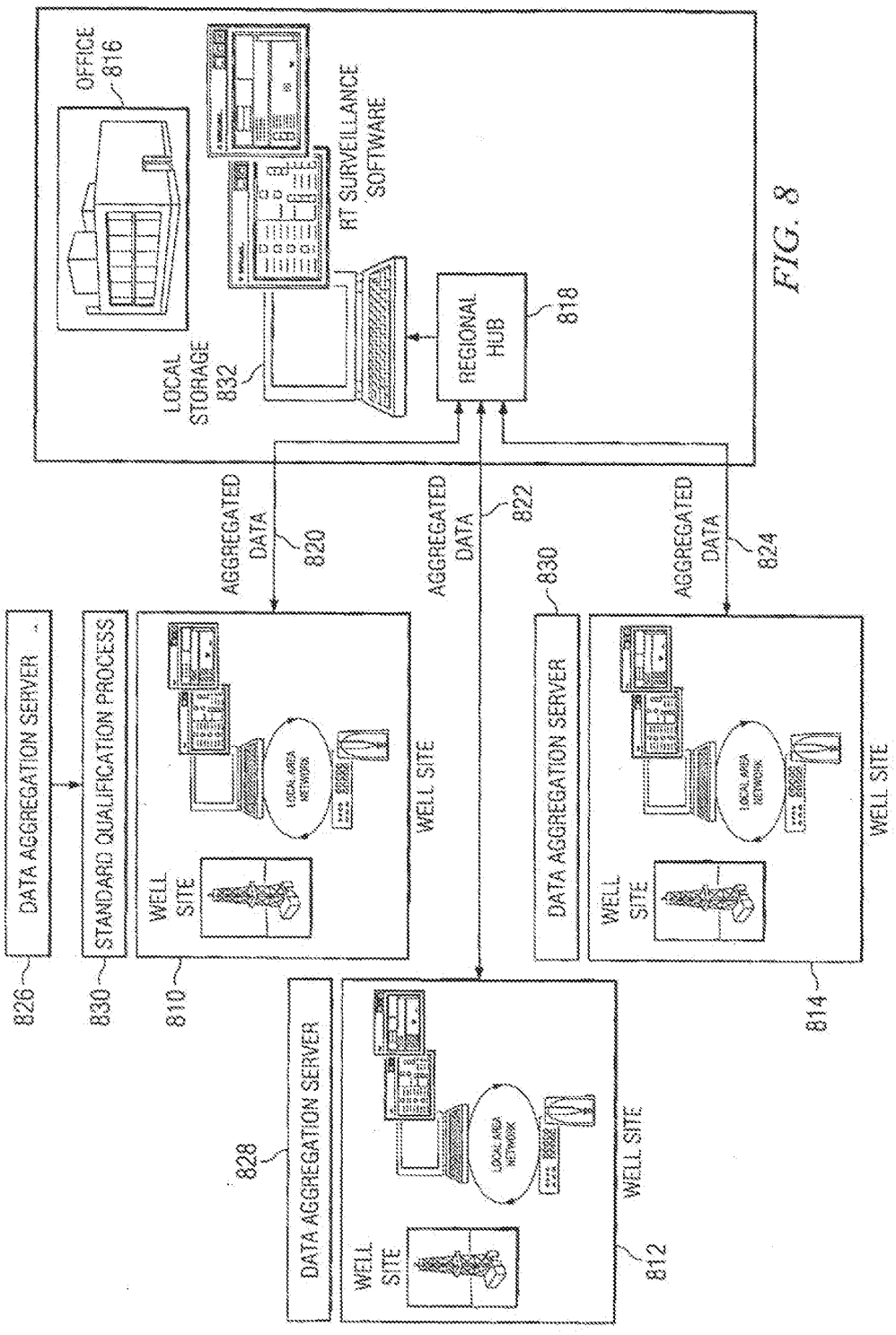

OFFICE
816
RT SURVEILLANCE SOFTWARE
LOCAL STORAGE
832
REGIONAL HUB
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AGGREGATED DATA
820
AGGREGATED DATA
822
AGGREGATED DATA
824
DATA AGGREGATION SERVER
826
STANDARD QUALIFICATION PROCESS
830
WELL SITE
810
DATA AGGREGATION SERVER
828
WELL SITE
812
DATA AGGREGATION SERVER
830
WELL SITE
814

FIG. 8

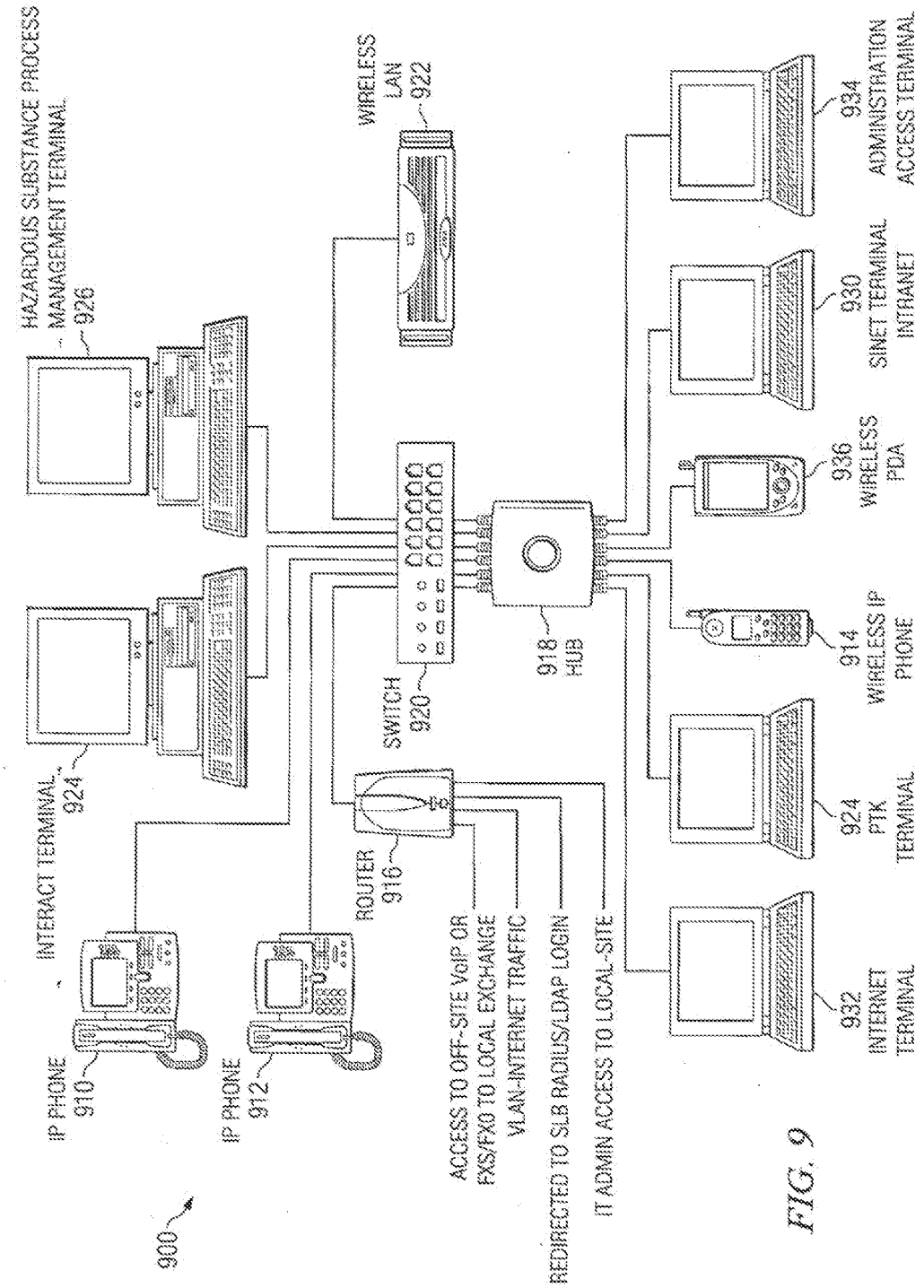

900
IP PHONE 910
IP PHONE 912
INTERACT TERMINAL 924
ROUTER 916
SWITCH 920
HUB 918
WIRELESS LAN 922
HAZARDOUS SUBSTANCE PROCESS MANAGEMENT TERMINAL 926
ACCESS TO OFF-SITE VoIP OR FXS/FXO TO LOCAL EXCHANGE VLAN-INTERNET TRAFFIC
REDIRECTED TO SLB RADIUS/LDAP LOGIN
IT ADMIN ACCESS TO LOCAL-SITE
932 INTERNET TERMINAL
924 PTK TERMINAL
914 WIRELESS IP PHONE
936 WIRELESS PDA
930 SINET TERMINAL INTRANET
934 ADMINISTRATION ACCESS TERMINAL

FIG. 9

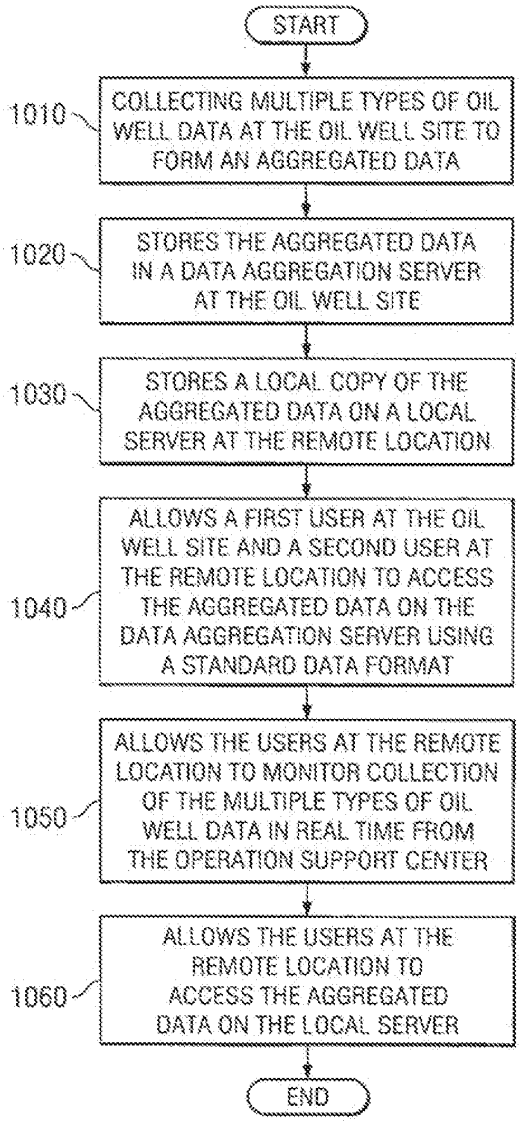

START
1010
COLLECTING MULTIPLE TYPES OF OIL WELL DATA AT THE OIL WELL SITE TO FORM AN AGGREGATED DATA
1020
STORES THE AGGREGATED DATA IN A DATA AGGREGATION SERVER AT THE OIL WELL SITE
1030
STORES A LOCAL COPY OF THE AGGREGATED DATA ON A LOCAL SERVER AT THE REMOTE LOCATION
1040
ALLOWS A FIRST USER AT THE OIL WELL SITE AND A SECOND USER AT THE REMOTE LOCATION TO ACCESS THE AGGREGATED DATA ON THE DATA AGGREGATION SERVER USING A STANDARD DATA FORMAT
1050
ALLOWS THE USERS AT THE REMOTE LOCATION TO MONITOR COLLECTION OF THE MULTIPLE TYPES OF OIL WELL DATA IN REAL TIME FROM THE OPERATION SUPPORT CENTER
1060
ALLOWS THE USERS AT THE REMOTE LOCATION TO ACCESS THE AGGREGATED DATA ON THE LOCAL SERVER
END

*FIG. 10*

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/002432

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B47/12

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2005/092523 A1 (MCCASKILL JOHN W [US] ET AL) 5 May 2005 (2005-05-05) paragraphs [0044] - [0047]; figure 6 | 1-27 |
| X | WO 02/25319 A (WEATHERFORD LAMB [US]; HARDING RICHARD PATRICK [GB]; LONGBOTTOM JAMES) 28 March 2002 (2002-03-28) page 5, line 20 - page 8, line 2; figures 1,6 | 1-27 |
| X | WO 2004/104373 A (SILVERS DAVID [US]; SILVERSMITH INC [US]) 2 December 2004 (2004-12-02) claim 1; figure 1 | 1-27 |
| A | US 2006/047527 A1 (CAVENY WILLIAM J [US] ET AL) 2 March 2006 (2006-03-02) paragraph [0026]; figure 2 | 1-27 |

-/--

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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

"P" document published prior to the international filing date but later than the priority date claimed

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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

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 9 July 2008 | 24/07/2008 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Strømmen, Henrik |

Form PCT/ISA/210 (second sheet) (April 2005)

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/002432

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 2006/240818 A1 (MCCOY ROBERT [US] ET AL) 26 October 2006 (2006-10-26) the whole document | |

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2008/002432

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | WO 2006116118 A1 | 02-11-2006 |

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(54) Title: REAL-TIME ONSITE INTERNET COMMUNICATION WITH WELL MANAGER FOR CONSTANT WELL OPTIMIZATION

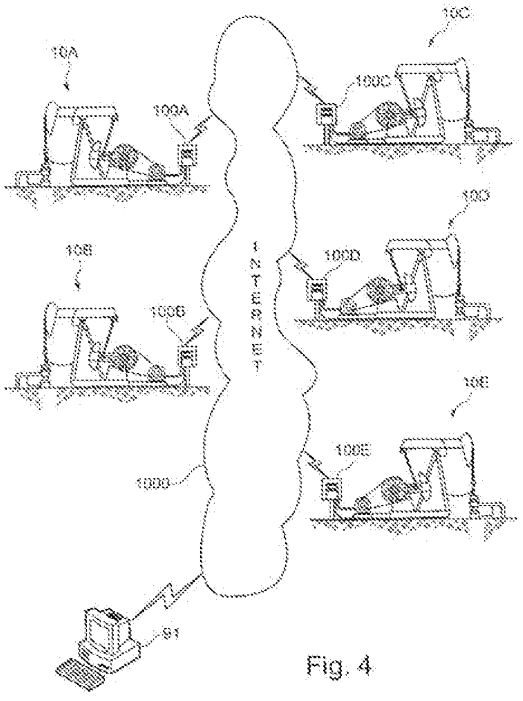



Fig. 4

(57) Abstract: An apparatus and method for well control and monitoring including an independent web server computer integrated with a pump controller located at each well in an oil field. The well controller locally controls the well pump, processes well and pump data, generates surface and downhole cards, and communicates production reports, recommendations for production improvements, and production statistics to remote sites via the internet. The controller can be queried remotely to provide production reports, etc. Furthermore, the controller can initiate alerts via email, text messaging, or internet messaging, for example, during fault conditions.

WO 2008/124765 A1

ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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

**Published:**

- *with international search report*
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# REAL-TIME ONSITE INTERNET COMMUNICATION WITH WELL MANAGER FOR CONSTANT WELL OPTIMIZATION

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates generally to methods and apparatus for remotely monitoring, controlling, and automating the operation of pumps for the production of hydrocarbons and dewatering, for example, and more specifically to a controller for rod pumps, progressing cavity pumps, injection well control, variable speed drives, well gas measurement, et cetera, for continuous optimization thereof.

### 2. Description of the Prior Art

Hydrocarbons are often produced from well bores by sucker rod pumps, reciprocating pumps driven from the surface by pumping units that move a polished rod up and down through a packing gland at a wellhead. The units may be of the predominant beam type or any other type that reciprocates the polished rod.

Because the incremental cost of larger sucker rod pumps is usually less than the added value realized by producing oil from the wells at the highest possible rate, sucker rod pumping units are typically sized to pump faster than the wells can produce. Consequently, sucker rod pumps periodically run out of liquids to pump and draw gas into the cylinders through the standing valves. The term "pumped-off" is used to describe the condition where the fluid level in the well is not sufficient to completely fill the pump barrel on the upstroke. On the next down stroke the plunger will impact the fluid surface in the incompletely filled barrel and send shock waves through the rod string and other components of the pumping system. This "fluid pound"

lowers well production efficiency and over time can cause damage to the drive unit or downhole pump, such as broken rods.

To minimize running pumped-off, sucker rod pumps are generally operated with some type of controller. Early controllers consist of simple controllers, such as clock timers that start and stop the pumping unit in response to a user selectable program, allowing the well to fill during the times when the pump is switched off. However, simple clock timers are not responsive to actual well conditions and do not detect actual pump-off conditions.

Thus, in the early 1970s, a viable well control method evolved using more sophisticated controllers that stop the rod pump when a well actually pumps-off. This method is known as pump off control (POC). Over the years, POC has employed different algorithms to sense pump-off conditions. Some of these involve measurement of changes in surface load, motor current, or motor speed.

In addition to running a rod pump in a pumped-off state, other abnormal conditions of the pump operation reduce well production efficiency. Common abnormal conditions include tubing movement, gas interference, an inoperative pump, the pump hitting up or down, a bent barrel, a sticking pump, a worn plunger or traveling valve, a worn standing valve, a worn or split barrel, fluid friction, and drag friction. As many of these problems gradually appear and progressively worsen, early detection of these problems can often minimize the cost of maintenance, minimize the cost of inefficient operation, and prevent or minimize the loss of production.

Traditionally, troubleshooting and repair of pump problems requires lifting the entire down-hole unit to the surface. It is not unusual to have a mile or more of sucker rods or tubing that must be lifted and disassembled by a single or pair of twenty-five or thirty foot long sections

at a time. This method of pump diagnosis and troubleshooting is costly both in terms of labor costs and lost revenue from the well.

Fortunately, many pump health indications and abnormal operating conditions can be detected by accurate monitoring of the pump operation, reducing the need for physical inspection of the downhole pump components and lowering the cost of well troubleshooting. Thus, from its humble beginning of merely stopping the well to prevent the mechanical damage of fluid pound and the inefficiency associated with operating an incompletely filled pump, POC has evolved in the last quarter century into a diagnostic system with robust well management capabilities. Gradually the phrase "pump off control" has been replaced with terms like "well manager," "rod pump controller," et cetera. (Lufkin Automation uses the trademark SAM® Well manager to identify its rod pump control system.) These newer terms connote more than pump off control. The later systems generally include diagnostic capability and collection and analysis of performance data for operation of the well in an economic fashion.

Many of these intelligent well controllers monitor work performed, or something that relates to work performed, as a function of polished rod position. This information is used, for example, to determine if the well is in a pumped-off condition, if valves are leaking or stuck, or for troubleshooting a wide variety of other problems. This information is generally presented and analyzed in the form of a plot of polished rod load versus polished rod position as measured at the surface. For a normally operating pump, the shape of this plot, known as a "surface card" or "surface dynagraph," is generally an irregular elliptical shape. The area bounded by this curve, often referred to as the surface card area, is proportional to the work performed by the pump. Many pump-off controllers utilize a surface dynagraph plot to determine when the sucker rod pump is not filling to shutdown the pump for a time period. For example, U.S. Pat. No.

3,951,209, issued Apr. 20, 1976 to Gibbs, describes a controller that measures at the surface both the load on the rod string and the displacement of the rod string to determine a pump-off condition and is incorporated herein by reference.

However, because the surface card is not always an accurate representation of the load and displacement of the downhole rod string, particularly for deep wells, more accurate well control is achieved by using a "downhole card," i.e., a plot of load versus rod string displacement as measured at the downhole pump. The downhole card is immensely useful. Its shape reveals defective pumps, completely filled pumps, gassy or pounding wells, unanchored tubing, parted rods, etc. Furthermore, the downhole card can be used to sense tubing leaks. Quantitative computation of pump leakage from downhole cards is described in "Quantitative Determination of Rod-Pump Leakage with Dynamometer Techniques," Nolen, Gibbs, SPE Production Engineering, August 1990.

When first developed in 1936, the downhole pump card was directly measured by a dynamometer located at the subsurface pump. The measured data was retrieved by the costly process of pulling the rods and pump. Because even today these measurements are not easily directly obtained, requiring a costly telemetry system to relay the data to the surface, methods have been developed to calculate the downhole dynagraph from the more easily obtained surface card. One such method is described in U.S. patent 3,343,409 (Gibbs), which is incorporated herein by reference. Gibbs utilizes surface measurements of load and position of the rod string to construct a downhole pump card; to produce the downhole card, solutions to a wave equation to satisfy dynamometer time histories of surface rod load and position are calculated by the use of a computer.

In addition to identification of abnormal well conditions or pump malfunctions, the most advanced of today's well managers can also infer well production rates with considerable accuracy by using the subsurface pump as a flow meter and the downhole card to compute producing pressure, liquid and gas throughput, and oil shrinkage effects. In other words, production rates can be determined continuously without the use of traditional metering equipment or production tests. For example, a decline in production rate can corroborate a mechanical problem indicated by a downhole card; the downhole pump may be worn or a tubing leak may have developed. The decline may also be caused by a change in reservoir conditions in the drainage area of the well; the receptivity of an offset injection well may have diminished, which may have resulted in a producing pressure decline and a decrease in production rate. Conversely, an increase in productivity as calculated by a well manager may indicate that the well is responding to secondary recovery efforts; the well should be pumped more aggressively to obtain the increased production that is available. These sophisticated well managers are instrumental in many facets of oil production including economic operation of the oilfield as a business venture, compliance with governmental regulations, well troubleshooting, and estimation of reservoir reserves. A method of inferred production using a well manager is taught by Gibbs in co-pending U.S. Patent Application No. 10/940,273, which is incorporated herein by reference.

Of significant use is the ability of well managers to communicate with a central host computer for supervisory control and data acquisition (SCADA). For example, a well manager unit receives surface rod and load information (or equivalent measurements), measures a surface card, computes a downhole card, and locally displays a graphical representation of the surface card and/or the downhole card for the operators' ease and benefit. However, the benefit of the

well manager features is diminished when the operator must be present at the well site to see and analyze the well data. A well manager with SCADA capability, on the other hand, can automatically transfer well data to a distantly located control station. SCADA allows information about the subsurface pump, including well and pump performance data, inferred fluid production over time, and surface and downhole cards, to be both displayed locally for manual recording and automatically sent to a distant central location. Furthermore, the SCADA system may be configured to send alarms, allowing problems to be timely announced. Control signals may also be sent from the central control station to the well manager. SCADA capability reduces or eliminates the need for an individual to visit the well site to determine the status at the controller and results in several advantages, including reducing delays in notifying the operator of alert or alarm conditions, increasing the accuracy of the disseminated well manager data, lowering costs of managing oil fields, and minimizing the need for the operator to visit potentially hazardous well sites. Thus, most sophisticated well managers have a built-in SCADA capability to communicate data by radio, hardwire, or telephone. This telemetry capability makes it possible for one or more computers to retrieve data from a controller, obtain status of operations, issue control instructions, monitor for alarms, and develop reports.

Although current SCADA systems provide some remote connectivity between a remote site and a number of well managers in an oil field, they generally employ expensive proprietary hardware and short-range RF radios of low bandwidth. Typical SCADA systems are polling systems that can only interrogate each well a few times each day to retrieve dynamometer and other performance data. Therefore downhole pump cards can on average be reviewed at the central location via SCADA only a few times each day.

Therefore, it is desirable to provide higher data throughput and continuous connectivity to a well manager by exploiting current internet technology. Such technology integrated with today's sophisticated well controllers would allow more well data to be collected at a central location at a lower cost. Several patents address connecting an oilfield to the internet. For example, U.S. Patent No. 6,857,474 issued to Bramlett et al. on February 22, 2005 shows a rod pump well manager with the capability to display a graphical pump card at a remote output display via an internet link 131 and is incorporated herein by reference. However, Bramlett's teaching is limited to using the internet to remotely display graphical surface and downhole cards; Bramlett does not disclose sending well production reports, statistics, pump diagnostics, alarms, alerts or other data from the well manager to remote users via the internet or receiving control data at the well manager from remote users over the internet.

The method according to U.S. Patent No. 7,096,092 issued to Ramakrishnan et al. on August 22, 2006 is illustrated in Figure 1. Ramakrishnan shows a method of managing oil fields including installing oil field sensors (50) on oil wells (60, 61, 62) , connecting the sensors (50) to computer controllers (52) disposed at the wells (60, 61, 62) for data collection and data analysis, and connecting a number of local oil field controllers (52) to a central web server (54). Access to oil field data in real time is provided to a remote computer (56) via the internet (1000). Raw data, partially analyzed data, or fully analyzed data is available remotely. The local controllers (52) are programmed with parameters for analyzing the data and automatically determining the presence of anomalies. Upon detecting the occurrence of an anomaly, the local controllers (52) are programmed to notify, via the central web server (54), an operator by email, pager, telephone, et cetera. If no response to the notification is received within a programmed period of time, the local controllers (52) automatically take pre-programmed corrective action.

Ramakrishnan does not disclose that the controllers are adapted to control rod pumps or that the controllers calculate downhole and surface cards or infer production.

U.S. Patent No. 6,967,589 issued to Peters on November 22, 2005 and illustrated in Figure 2 shows a system for monitoring gas/oil wells with a local monitoring unit (58) located at each well (61, 62), a central field-located relay unit (64) in wireless short range RF communication with a number of monitoring units (58), and a host interface linked (66) with the relay unit (64) via the internet (1000). The monitoring units (58) collect data regarding the status of the gas/oil wells (61, 62) and wirelessly transmit that data to the relay unit (64). The relay unit (64), in turn, connects to a host interface (66) over the internet (1000) and transmits the data. That is, a central field-wide web-enabled relay unit (64) is used for numerous well monitoring units (58). Each monitoring unit (58) can transmit information on demand or after an alarm condition is sensed. The relay unit (64) can request information from a monitoring unit (58) or respond to a wake up transmission sent to it from either the host interface (66) or a monitoring unit (58). The host interface (66) receives data from the relay unit (58) for providing data to an operator. Peters does not disclose that the well monitors (58) are adapted to control rod pumps or that they calculate downhole and surface cards or infer production.

Also illustrated by Figure 2, U.S. Patent No. 6,898,149 issued to Hill et al. on May 24, 2005 shows a data communications system for use with an oil or gas well (60) including downhole well sensors (67) that communicate via a conventional wireless SCADA interface (68) to a local internet server (64) located in the oil field. In other words, a field-wide web server (64) is used for servicing numerous wells. The internet server (64) acts to transmit data logging at remote points for display. Hill does not disclose controllers adapted to control rod pumps or to calculate downhole and surface cards.

Referring to Figure 3, U.S. Patent No. 6,873,267 issued to Tubel et al. on March 29, 2005 shows a system for monitoring and controlling hydrocarbon production wells (63, 65) from a first remote location (70) including a surface control and data acquisition systems (72, 74) each with one or more sensors or downhole flow control devices (76, 78). The surface control and data acquisition systems (72, 74) are in satellite communication with a remote controller (80) disposed at a second remote location (82). The remote controller includes an internet web site server for providing access to end users at the first remote location (70) over the internet (1000). The internet server (80) is disposed at a remote location, not locally at each well (63, 65) or at the surface control and data acquisition systems (72, 74). Tubel does not disclose that the system is adapted to control rod pumps or to calculate downhole and surface cards.

Finally, U.S. Patent No. 6,498,988 issued to Robert et al. on December 24, 2002 shows a technique for centralized processing for design and analysis on a server computer of oilfield engineering data transmitted over the internet from client computers at distributed locations. The data is processed at the remote server computing device and the results are communicated over the internet to the client computing device. Although each remote client computer has internet connectivity, they do not function as internet servers, and the data is not processed locally.

3. **Identification of Features Provided by Some Embodiments of the Invention**

A primary object of the invention is to provide a well manager for controlling a rod pump with constant and direct internet connectivity and the capability to act as a web server so that the well manager can host a remote user directly via the internet at any time from anywhere in the world to provide the remote operator unlimited access to critical operating data.

Another object of the invention is to provide a well manager that processes well data at the well site and requires little or no post-processing of collected data.

Another object of the invention is to eliminate the need for specialized and proprietary SCADA protocols and hardware connection methods such as direct serial communication, or other polling-style communication methods to provide data to a distant central location.

Another object of the invention is to provide a well manager unit that requires only standard commercial off-the-shelf computer technology.

Another object of the invention is to provide a well manager having a computer with standard network, administration and security features that require no specialized knowledge or training beyond that generally possessed by corporate information technology (IT) personnel to allow the well manager to be easily integrated into existing corporate IT systems.

Another object of the invention is to provide a well manager that runs totally independently of all other managing systems.

Another object of the invention is to provide a well manager that locally generates on-the-fly data processing and reports and displays them on an output display at the well or remotely via the internet.

Another object of the invention is to provide a well manager that communicates with a remote user using standard email alerts, SMS text messages, or other common internet messaging vehicles to provide the remote user with real-time alerts and reports generated directly by the well manager unit, thus eliminating the need for constant well monitoring by personnel and expensive hardware systems.

Another object of the invention is to provide a well manager where all data and settings are accessible via a web interface to reduce support costs by eliminating the requirement for physical presence to troubleshoot or reconfigure the well manager.

Another object of the invention is to provide a well manager that retrieves, stores, organizes, and processes data onsite in real time, providing reports compatible with off-the-shelf software products such as Excel,® Word,® Access,® et cetera.

Another object of the invention is to provide a well manager that runs proprietary software, such as SROD and DIAG, on specific data to determine opportunities for operating improvements and increased efficiencies.

Another object of the invention is to provide a well manager with backwards-compatible SCADA interoperatively.

## SUMMARY OF THE INVENTION

The objects identified above, as well as other features of the invention are incorporated in an apparatus and system for control of rod pumped wells including a well manager pump controller that has a computer system with data acquisition and control circuitry for collecting data from and controlling the rod pump. Preferably, the well manager calculates downhole or surface pump cards for pump off control. The computer system provides on-site well data processing and generates a full suite of well and reservoir operational management reports in user-friendly formats from the collected rod pump data to provide analysis, diagnostics and recommendations for optimizing well performance. The computer system also includes a high capacity web server for selectively and securely allowing a remote computer client to access the well manager over the internet to query well data, download processed reports, control the well, and configure the well manager. The well manager can also push reports, alerts, and alarms to a remote operator via email, text messaging or internet instant messaging, for example, during rod pump fault conditions.

In an oil field of multiple wells, each rod pump has an individual and dedicated well manager with an integral web server that is independent of all others. This system eliminates the need for traditional SCADA systems.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail hereinafter on the basis of the embodiments represented in the accompanying figures, in which:

Figure 1 is a schematic diagram illustrating an arrangement of prior art wherein well sensors are coupled to circuitry disposed locally at the well, with well circuitry for a number of wells in an oil field coupled to a central internet server;

Figure 2 is a schematic diagram illustrating an arrangement of prior art wherein well sensors are coupled to circuitry locally disposed at the well which transfer data in via wireless RF or SCADA links to a central internet server that serves a multi-well oil field;

Figure 3 is a schematic diagram illustrating an arrangement of prior art wherein downhole well sensors communicate with surface control systems, which in turn transmit data via satellite to a remote internet server;

Figure 4 is a schematic diagram according to a preferred embodiment of the invention illustrating a plurality of rod pumps each with a well manager having an integral web server therein that communicates with a remote client via the internet;

Figure 5 is a schematic diagram according to a preferred embodiment of the invention illustrating a local well manager adapted for controlling a rod pump and disposed in the vicinity of the well, including an internet server incorporated therein;

Figure 6 is a perspective view of a well controller according to an embodiment of the invention showing a computer display screen and input keypad housed in a weathertight enclosure;

Figure 7 is a functional schematic diagram of the computer architecture of the well manager according to an embodiment of the invention;

Figure 8 is a functional schematic diagram of the software of the well manager according to an embodiment of the invention; and

Figure 9 is a flow chart diagram depicting typical communication between the well manager of Figures 5-8 and a remote client computer.

## DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Figure 4 illustrates a number of rod pumps according to a preferred embodiment of the invention. Rod pumps 10A, 10B, 10C, 10D and 10E are each equipped with a well manager 100A, 100B, 100C, 100D, 100E, respectively. Each well manager 100A, 100B, 100C, 100D, 100E is independent of the others. Well managers 100A, 100B, 100C, 100D, 100E preferably provide pump off control and control the speed of operation of rod pumps 10A, 10B, 10C, 10D, 10E, respectively, to match production rate with well fill rate.

Unlike the prior art arrangements of Figures 1-3, each well manager 100A, 100B, 100C, 100D, 100E includes an integrated web server that intelligently handles request from a remote client for well data formatted in Hypertext markup language (HTML) or other user-friendly report formats.

Figures 5-7 illustrate a preferred embodiment of the invention. Figure 5 shows a typical rod pumping system, generally indicated by reference number 10, including a prime mover 12, typically an electric motor. The power output from the prime mover 12 is transmitted by a belt 14 to a gear box 16. The gear box 16 reduces the rotational speed generated by prime mover 12 and imparts a rotary motion to a pumping unit counterbalance, a counterweight 18 and a crank arm 20 that are journaled to a crank shaft end 22 of gear box 16. The rotary motion of crank arm

20 is converted to reciprocating motion by means of a walking beam 24. Crank arm 20 is connected to walking beam 24 by means of a Pitman 26. A walking horsehead 28 and a cable 30 hang a polished rod 32 which extends through a stuffing box 34.

A rod string 36 of sucker rods hangs from polished rod 32 within a tubing 38 located in a casing 40. Tubing 38 can be held stationary to casing 40 by anchor 37. The rod string 36 is connected to a plunger 42 of a subsurface pump 44. Pump 44 includes a traveling valve 46, a standing valve 48 and a pump barrel 50. In a reciprocation cycle of the structure, including the walking beam 24, polished rod 32, rod string 36 and pump plunger 42, fluids are lifted on the upstroke. When pump fillage occurs on the upstroke between the traveling valve 46 and the standing valve 48, the fluid is trapped above the standing valve 48. A portion of this fluid is displaced above the traveling valve 46 when the traveling valve moves down. Then, this fluid is lifted toward the surface on the upstroke.

The prime mover 12 of pumping system 10 is operatively controlled by a locally-disposed well manager 100. Well manager 100 may employ any of a number of pump control methodologies, including control of the prime mover 12 based on surface cards, downhole cards, or motor power. U.S. Patent No. 3,951,209 issued to Gibbs, which describes pump control by surface cards, and U.S. Patent No. 5,252,031 issued to Gibbs, which describes pump control by downhole cards, are incorporated herein by reference.

Well manager 100 includes a computer system 102 (Figure 7). Computer system 102 collects data from and sends control signals to rod pump 10. Computer system 102 also provides on-site well data processing, generating a full suite of well and reservoir operational management reports from the collected rod pump data. Furthermore, computer system 102 functions as a high-capacity web server that hosts a server software application for selectively and securely

allowing a remote client computer 91 access to the server over the internet 1000 for transfer of well data and reports. The computer system 102 preferably has the memory capacity and functional capabilities of at least a powerful desktop computer to support a large number of input and control channels, handle data-intensive mathematical computations, and maintain high-throughput internet communications.

Referring to Figure 6, well manager 100 is ideally equipped with a local display monitor 120 and input keyboard, keypad, and/or input pointing device 122 that are operatively coupled to the computer system 102 for interfacing with a local operator. Well manager 100 is typically incorporated into a single chassis of electronics housed in a weathertight enclosure 101. Well manager may also include a wireless local interface to improve the field operator's efficiency. For example, Bluetooth communication

Figure 7 is a block diagram that illustrates the architecture of a preferred embodiment of the computer system 102, although other architectures may be used as appropriate. Computer system 102 includes a central processing unit (CPU) 104 that is coupled to various buses by a northbridge 150 and a southbridge 152 chipset. CPU 104 is operatively coupled to volatile memory 106 by a high speed memory bus 107 and to a video display 120 by a graphics bus 121 such as an Accelerated Graphics Port (AGP) or a Peripheral Component Interconnect (PCI) Express bus. The memory bus 107 and the graphics bus 121 are directly coupled to the northbridge 150. In other words, they are located on the high-speed front side bus (FSB).

CPU 104 is operatively coupled to a number of other devices or buses on the slower back side bus (BSB), i.e., through the southbridge 152. For instance, keypad 122, non-volatile memory 108, and a network interface 105 are directly tied to southbridge 152. Network interface 105 is preferably an industry standard Transmission Control Protocol over Internet

Protocol (TCP/IP)-capable interface that is accessible by hardwire or wireless network communication methods. An optional Universal Serial Bus (USB) 154 connects USB ports 156 to southbridge 152, and an optional hard disk drive or compact disc (CD) 158 is tied to the BSB by an Integrated Drive Electronics (IDE) (also known as Advanced Technology Attachment (ATA)) bus 160. Input and output data acquisition and control circuits 110, 112 are preferably coupled to southbridge 152 by a PCI bus 162. Although not illustrated, computer system 102 includes a power supply with power conditioning circuitry that typically receives line power and supplies low voltage direct current power to the other components of computer system 102.

CPU 104 is preferably a microprocessor or microcontroller, although special-purpose electronic logic circuits may be used. As is well known in the computer field, processor 104 executes software code instructions retrieved from a memory device 106, 108, 158 to interact with a user, control the reception of input data, and access, manipulate, store, transfer and display data on output devices. CPU word size may range from 8 to 64 bits, but computer system 102 is preferably capable of processing words of sufficient size at a sufficient speed so as to accurately and concurrently control the rod pump 10 (Figure 5), process well data, and perform web server services all in real time.

Memory 106, 108, 158 is used for storing input data, processed data, and software in the form of instructions for the processor. Computer system 102 ideally includes both volatile memory 106 such as random access memory (RAM), which due to its high speed and ease of programming is primarily used to store input data and frequently changing digital control logic software, and non-volatile memory 108 such as battery-backed-up complimentary metal oxide semiconductor (CMOS) memory or electronically erasable programmable read-only memory (EEPROM), which retain memory without power from the computer power supply. CMOS

memory and EEPROMs are preferable to store data or software code that is expected to be infrequently changed. Computer system 102 may also include non-volatile read-only memory (ROM). ROM chips, which cannot be reprogrammed, are preferred to store low-level interface software programs, often referred to as firmware, that contain specific instructions to allow higher-level digital control logic software to access and control a specific piece of equipment. For example, a basic input/output system (BIOS) chip 115 used to provide low-level boot instructions to CPU 104 is occasionally provided on a ROM chip. Other memory devices, such as magnetic or optical mass storage devices 158 are optionally included in computer system 102 to store software code and data. Network memory devices, accessed via network interface 105, may also be used. Software code and data originating from non-volatile memory 108, hard disk drive or CD 158, or via network interface 105 are usually transferred to RAM 106 for faster operation of computer system 102. As computer systems are well known in the art, they are not discussed further herein.

During control of rod pump 10 by well manager 100 (Figure 5), CPU 104 continuously scans the status of all input devices connected to input data acquisition circuitry 110, correlates the received input with control logic in memory 106, and produces the appropriate output responses needed to control pump 10 via the output control circuitry 112. As shown in Figures 5 and 7, typical inputs include a load cell 93 on the polished rod 32 and an inclinometer 94 on the walking beam 24, although other inputs may be used. The input circuitry 110 preferably includes one or more analog-to-digital converters (ADC) 111 to provide capability for monitoring analog electronic signals and a number of digital logic input gates 109 for receiving digital signals, thus allowing input from almost any sensor, monitor, gauge, or transducer. Sensor input to well manager 100 may be in either discrete or continuous form, or a combination

of both. Discrete inputs may come from push buttons, micro switches, limit switches, photocells, proximity switches, shaft encoders, optional scales, or pressure switches, for instance. Continuous inputs may come from sources such as strain gauges, resolvers, thermocouples, transducers, resistance bridges, potentiometers, or voltmeters.

Well manager 100 examines the status of a set of inputs and, based on this status and instructions coded in digital control logic software 200, actuates or regulates a set of outputs for actuating hardware such as solenoids and variable speed motor drive circuitry. The output control circuitry 112 preferably includes one or more digital-to-analog converters (DAC) 113 for generating analog output signals and a number of digital logic output gates 114 for outputting digital signals so that well manager 100 can be connected to almost any analog or digital device in the field for control purposes. An output control line 92 for providing a control signal to regulate the speed of variable speed motor 12 is shown in Figures 5 and 7.

Well manager 100 may provide open-loop control, closed-loop control, or a combination of both. In open-loop control, well manager 100 issues commands to the rod pump components but has no means of assessing the results of these commands; no provision is made for feedback of information concerning movement of a controlled element, for example. In closed-loop control, also referred to as feedback control, well manager 100 outputs a command signal to a rod pump element and then compares the expected result of the command signal to the actual measured movement or location of the driven component. The difference constitutes an error signal, which is fed back to well manager 100 to adjust the command signal until no error exists. Closed loop control is generally required for use of a servomotor. The feedback devices normally used for measuring movement or location of the component are called resolvers, encoders, Inductosyn® transducers, or optical scales, and any of these, other suitable devices, or a

combination thereof are used with well manager 100 as appropriate. As control systems in general, and computer-aided data acquisition and control in particular, are well known in the art, specific details are not addressed herein.

Well manager 100 includes computer software 200 as an integral part of the system. Figure 5 illustrates the well manager 100. Figure 7 is a functional block diagram of a preferred embodiment of computer system 102, and Figure 8 is a functional block diagram of a preferred embodiment of software 200. Referring to Figures 5, 7 and 8 collectively, the software code 200 resides in RAM 106, non-volatile memory 108, hard disk drive, CD, or other mass storage medium 158. Additionally, the software 200 may be stored at a separate computer and accessed over the internet 1000 via network interface 105. Computer software 200 serves several purposes, including retrieving well data from the input circuitry, transforming and displaying data on computer monitors, generating reports, issuing control instructions for the rod pump, and transmitting data to a remote user over the internet. Computer software 200 includes an operating system (OS) 210, a well manager application 220, a web server application 230, an optional web browser application 240, and an optional network firewall application 250.

Operating system 210 controls computer resources, peripherals, and the execution of software applications for computer system 102. Operating system 210 is preferably an industry-standard OS such as a Linux,® Unix,® Windows,® or Macintosh® Operating System. As OS technology is commonplace and well understood in the art, operating system 210 is not discussed further herein.

Software 200 running on computer system 102 generates a local user interface 180, 180' that is displayed on monitor 120 (Figure 6) at the well site. In a preferred embodiment, local user interface 180 is a graphical user interface (GUI) constructed of standard windows-type

display and control mechanisms including windows, client windows, frames, icons, buttons, check boxes, radio buttons, scroll bars, drop-down menus, pull-down menus, folder tabs, bar graphs, panes, panels, forms, slide bars, selection boxes, dialog boxes, text boxes, list boxes, menu bars, bar graphs, wizards, et cetera. The graphical user interface is preferably constructed using an object-oriented programming language such as C++ for a Microsoft® Windows,® Linux® or Unix® OS. The graphical user interface 180 may be generated by a standard web browser application 240 such as Internet Explorer® or Netscape® running on computer system 102 that displays as a web page HyperText mark-up language (HTML) code generated concurrently by well manager application 220 and web server application 230, or alternatively, the graphical user interface 180' may be generated directly by well manager application 220 (using OS 210 resources as appropriate). In another embodiment (not illustrated), the local user interface may consist entirely of a legacy-style character and graphics display with keypad control rather than a windows-style interface. In this case, local user interface is without the use of browser application 240. As user interface and object-oriented programming are well known in the field, the details of constructing the user interfaces are not discussed further herein.

Well manager software application 220 is preferably a suite of custom software programs and files that control rod pump 10 (Figure 5), generate a local user display 180, 180', analyze well data, provide user reports over the internet to remote users, send alarms and alerts to remote users, and accept control commands over the internet from remote users for control of the rod pump. Well manager software application 220 preferably includes a well control module 221, a family of hyperlinked HTML form files 223 disposed in a web page directory accessed by web server application 230, and a series of Common Gateway Interface (CGI) shell scripts or compiled programs 227, disposed in a cgi-bin directory, that are selectively executed in order to

transform the otherwise static HTML form files 223 into a dynamic user interface when displayed in a web browser.

Well control module 221 is a custom software program that preferably provides pump-off control and production optimization capabilities such as lift optimization, automatic well testing, compressor monitoring-control, trend analysis, and pump system analysis. In rod-pumping applications, for example, proprietary optimization software, such as SROD and DIAG, is executed following each stroke of the pumping unit to determine optimum pumping speed, whether the unit should be turned off or remain running, the amount of production through the pump, the pump intake pressure, mechanical efficiencies, and opportunities for operating improvements and increased efficiencies. For example, a well manager application is described in U.S. Patent Application No. 10/940,273 filed on January 5, 2005 by Gibbs et al., entitled "Inferred Production Rates of a Rod Pumped Well from Surface and Pump Card Information," which is incorporated herein by reference.

Well manager 100 collects tremendous amounts of rod pump data at input circuitry 110 for analysis by well manager software application 220. Well manager application 220 retrieves, stores, organizes, and processes data onsite in real time, providing reports compatible with off-the-shelf software products such as Excel,® Word,® Access,® etc. Well manager application 220 generates and makes available locally a myriad of reports from the collected data, allowing a user to query and format well data and graphically display trends with tremendous flexibility. An optional relational database application 225, such as MySQL,® may be integrated with well manager application 220 in order to simplify the handling of the large amount of collected well data. As relational databases are well known in the art, database 225 is not discussed further herein.

Software 200 includes a web sever application 230 that enables users at remote computer 91 (Figure 5) to access well manager 100 to upload control instructions and download well data and reports. Apache is a popular open source HyperText transport protocol (HTTP) web server application that is used with Linux, Windows and other operating systems. Utilizing standard ethernet and TCP/IP networking protocols, well manager 100 is connected to the internet 1000 and assigned a static internet protocol (IP) address enabling direct inbound communication with the unit at the well site. This addressing schema eliminates the need for specialized and proprietary SCADA protocols and hardware connection methods such as direct serial communication, analog radio communication, or other polling-style communication methods. With communications managed by web server application 230, well manager 100 is accessible via the static IP address from anywhere in the world having internet access. As web server applications are commonplace and well known in the art, web server application 230 is not discussed further herein.

Well manager 100 may include a network firewall to protect it from unauthorized intrusion and computer hacking efforts. The firewall may be a firewall software application 250 executed by computer system 102, or it may be a discrete and independent hardware firewall 190 operatively coupled between network interface 105 of computer system 102 and the internet 1000. Regardless of the type of firewall installed, the firewall is preferably commercial off-the-shelf and provides controlled access to well manager 100 using multiple recognized network security methods such as user and password challenges, VPN access, filtered IP address access, et cetera. In other words, well manager 100 is secured to eliminate unauthorized access the same way that an ordinary computer is protected using existing or future common network security

products. As network firewalls are well known in the art, firewall 190, 250 is not discussed further herein.

Figure 9 is a flow chart diagram illustrating an example communication sequence between a remote user at computer 91 and well manager 100 according to one embodiment of the invention. Referring to Figures 8 and 9, web server application 230 and well manager application 220 cooperate to provide secure remote internet access to well manager 100. Web server 230 provides initial login access to a remote client computer 91. Once the remote client 91 is authenticated, an initial or default HTML file 224 is transmitted by web server 230 to the remote client computer. The initial HTML file 224 may include current well data and status provided by well manager application 220. In other words, the default HTML file 224 is not necessarily a static or unchanging file. The initial HTML file 224, displayed as a web page in a web browser application 241 running on remote client computer 91, forms a remote user interface 181. Web server 230 fields requests from remote users via one or more HTML web pages 223. Well manager 220 interprets each request using CGI scripts or programs 227 and selects, analyzes, sorts and codes well data in HTML format in response to the request. Web server 230 transmits the generated HTML code over the internet 1000 to remote computer 91 for display in a web browser application 241 running thereon. Thus, the remote user interface 181 display consists entirely of HTML code displayed in a browser software application running on the remote computer system 91. Additionally, due to the tremendous onboard processing power provided by computer 102, well manager 100 is capable of generating on-the-fly data processing and reports locally rather than relying on post processing of well data by a distant computer facility. These data reports, generated by well manager application in Word® or Excel® format for example, may be downloaded by remote computer 91 via web server 230 and internet 1000.

Remote computer 91 may be a personal computer, desktop computer, laptop computer, mini computer, or mainframe computer, for example, but remote computer 91 may also be a wireless personal digital assistant (PDA) such as a BlackBerry® or Palm® handheld device or cell phone that communicates with well manager 100 via a wireless internet or email connection.

Well manager 100 may additionally be programmed to "push" data to a remote user, rather than responding to a user request that "pulls" data. For instance, reports can automatically and routinely be generated and emailed to a remote user. Also, situations requiring critical decisions, alerts, and alarms may be immediately communicated in real-time to on-call operators via email, SMS text messaging, or any other standard type of internet messaging platform, eliminating the need for expensive hardware systems and constant monitoring by personnel at a SCADA control station. As internet application programming is well known in the art, details are not provided herein.

Management and access to well manager 100 for system administration is provided by the web interface built into well manager 100 and accessible via TCP/IP through a computer web browser. Well manager 100 is simply another computer node in a corporate network requiring few, if any, changes in security policies and protection methods. Administration of the network features and security of the well manager unit are thus easily managed by ordinary corporate information technology personnel as no additional protocol training or specialized knowledge is necessary to ensure successful network integration of well manager unit 100. All configuration, management and reports generated are ideally accessible directly from the web interface. Furthermore, well manager 100 is easily upgraded by uploading new software 200 or firmware 108 over the internet 1000.

As shown in Figure 4, well manager 100 runs totally independently of managing systems or other well controllers. With direct internet access available to well manager unit 100, the need for traditional management systems and specialized hardware or software systems is eliminated That is, SCADA systems using polling-style data collection are no longer necessary. However, well manager 100 is preferably backwards compatible to allow it to work with existing legacy SCADA devices until obsolete SCADA systems are completely phased out.

Although the invention is described herein with reference to control of rod pumps, the invention is not limited as such. Rather, the invention includes an entire spectrum of artificial lift controllers having integral internet web servers such as for controlling rod pumps, progressing cavity pumps, injection wells, ESP, variable speed drives, et cetera. Nor is the invention limited to the production of hydrocarbons; the invention includes controllers with integral internet web servers for producing water, for dewatering, for gas measurement, et cetera. Finally, the invention is not limited to a stand alone controller, but includes portable diagnostic equipment with integral internet web servers and controllers with integral internet web servers that are also combined with other systems, for example.

Although the embodiments of well manager 100 described herein employ HTML and TCP/IP formats, the invention is not limited to using these formats. New communication formats and protocols may be developed over time which may replace existing formats, and well manager 100 preferably employs technologies consistent with the internet standards in use at any given time.

In summary, by providing well manager 100 with real-time, constant onsite internet communication, remote operators have access to operating data at all times. All of the well data reporting functionality of well manager 100 that is available locally is exportable over the

internet to remote users. For example, reservoir engineers can monitor flood response on a minute-to-minute basis, lease operators can have periodic custom reports of the status of each well produced automatically, and technicians can determine the discharge pressure of a compressor station in a small remote field. Support costs and requirements are reduced, because no physical presence at the well is required for troubleshooting or reconfiguration of the well manager units by the operator; remote troubleshooting of the well, the pump 10, or the well manager 100 is possible over the internet 1000. The need for corrective actions can be identified sooner to minimize expensive repairs, losses in production, or pollution to the environment.

The Abstract of the disclosure is written solely for providing the United States Patent and Trademark Office and the public at large with a way by which to determine quickly from a cursory reading the nature and gist of the technical disclosure, and it represents solely a preferred embodiment and is not indicative of the nature of the invention as a whole.

While some embodiments of the invention have been illustrated in detail, the invention is not limited to the embodiments shown; modifications and adaptations of the above embodiment may occur to those skilled in the art. Such modifications and adaptations are in the spirit and scope of the invention as set forth herein:

**WHAT IS CLAIMED IS:**

1. An apparatus for controlling a rod pump (10), said rod pump characterized by having a rod (32) that is reciprocated by a prime mover (12), the apparatus comprising:

a pump controller (100) coupled to and disposed near said rod pump, said controller arranged and designed to control the speed of said prime mover, to receive and record measurements of a plurality of parameters of said rod pump, and to generate an operational report therefrom; and

a web server (102, 210, 230) integrated with said well controller and operatively connected to an internet (1000), said web server arranged and designed to handle a request from and transmit said operational report to a remote client computer (91) via said internet.

2. The apparatus of claim 1 wherein said controller comprises:

a computer system (102);

data acquisition input circuitry (110) operatively coupled said computer system and a sensor (93, 94) and arranged to measure a parameter of said rod pump;

a well manager software application (220) structured for execution by and residing on said computer system and designed and arranged to calculate a desired speed of said prime mover as a function of a measurement of said parameter; and

control output circuitry (112) operatively coupled between said computer system and said prime mover and arranged and designed to cause said prime mover to move at said desired speed.

3. The apparatus of claim 2 wherein said controller further comprises:

first and second sensors (93, 94) and arranged to measure a stroke position of said rod (32) and a load acting on said rod pump (10), respectively;

said well manager software application (220) arranged to generate a downhole pump card from measurements of said first and second sensors (93, 94) and to calculate a desired speed of said prime mover (12) as a function of said downhole pump card.

4. The apparatus of claim 2 wherein said web server comprises:

a web server software application (230) structured for execution by and residing on said computer system (102).

5. In a well produced by a pump (10) having a pump controller (100) operatively coupled to said pump for controlling the speed of said pump, the improvement comprising:

a web server (102, 210, 230) integrated with said pump controller (100), said web server coupled to an internet (1000) and arranged and designed to allow communications between said pump controller and a remote client computer (91) via said internet.

6. A method for controlling a pump (10)having a prime mover (12), the method comprising the steps of:

integrating a web server (102, 210, 230) with a controller (100) that is arranged and designed to control the speed of said prime mover;

disposing said controller (100) and said web server integrated therewith near said pump (10);

operatively coupling said web server to an internet (1000);

measuring a parameter of said pump by said controller;

calculating by said controller (100) a desired speed of said prime mover (12) as a function of a measurement of said parameter;

storing in said controller said measurement as data;

controlling the speed of said prime mover at said desired speed by said controller;

receiving a request for a report from a remote client (91) via said internet (1000) by said controller (100); and

transmitting said report by said controller to said remote client via said internet.

7. The method of claim 6 further comprising the step of:

generating said report by said controller from said data.

8. The method of claim 7 further comprising the steps of:

formatting said report by said controller in a hypertext markup language; and

displaying said report by said remote client as a web page (181).

9. The method of claim 6 further comprising the step of:

authenticating said remote client (91) by said controller (100).

10. The method of claim 6 wherein said pump (10) is a rod pump characterized by having a rod (32) that is reciprocated by said prime mover (12), the method further comprising the steps of:

measuring a load of said rod pump (10) and a position of said rod (32) by said controller (100);

generating a downhole pump card from load and position measurements by said controller;

storing in said controller said load and position measurements as said data; and

controlling the speed of said rod pump by said controller as a function of said downhole pump card.

11. The method of claim 6 further comprising the step of:

pushing a notification of a condition of said pump to a remote user (91) over said internet (1000) by said controller (100).

12. The method of claim 6 further comprising the step of:

configuring said controller (100) by a remote user (91) over said internet (1000).

13. A method for managing production of an oil reservoir produced by first and second wells having first and second pumps (10A, 10B), respectively, the method comprising the steps of:

disposing first and second pump controllers (100A, 100B) at said first and second pumps, respectively, said first controller operatively coupled to said first pump so as to control the speed thereof, and said second controller operatively coupled to said second pump so as to control the speed thereof;

integrating a first web server with said first controller (100A), said first web server arranged and designed for receiving a first request from a remote client (91) and transmitting a first response to said remote client via an internet (1000);

coupling said first web server to said internet;

integrating a second web server with said second controller (100B), said second web server arranged and designed for receiving a second request from said remote client (91) and transmitting a second response to said remote client via said internet (1000), said second controller independent of said first controller; and

coupling said second web server to said internet.

14. The method of claim 13 further comprising the steps of:

generating said first response by said first controller (100A) from data of said first pump (10A); and

generating said second response by said second controller (100B) from data of said second pump (10B).

15. The method of claim 14 further comprising the steps of:

formatting said first response by said first controller (100A) in a hypertext markup language;

displaying said first response by said remote client (91) as a first web page (181);

formatting said second response by said second controller (100B) in a hypertext markup language; and

displaying said second response by said remote client (91) as a second web page.

16. The method of claim 13 further comprising the steps of:

authenticating said remote client (91) by said first controller (100A); and

authenticating said remote client (91) by said second controller (100B).

17. The method of claim 14 wherein said first and second pumps (10A, 10B) are first and second rod pumps, respectively, the method further comprising the steps of:

measuring a first load of said first rod pump (10A) and a first position of a rod of said first rod pump by said first controller;

generating a first downhole pump card from first load and position measurements by said first controller (100A);

storing in said first controller said first load and position measurements as said first data;

controlling the speed of said first rod pump (10A) by said first controller (100A) as a function of said first downhole pump card;

measuring a second load of said second rod pump (10B) and a second position of a rod of said second rod pump by said second controller;

generating a second downhole pump card from second load and position measurements by said second controller (100B);

storing in said second controller said second load and position measurements as said second data; and

controlling the speed of said second rod pump (10B) by said second controller (100B) as a function of said second downhole pump card.

18. The method of claim 13 further comprising the steps of:

pushing a first notification of a first condition of said first pump (10A) to a remote user (91) over said internet (1000) by said first controller (100A); and

pushing a second notification of a second condition of said second pump (10B) to said remote user (91) over said internet (1000) by said second controller (100B).

19. The method of claim 13 further comprising the steps of:

configuring said first controller (100A) by a remote user (91) over said internet (1000); and

configuring said second controller (100B) by said remote user (91) over said internet (1000).

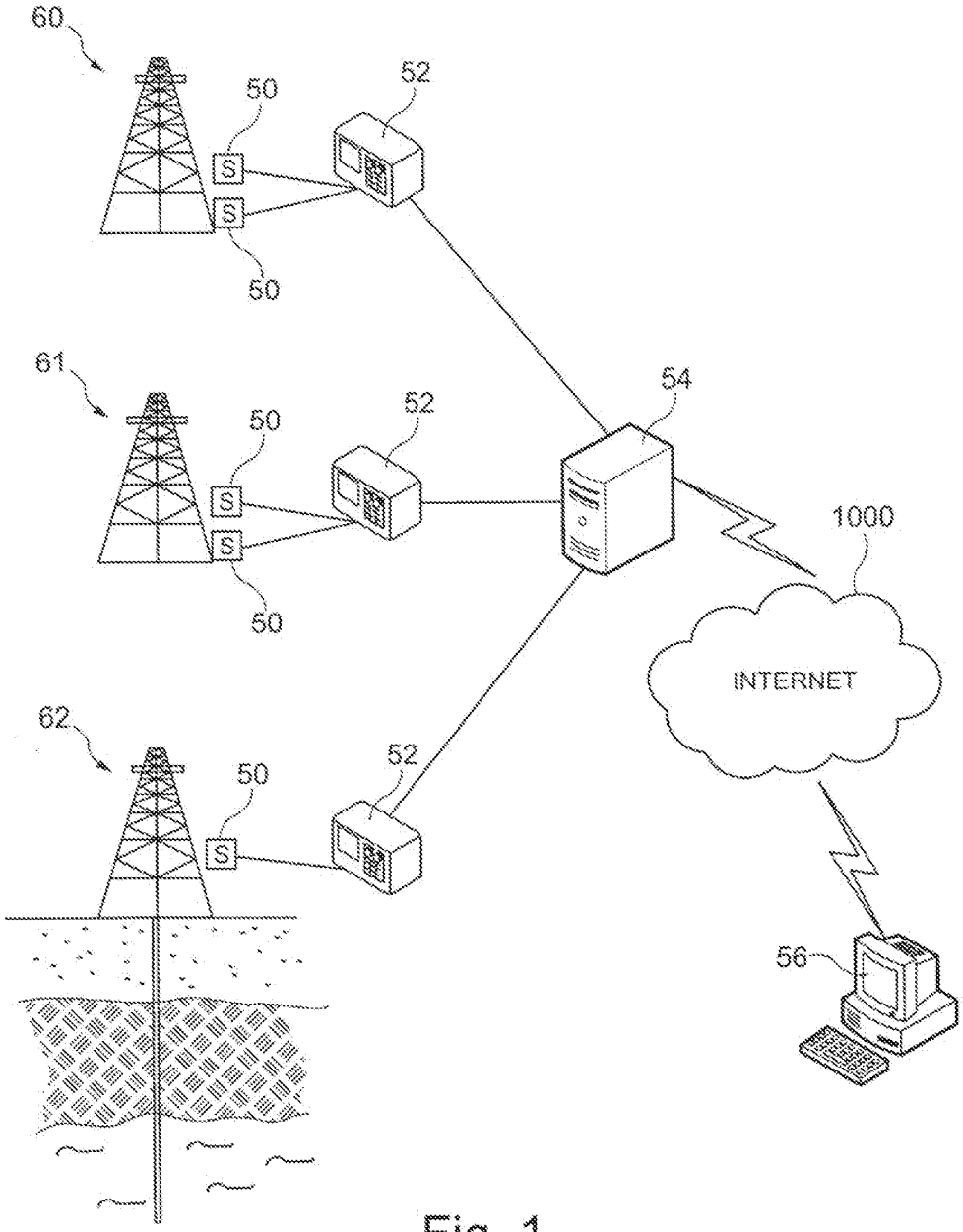



Fig. 1
(PRIOR ART)

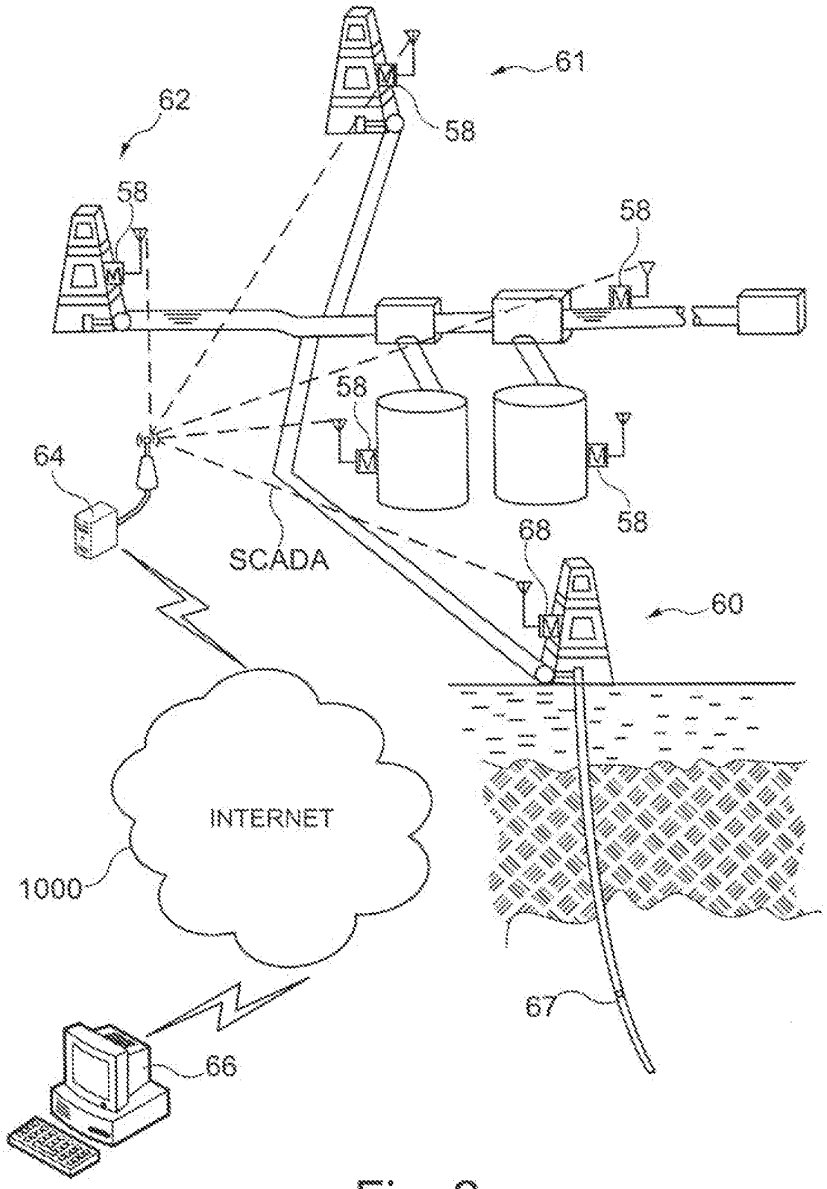



Fig. 2
(PRIOR ART)

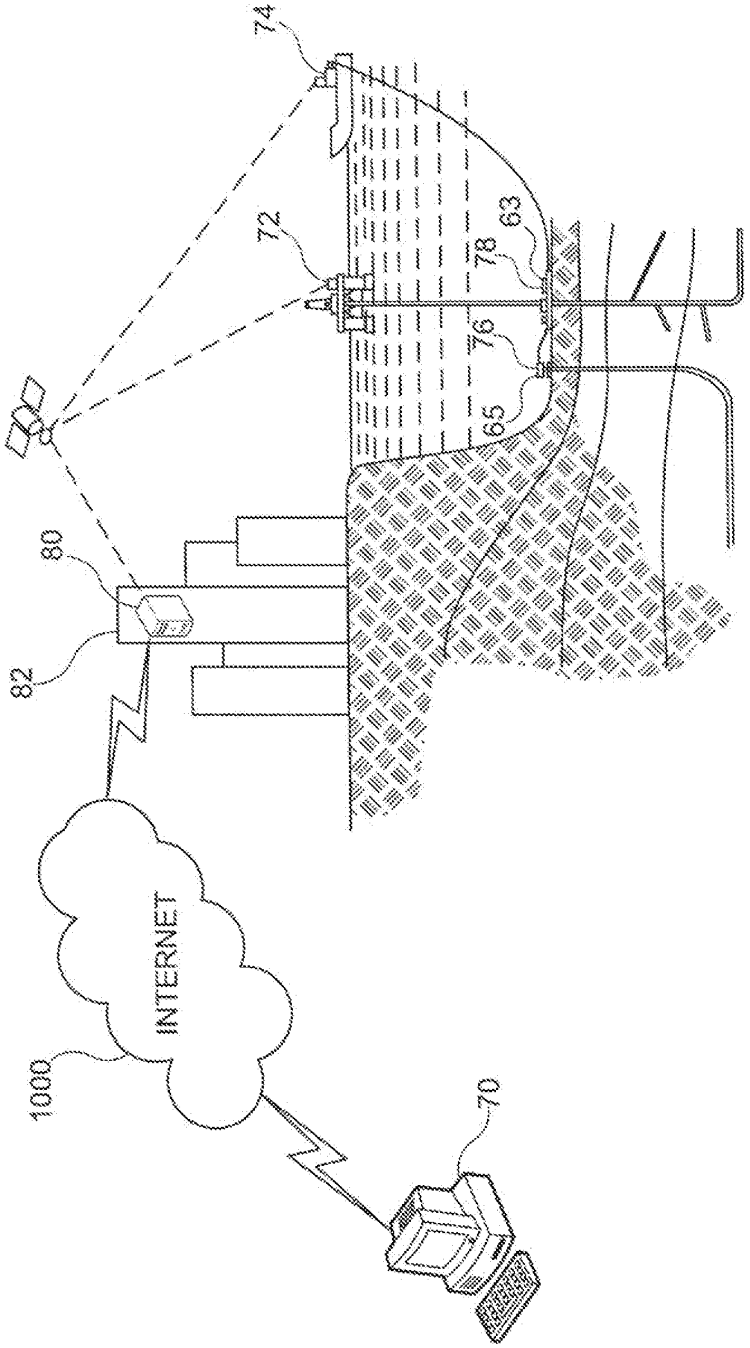



Fig. 3
(PRIOR ART)

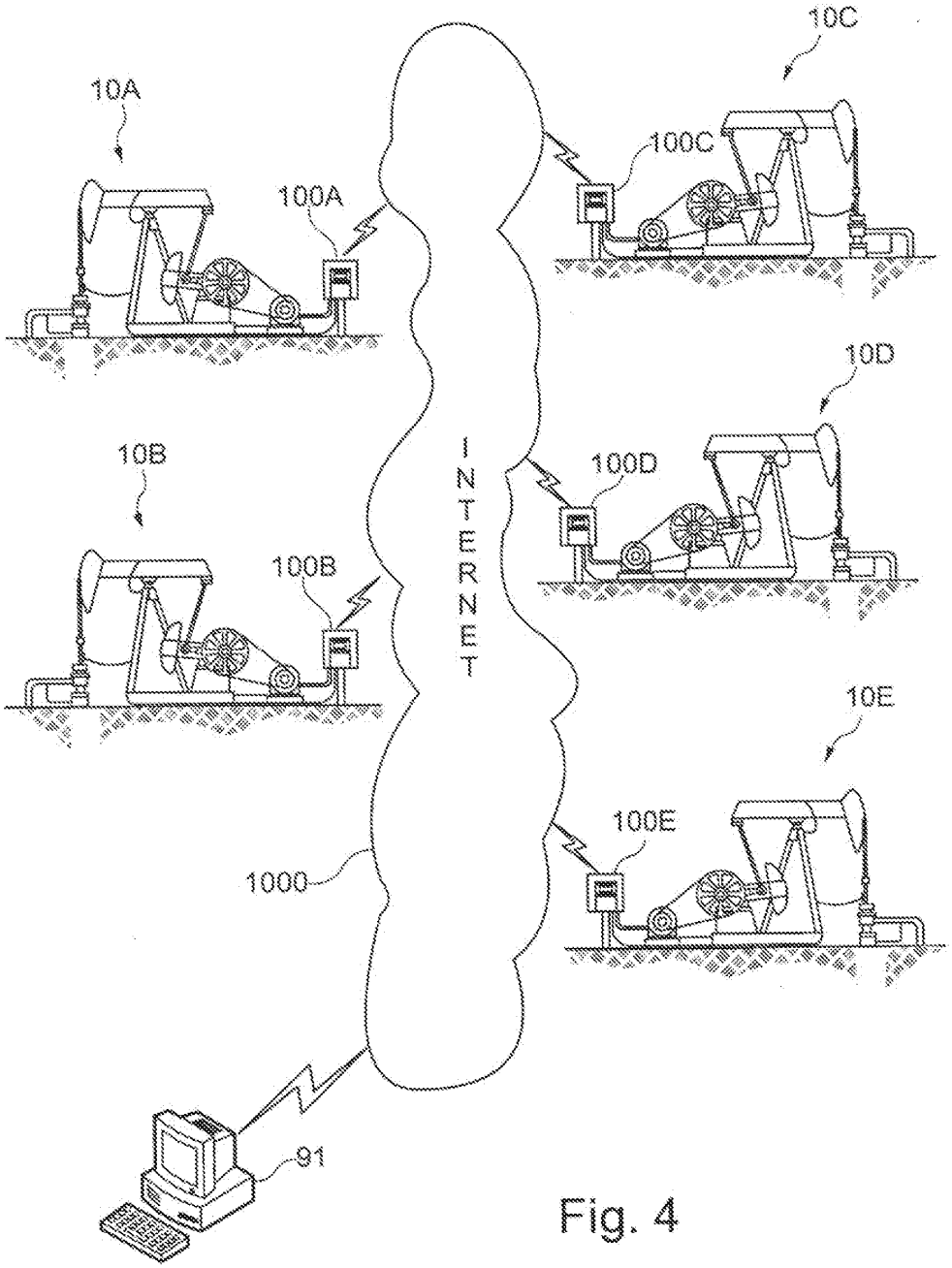



Fig. 4

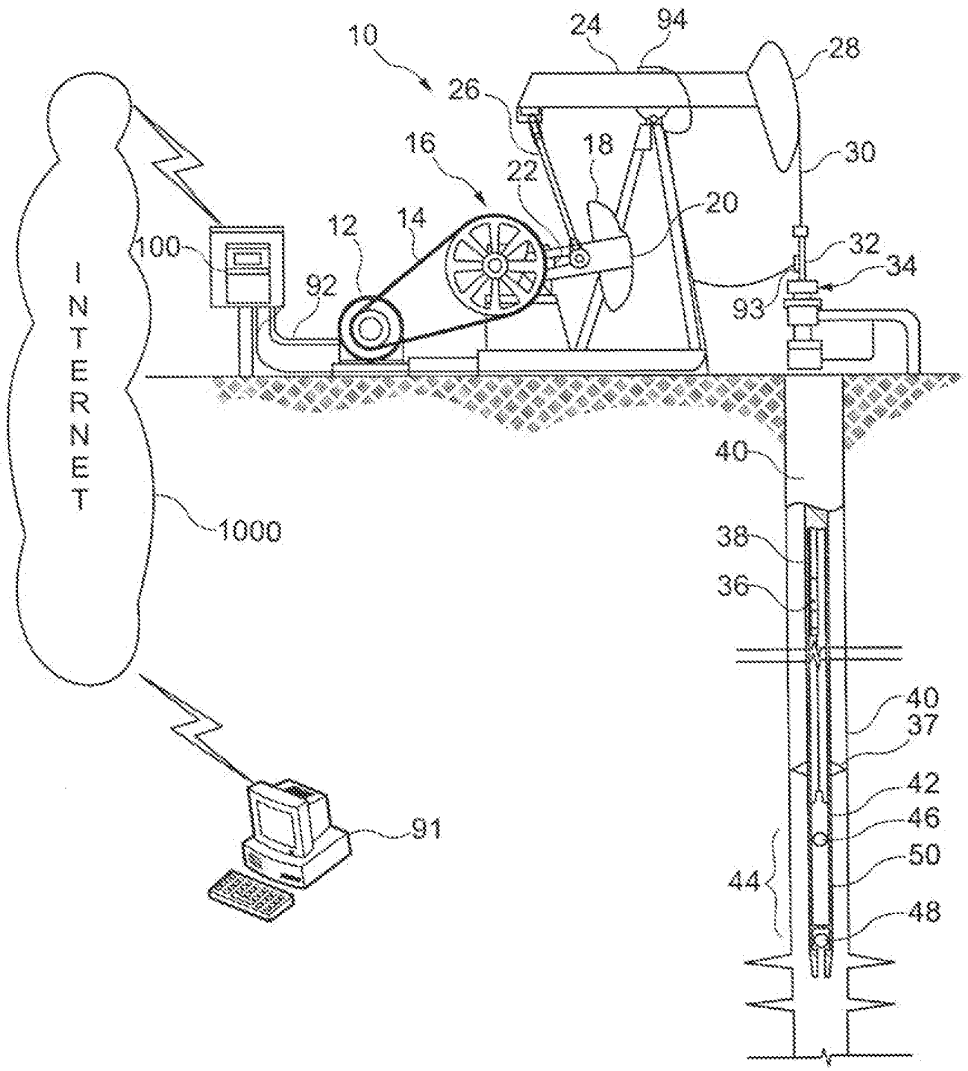

10
24
94
28
26
16
22
18
30
20
12
14
100
32
34
92
93
INTERNET
40
1000
38
36
40
37
42
46
50
91
44
48

Fig. 5

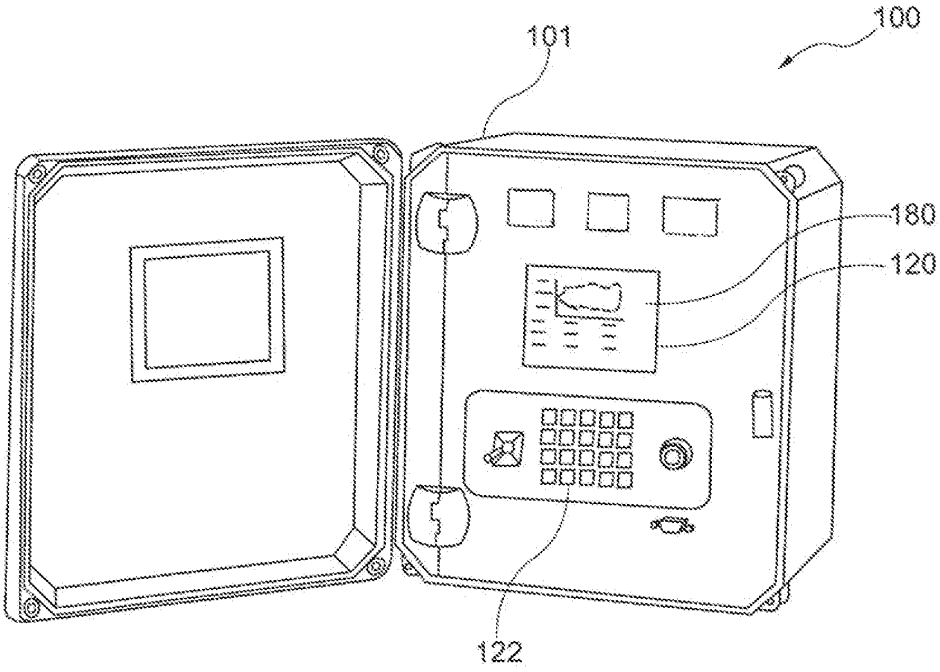



Fig. 6

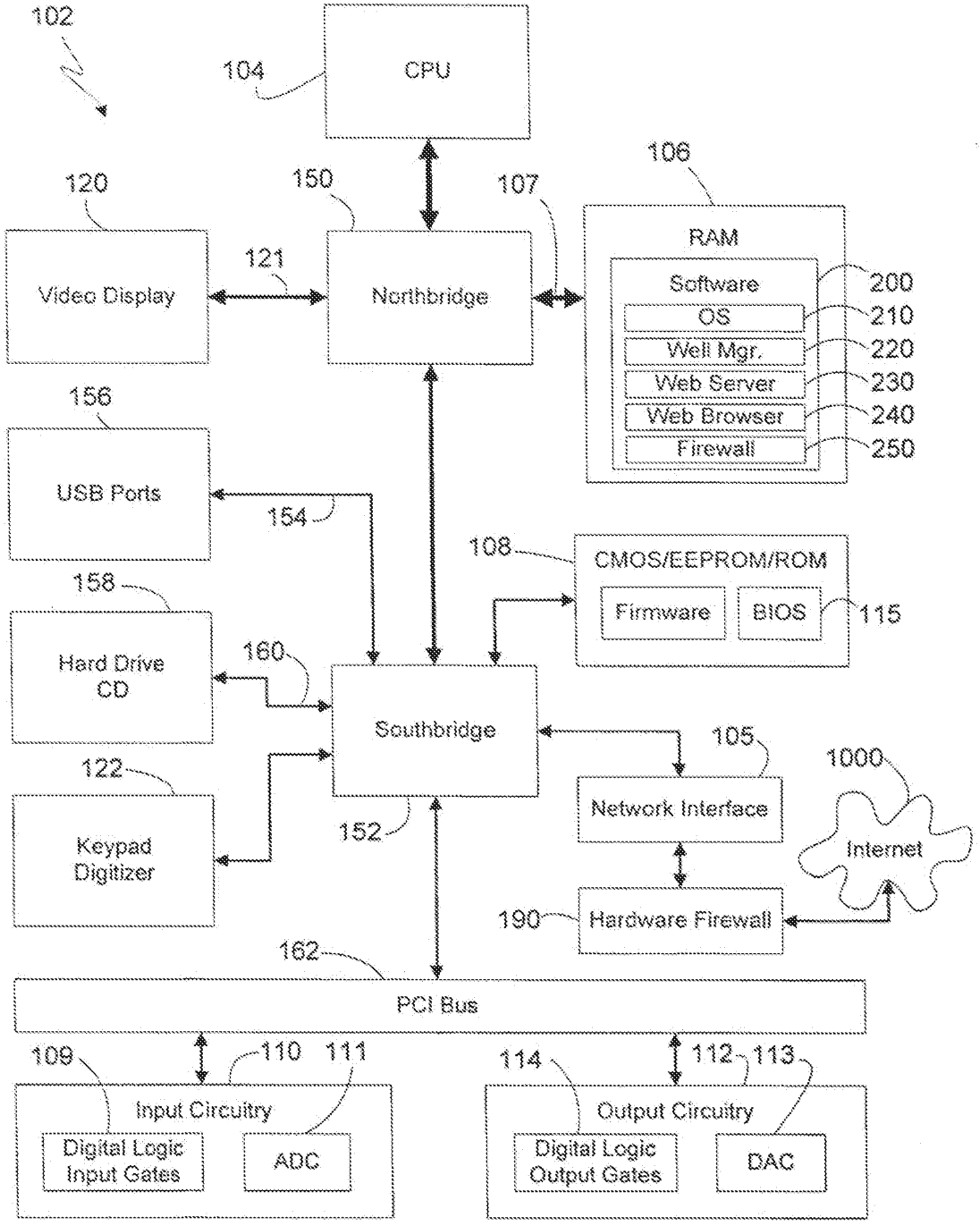

102
104
CPU
106
120
150
107
RAM
Video Display
121
Northbridge
Software
200
OS
210
Well Mgr.
220
Web Server
230
Web Browser
240
Firewall
250
156
USB Ports
154
108
CMOS/EEPROM/ROM
158
Firmware
BIOS
115
Hard Drive
CD
160
Southbridge
105
1000
122
Network Interface
Internet
Keypad
Digitizer
152
190
Hardware Firewall
162
PCI Bus
109
110
111
114
112
113
Input Circuitry
Output Circuitry
Digital Logic
Input Gates
ADC
Digital Logic
Output Gates
DAC

Fig. 7

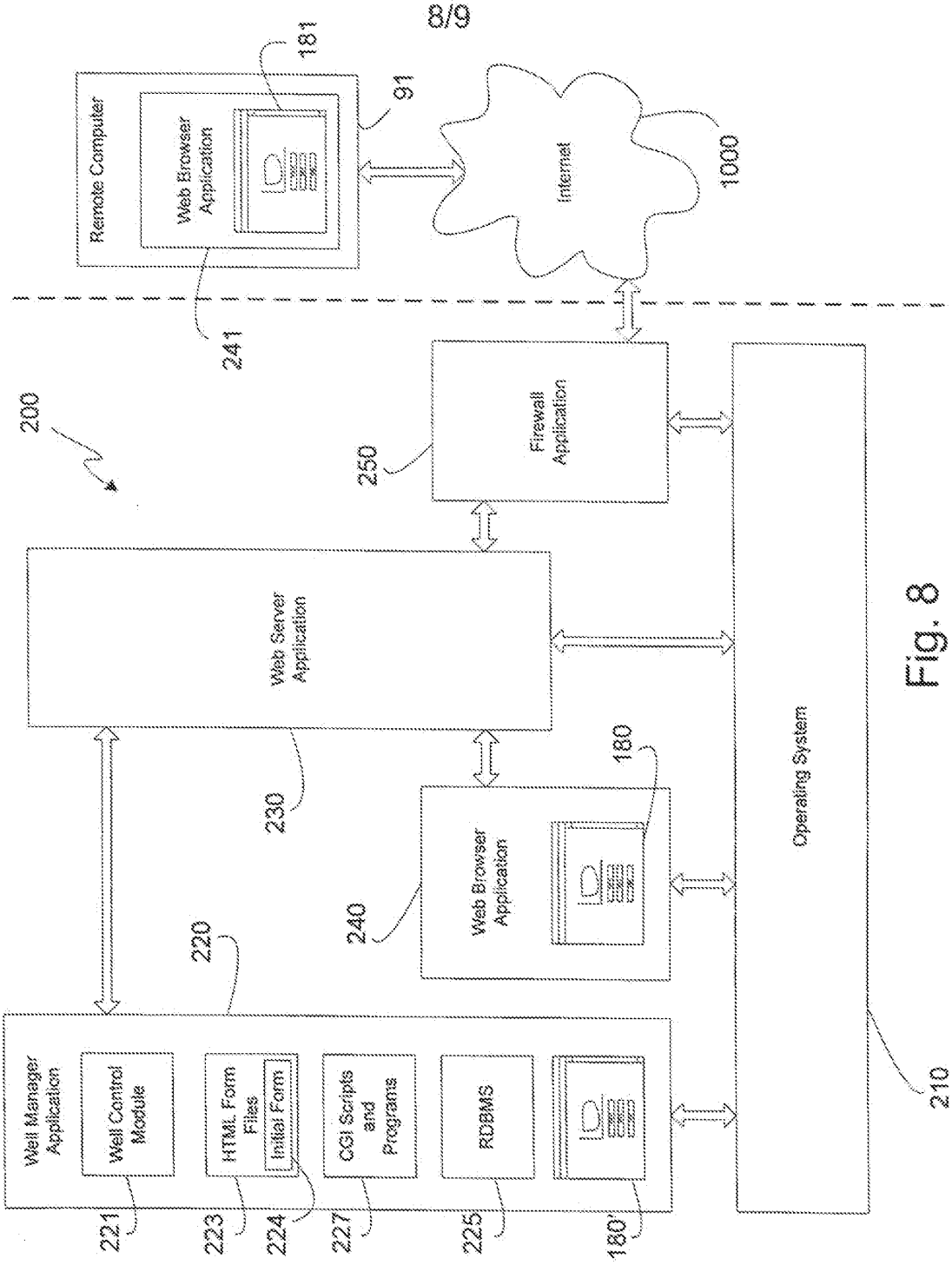

Remote Computer
Web Browser Application
181
91
Internet
1000
241
200
250
Firewall Application
Web Server Application
230
180
Web Browser Application
240
220
Operating System
210
Web Manager Application
Web Control Module
HTML Form Files
Initial Form
CGI Scripts and Programs
RDBMS
221
223
224
227
225
180'

Fig. 8

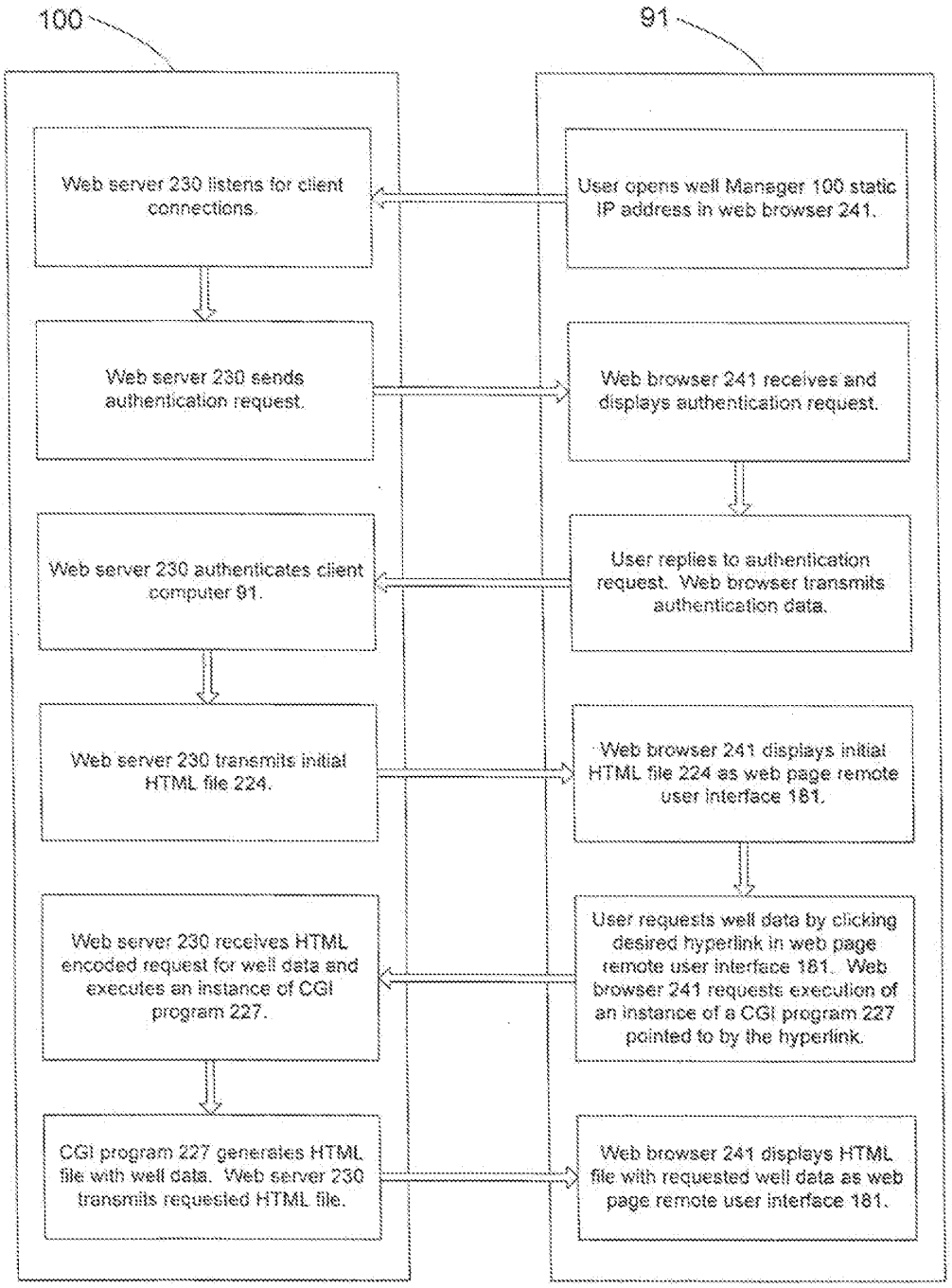

100
91
Web server 230 listens for client connections.
User opens well Manager 100 static IP address in web browser 241.
Web server 230 sends authentication request.
Web browser 241 receives and displays authentication request.
Web server 230 authenticates client computer 91.
User replies to authentication request. Web browser transmits authentication data.
Web server 230 transmits initial HTML file 224.
Web browser 241 displays initial HTML file 224 as web page remote user interface 181.
Web server 230 receives HTML encoded request for well data and executes an instance of CGI program 227.
User requests well data by clicking desired hyperlink in web page remote user interface 181. Web browser 241 requests execution of an instance of a CGI program 227 pointed to by the hyperlink.
CGI program 227 generates HTML file with well data. Web server 230 transmits requested HTML file.
Web browser 241 displays HTML file with requested well data as web page remote user interface 181.

Fig. 9

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/59749

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 11/00 (2008.04)
USPC - 702/188
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)
USPC: 702/188

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 702/6, 702/127, 702/188; search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Delphion [German (Applications - Full text), German (Granted - Full text), European (Applications - Full text), European (Granted - Full text), INPADOC, Abstracts of Japan, US (Granted - Full text), WIPO PCT Publications (Full text), US (Applications - Full text)]; Google Scholar; pump control, hydrocarbon, gas, oil, downhole

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 2006/0149476 A1 (GIBBS et al.) 06 July 2006 (06.07.2006), abstract, para [0001], [0021], [0032], [0041], [0073]. | 1-19 |
| Y | US 2006/0271299 A1 (WARD et al.) 30 November 2006 (30.11.2006), abstract, fig 7, para [0018], [0028]-[0029], [0050], [0052], [0064] | 1-19 |
| A | US 2003/0065447 A1 (BRAMLETT et al.) 03 April 2003 (03.04.2003), abstract, fig 1-6. | 1-19 |
| A | US 4,594,665 A (CHANDRA et al.) 10 June 1986 (10.06.1986), abstract, fig 1A-23. | 1-19 |

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"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 |
|---|---|
| 07 August 2008 (07.08.2008) | 15 AUG 2008 |

| Name and mailing address of the ISA/US | Authorized officer: |
|---|---|
| Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

Form PCT/ISA/210 (second sheet) (April 2007)

(19) Europäisches Patentamt
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(11) EP 2 090 943 A1

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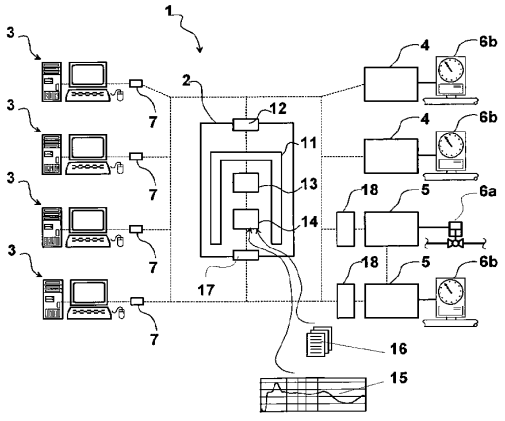
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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

## (54) Control method for remote installations

(57) A control method for remote installations through data processing networks, in particular, through a data processing network (1) with TCP/IP protocol, said installations comprising equipment (6a, 6b) such as measuring instruments of process variables and actuators of mechanical and electric devices of various type, such as valves, motors, pumps and other machines in civil or industrial installations. The method provides prearranging a server (2) wherein a gateway (11) resides on a first port (12) of the server having a public static IP address visible in the network. A terminal of the network, which can be a user (3) for controlling the plant or a peripheral device (4,5) associated with an equipment (6a, 6b) of the plant, requires and obtains a dynamic IP address (10) and a grant to access said terminal. Then, a request is carried out of a connection to the gateway by said terminals through said first port. The connection is accepted and said dynamic IP address is recorded through the gateway. The gateway then asks and obtains from the terminal a identification code proper of the terminals, which code is recorded in a table (16) of correspondence among dynamic IP addresses and identification codes of the terminals. This table is used for all the operations of communication with the terminal.

**Fig. 1**




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EP 2 090 943 A1

## Description

### Field of the invention

**[0001]** The present invention relates to a control method for remote installations through data processing networks, said installations comprising equipment such as measuring instruments of process variables and actuators of mechanical and electric devices of various type, such as valves, motors, pumps and other machines.

**[0002]** The term control method embraces the use of functions of data acquisition for displaying and/or changing the data in a user interface, functions for generating alarms, blocks, tuning operations, as well as functions of adjustments.

**[0003]** The method according to the invention can be used for example for remote controlling process installations, such as plants for chemicals and the like, for the food industry, for making energy, purification plants, hydraulic, mechanical, electric plants, etc.

### Background of the invention

**[0004]** All the known methods for controlling remote installations provide a communication step between peripheral devices associated with operating equipment and at least one point, called supervision unit, said supervision unit, for example being arranged at a user's remote control station. Said peripheral device and supervision unit are called terminals.

**[0005]** The remote control system according to said methods require communication means or connections between terminals, such connections forming a local network (LAN) or extended network (WAN), according to whether the object of the control are a single installation or several installations, distributed in a more or less wide territory. For example, systems that perform said methods are called respectively SCADA (Supervisory Control And data acquisition) or DCS (Distribued Control System).

**[0006]** In particular, said communication means can be:

- cables, for example telephone twin cables, associated with a modem;
- electromagnetic waves, normally set in the frequency bands known as UHF and VHF, said electromagnetic signals coupling to proprietary networks comprising one or more radio links and GSM that uses public networks.

**[0007]** In the last decades as means of communication between terminals the Internet and Intranet connections have developed. Said terminals gain access to the network transmitting the data on public networks, always by means of cables, modem and/or electromagnetic waves. PSTN or ADSL connections respectively are also cable connections with analog or digital modem whereas for radiofrequency connections GPRS and UMTS systems are used.

**[0008]** The known methods of remote control system provide, furthermore, a step of identification of the terminals. Means for identification can be, for example, telephone numbers, radio addresses, IP addresses.

**[0009]** In particular, an IP address, being a succession of numbers, normally four, and in such a case it is called IPv4, each set between 0 and 255 and separated by dots, thus allowing to generate a very high number of addresses. However, the system of IP addresses is becoming less appropriate due to a very diffused use of Internet and of data processing networks generally for transmitting data.

in order to overcome this problem various solutions have been proposed. A first solution consists of using a TCP/IP protocol that provides sequences of six numbers instead of four, this version being called IPv6. A generalized use of IPv6 requires however a long time and very high costs.

**[0010]** A second solution a method called NET/Gateway, still based on the use of IP addresses under IPv4. Said method provides distinguishing static IP addresses and dynamic IP addresses. Whereas the former are invariably associated with a determined subject, which is identified always with the same address whenever it is connected to the network, the latter, instead, are allocated to a subject at the beginning of a connection and have validity for the only duration of the connection same. actually, said dynamic IP addresses identify a connection and not a connected subject.

**[0011]** Such NET/Gateway method is already largely used for normal Internet utilizations and in mobile phone systems: for example, the common GPRS/UMTS and PSTN connections, as well as private ADSL, use dynamic IP addresses.

**[0012]** In case of controlling remote installations, the use of dynamic IP addresses is known in many successive connections for identifying even different terminals, provided said terminals are not always connected to the data processing network. A same group of terminals requires then a number of IP addresses smaller than a group consisting of only static IP addresses.

**[0013]** However, in case of the systems of controlling remote installations, the use of dynamic IP addresses has some difficulties.

**[0014]** In particular, the data packets sent by a same peripheral device in successive connections, and sent to a user of the control, or to a control device, must provide coherent sets, i.e. it shoulkd be able to identify univocally the peripheral device that has sent them.

**[0015]** For example, a user of a remote control system of a plant must be adapted to assign univocally to a determined peripheral device, typically a determined measuring instrument, the data displayed in an assigned area of the interface associated with said user. Similarly, the writing a coherent registration, or trend, of historical values of a process variable, by adjoining data packets obtained in successive connections of the associated pe-



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ripheral devices with an instrument that detects this variable, requires a univocal identification of the instrument at any updating of the registration.

**[0016]** An univocal identification of the terminals is clearly impossible by using only dynamic IP addresses. A dynamic IP address allows a connection to the network but not the visibility of a terminal, nor a communication with other peripheral devices, said IP address being unknown to said other terminal.

**[0017]** Presently, the various solutions proposed in order to solve this problem have given not much satisfactory results. On the other hand, the use of static IP addresses, as above described, is scarcely practicable for controlling remote installations.

Summary of the invention

**[0018]** It is then a feature of the present invention to provide a control method for remote installations through data processing networks with dynamic IP addresses that allows an univocal identification of terminals, said terminals being peripheral devices associated with operating equipment of the installations or supervision units associated with users of the control.

**[0019]** It is another feature of the present invention to provide a control method for remote installations that avoids the use of additional data repeating apparatus sent from peripheral devices to equipment of the installation.

**[0020]** These and other objects are achieved through a remote control method of an equipment of a plant by a user through a data processing network with TCP/IP protocol, said data processing network comprising:

- prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public static IP address visible in said data processing network,
- requesting an access to the data processing network by a terminal selected from the group comprised of:

- a supervision unit associated with said user,
- a peripheral device associated with said equipment,
- assigning a dynamic IP address and granting access to said terminal,

the main feature of the method being to provide, furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**[0021]** Actually, each time that a terminal is connected, the gateway updates said table of correspondence among dynamic IP addresses and terminal identification codes. This way, the terminal can communicate without possessing static addresses, being it enough that they reach through the data processing network the gateway accessible through said first port of the server.

**[0022]** In particular, the connection of the peripheral device to the data processing network can be carried out in a known way, according to a technique chosen for example among:

- Ethernet,
- GPRS, wherein the dynamic IP address is granted by a network service provider or IAP,
- radio waves of wavelength preferably comprised within known bands such as UHF or VHF, wherein the method comprises a step of radio conversion towards Ethernet or towards GPRS through the above described steps.

**[0023]** In particular, the connection of the supervision unit to the data processing network can be carried out in a known way, by a technique chosen for example among:

- Ethernet,
- GPRS,
- ADSL,
- PSTN,

**[0024]** In the last three cases an operation of a IAP being provided for assigning the IP address.

**[0025]** In particular, a user can obtain data relative to an equipment of the installation through a specific query. To this end, the method can comprise the steps of:

- requesting data relative to a peripheral device, said requesting step being formulated to the gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. the connection bound by the peripheral device by the table of correspondence through the gateway,
- sending the request to said peripheral device on said connection through the gateway.

**[0026]** Not exclusively, to this end, the method can comprise a step of request for data transmission to a control unit, this request being formulated to the gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**[0027]** Always not exclusively, to this end, the method

can comprise, furthermore, the steps of:

- searching the current control unit IP address, i.e. of the connection associated to said control unit by the table of correspondence through the gateway,
- sending the data to said control unit on said connection by said gateway.

Said steps of transmitting requests and data are allowed associating requests and data to a header that contains an univocal identification of the addressee and an univocal identification of the sender, and associating said identifications in a TCP/IP packet. This packet is sent to the server on the previously open connection.

Preferably, said server can comprise furthermore

- program means called master,
- a a data registration zone called database, this database being associated with a seconda port of the server, said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**[0028]** Furthermore, the method can provide a step of data transmission from the database to a supervision unit through said second port of the server.

**[0029]** Alternatively, data relative to an equipment of the installation can be obtained by a user of the control or from the database according to a program, said program comprising temporal limits and/or alarm conditions.

**[0030]** To this purpose and in a first aspect, the method can comprise a step of assigning temporal limits by a user preferably through a supervision unit, such temporal limits cause data to be sent from a peripheral device to the gateway and from the gateway to a supervision unit for being notified to a user, or from the gateway to the master for registration in the database.

**[0031]** Preferably, such temporal limits are recorded in a peripheral device associated with said equipment of the installation.

**[0032]** In particular, such temporal limits can be defined by equal time intervals, said intervals forming a frequency of data transmission from said peripheral device.

**[0033]** In a second aspect of the invention. and for the same objects, the method can provide a step of defining conditions of alarm by a user, preferably through a supervision unit associated with said user, such conditions being for example:

- exceeding an assigned threshold value by a process variable,
- missing confirmation of execution of a command to a peripheral device associated with an actuator, advantageously after a determined number of iterations of said command,
- missing receipt of commands from a peripheral device for a determined time interval,

Such conditions of alarm causing a data transmission from said peripheral device to the gateway and from the gateway to a supervision unit for being notified to a user, or from the gateway to the master for registration in the database, in particular, for compilation of historical alarm data.

**[0034]** Preferably, such conditions are recorded in said peripheral device.

**[0035]** Some peripheral devices, normally associated with measuring instruments, which can be in series or in parallel to each other, can carry out, further to the described functions of transmission of data, also automatic actuating functions of other peripheral devices, normally associated with actuators.

**[0036]** In this case the data, alarms and controls, are preferably exchanged directly between peripheral devices, for example by radio. The server, can, in any case, carry out contemporaneous functions of notifying an alarm to a supervision unit through the gateway, according to the steps of search and sending above described, or of registration of alarms and events in the database through the gateway and the master.

**[0037]** A step can be provided of defining alarm conditions, by a user, such that at said conditions of alarm the steps are repeated according to a determined time interval, until the condition of alarm that the has caused it is present. Such conditions of alarm can be recorded in a peripheral device.

**[0038]** To this purpose, a condition of alarm can cause the generation of a command, this command being a signal sent from a first peripheral device, called master peripheral device, to a second peripheral device, called slave peripheral device. This chain of generation, transmission and running controls is called automatism, in this case said method providing at least two peripheral devices associated with operating equipment of the installation, of which one is an instrument and the other is an actuator.

**[0039]** Preferably, the step of sending said command is repeated according to a determined time interval, until the condition of alarm that has generated it remains.

**[0040]** The method can comprise furthermore, a step of disconnecting an automatism.

**[0041]** Preferably, communication between a master peripheral device and a slave peripheral device is made through radio waves, for example of wavelength comprised within known bands such as VHF and UHF.

**[0042]** Furthermore, the method can comprise the steps of:

- generating a command by a user of the control through a control unit, said command being for a slave peripheral device,
- requesting a transmission of said command to said

slave peripheral device, said requesting step being formulated to the gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. the connection associated to said slave peripheral device by the table of correspondence through the gateway,
- sending said command to said slave peripheral device on said connection by said gateway.

**[0043]** This way, a user of the control can operate an actuator for changing a status of an equipment, for example running or stopping a motor, or opening a valve, by receiving an alarm or in any case at the user's choice.

Brief description of the drawings

**[0044]** The invention will be made clearer with the following description of an exemplary embodiment thereof, exemplifying but not limitative, with reference to the attached drawings wherein:

- Figure 1 is a diagrammatic view of a data processing network for remote controlling of a plant, according to the invention;
- Figure 2 is a diagrammatic view of exchange of data in a procedure of request and grant of an access of a terminal GPRS to the data processing network;
- Figures 3a and 3b show a diagrammatic view of exchange of data in phases of univocal identification of a terminal connected to the data processing network;
- Figure 4 is a diagrammatic view of exchange of data in a procedure of transmission of a requesting data or of a command formulated by a control unit and directed to a peripheral device;
- Figure 5 is a diagrammatic view of exchange of data in a procedure of updating data relative to a peripheral device.

Description of preferred exemplary embodiments

**[0045]** With reference to figure 1, an implementation is presented of the method according to the invention. For remote controlling a remote plant a data processing network 1 is available with TCP/IP protocol. It comprises a server 2, whose ports 12 and 17 are identified and shown in the network through TCP/IP public and static address.

**[0046]** The network comprises then a variable number of control unit 3, forming the interface with the users of the control, not shown in the figures, a variable number of peripheral devices 4 or 5, associated with operating equipment of a plant, such as measuring instruments 6b or actuators 6a, for example a valve. In the instantaneous status of the system shown in figure 1 four users are connected to the network through respective control units 3, and four peripheral devices 4 or 5.

**[0047]** In the example shown in figure 1, the control units 3 are connected to the network 1 by means of ADSL modem 7. Concerning the peripheral device 4 they are connected to the network 1 by means of integrated GPRS devices, whereas the peripheral device 5 have a radio connection and require further peripheral devices 18 with double radio/GPRS interface for connection to the network 1.

**[0048]** The mode of connection chosen for the control unit and the peripheral devices, respectively ADSL and GPRS, require the operation of a network services provider, diagrammaticlly shown with the symbol 9 (figure 2) for assigning to the terminal of a TCP/IP address 10, in this case of dynamic type, i.e. representstivo of a peripheral device during the sole current session.

**[0049]** Always with reference to the example of figure 1, in the server a gateway 11 is resodent, which dialog with each other components of the network through the port 12 of the server, available owing to a public static IP address visible in all the data processing network; nel server is furthermore, residing a master 13, which recepisce and selects the data from the gateway 11, and is furthermore, residing a database 14, on which the master 13 records data selected, in the shape of trend of process variables 15 and of storici 16 of alarms and events. this database is accessible by a port dedicated 17, which are also available from each point of the data processing network owing to an IP address public and static.

**[0050]** Are now described the mode of operation of a control system that applies the method according to the invention.

**[0051]** A first procedure, common to all the mode of operation since preliminary an each exchange of data between components of the data processing network, is the request preparing for entering the data processing network 1 by the terminal. Figure 2 represents this process with reference to a peripheral device 4, but is valid also for peripheral devices 18 and the control unit 3, after change of these numbers to number 4, as indicated between brackets. This consideration is also valid for processes described hereinafter.

**[0052]** Firstly, the peripheral device 4 has a request 21 for entering the data processing network 1 to the network service provider 9. Then, the provider 9 inoltra a nulla-osta 22 to the connection and assegna to this connection an dynamic IP address 10.

**[0053]** A second procedure causes an univocal identification of the terminal linked, cause to be possible the exchange of data between such terminal. Figures 3A and 3B show this process with reference to a peripheral device 4.

**[0054]** Firstly (figure 3A), the peripheral device 4 has a request 31 of connection to the server 2, more precisely to the gateway 11 through the port 12 (figure 1), visible owing to an IP address static known to the peripheral device 4. Then, the gateway 11 inoltra a nulla-osta 32 to

the connection and annota the data relative to the new linking, i.e. the dynamic IP address 10 associated with the linking. At this point (figure 3B) the gateway 11 inoltra a request 33 an identification code proper to the peripheral device 4, which delivers a response 34 containing the identification code required 35. The gateway 11 stores the identification code 35 at the dynamic IP address 10, in a table 36 of correspondsnze between dynamic IP addresses of connection and identifiedvi of peripheral devices.

**[0055]** A third procedure, described with reference to figure 4, consists of sending a message to the server 2 by a control unit 3, said message being for an assegned peripheral devices 4. this message can be a request for updating data relative to a peripheral device associated with an instrument measuring 6b (figure 1), or a command for a peripheral device associated with an actuator 6a.

**[0056]** In the former case, the control unit 3 delivers to the gateway 11 a request 41 of updating the data of an assegned peripheral devices 4, connection to the request the identification code proper of the peripheral device same. The gateway 11 esegue a search 42 of the IP address 10 relative to the connection of the peripheral device 4 destinataria of the request for updating data, using for this search the table 36 of correspondence among dynamic IP addresses and identification codes of peripheral devices connected. once recovered the IP address 10, the gateway proceeds to the step of sending 43 of the request for updating data to the peripheral device 4.

**[0057]** In the latter case, val still the description now carried out replacing simply "request for updating dati" with "comando".

**[0058]** A fourth procedure, described with reference to figure 5, consists of data transmission to the server 2 by a peripheral device 4, such data being set to an assegned control unit 3. This procedure can be activated in response to a request for updating data, above described, or can be activated according to a program of time or a logic based on alarm conditions, this logic and this program being recorded in the peripheral device and/or nel server. The peripheral device 4 esegue then the step of sending 51 of a packet of data, corredato delil identification code 52 proper of the addressee, which in this case is the control unit 3.

**[0059]** If this procedure both activated in response to a request for the control unit, the dynamic IP address of the control unit destinataria of the data is known, since is weftngiven by the packet data that conteneva the demand, therefore the gateway 11 esegue the step of sending 55 of the data to the peripheral device 3.

**[0060]** In the other cases, it is known only the identification code proper of the addressee, therefore the gateway 11 must execute a search 53 of the IP address 54 relative to the connection of the or the control unit 3 destinatarie of the data, using for this search the table 36 of correspondence among dynamic IP addresses and identification codes of peripheral devices connected. once recovered the IP address 54, the gateway proceeds to the step of sending 55 of the request for updating data to the control unit 3.

**[0061]** Other sequences of transmission of data are, typically:

a) storing of a program in a peripheral device, which is similar to the first procedure;
b) registration of data nel database, which is similar to the fourth procedure;
c) running an automatism, in particular, in the shape of dialogo between peripheral devices where the server is not involved unless for functions of registration of events and alarms, unless for making reference to the table of corispondences;
d) disconnecting an automatism, which is similar to the first procedure;
e) consultation of the database by a user, as function accessoria, in a way similar to the first procedure.

**[0062]** The description of which above an exemplary embodiment specific of the method is capable of show the invention from a viewpoint conceptual so that other, using the prior art, can be changing and/or adapting in various applications this exemplary embodiment specific without further ricerche and without moving away from each other by the concept inventive, and, then is intended that such adaptation and changes will be high as equivalent of an exemplary embodiment specific. The means and the material to provide the various functions described can be changes nature without for this come out from the field of invention. is intended that the expressions or the terminology used have object purely describedvo and for this not limitative.

## Claims

1. A control method for remote controlling an equipment of a plant by a user, in particular, through a data processing network with TCP/IP protocol, said data processing network comprising:

   - prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public static IP address visible in said data processing network,
   - requesting an access to the data processing network by a terminal selected from the group comprised of:
   - a supervision unit associated with said user,
   - a peripheral device associated with said equipment,
   - assigning a dynamic IP address and granting access to said terminal,

**characterised in that it provides** furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**2.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves of wavelength comprised within known bands such as UHF or VHF.

**3.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves and a step is provided of radio conversion towards Ethernet or towards GPRS.

**4.** Method, according to claim 1, wherein the steps are provided of:

- requesting data relative to a peripheral device, said requesting step being formulated to said gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. of the connection associated to said peripheral device by said table of correspondence by said gateway,
- sending said requesting step to said peripheral device on said connection by said gateway.

**5.** Method, according to claim 1, wherein a step is provided of requesting data transmission to a control unit, said requesting step being formulated to said gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**6.** Method, according to claim 6, wherein the steps are provided of:

- searching the current control unit IP address, i.e. the connection associated to said control unit by said table of correspondence by said gateway,
- sending said data to said control unit on said connection by said gateway.

**7.** Method, according to claim 6, wherein said server can comprise furthermore

- program means called master,
- a data registration zone called database, this database being associated with a seconda port of the server,

said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**8.** Method, according to claim 5, wherein a step is provided of assignment of data from said database to a supervision unit by a second port of the server.

**9.** Method, according to claims 6 and 7, wherein a step is provided of assegning temporal limits by a user through a supervision unit,d said temporal limits being recorded in a peripheral device associated with an equipment of the installation.

**10.** Method, according to claim 1, wherein the steps are provided of:

- generating a command by a user of the control through a control unit, said command being directed to a peripheral device associated with an actuator,
- requesting a transmission of said command to said peripheral device, said requesting step being formulated to said gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the connection relative to said peripheral device by said table of correspondence by said gateway,
- sending said command to said peripheral device on said connection by said gateway.

**Amended claims in accordance with Rule 137(2) EPC.**

**1.** A control method for remotely controlling an equipment of a plant by a user, in particular, through a data processing network with TCP/IP protocol, said data processing network comprising:

- prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public

static IP address visible in said data processing network,
- requesting an access to the data processing network by a terminal selected from the group comprised of:

  - a supervision unit associated with said user,
  - a peripheral device associated with said equipment,

- assigning a dynamic IP address and granting access to said terminal,

**characterised in that** it provides furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**2.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves of wavelength comprised within known bands such as UHF or VHF.

**3.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves and a step is provided of radio conversion towards Ethernet or towards GPRS.

**4.** Method, according to claim 1, wherein the steps are provided of:

- requesting data relative to a peripheral device, said requesting step being formulated to said gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. of the connection associated to said peripheral device by said table of correspondence by said gateway,
- sending said requesting step to said peripheral device on said connection by said gateway.

**5.** Method, according to claim 1, wherein a step is provided of requesting data transmission to a control unit, said requesting step being formulated to said gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**6.** Method, according to claim 6, wherein the steps are provided of:

- searching the current control unit IP address, i.e. the connection associated to said control unit by said table of correspondence by said gateway,
- sending said data to said control unit on said connection by said gateway.

**7.** Method, according to claim 6, wherein said server can comprise furthermore

- program means called master,
- a data registration zone called database, this database being associated with a seconda port of the server,

said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**8.** Method, according to claim 5, wherein a step is provided of assignment of data from said database to a supervision unit by a second port of the server.

**9.** Method, according to claims 6 and 7, wherein a step is provided of assigning temporal limits by a user through a supervision unit, d said temporal limits being recorded in a peripheral device associated with an equipment of the installation.

**10.** Method, according to claim 1, wherein the steps are provided of:

- generating a command by a user of the control through a control unit, said command being directed to a peripheral device associated with an actuator,
- requesting a transmission of said command to said peripheral device, said requesting step being formulated to said gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the connection relative to said peripheral device by said table of correspondence by said gateway,

- sending said command to said peripheral device on said connection by said gateway.



EX1004, Page 316

**Fig. 1**

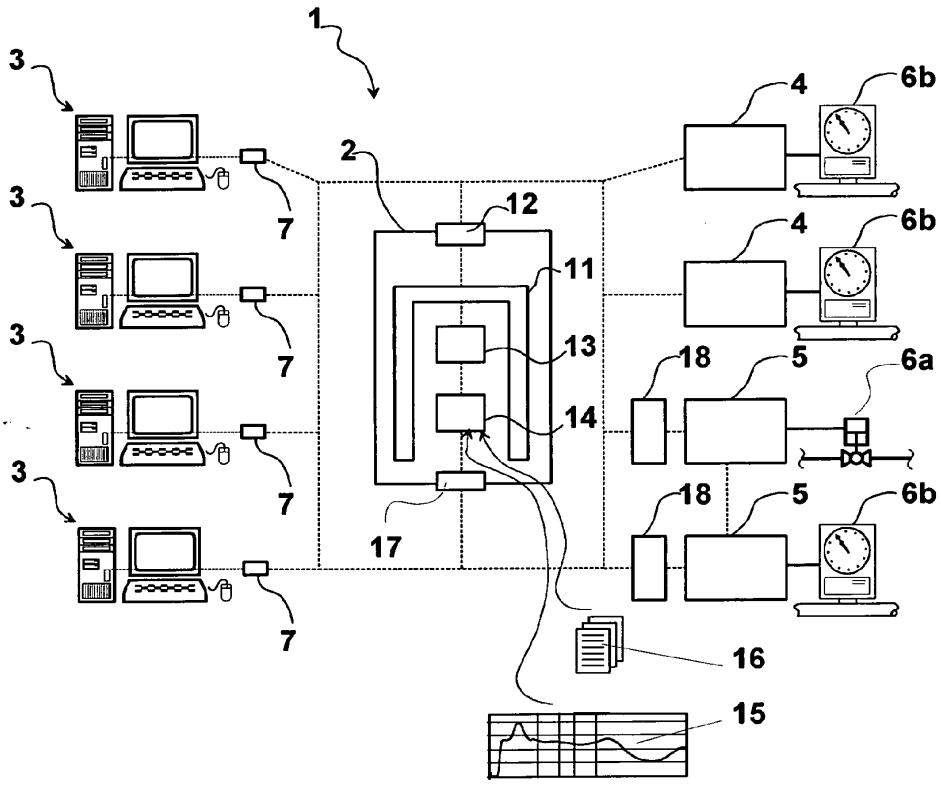


**Fig. 2**

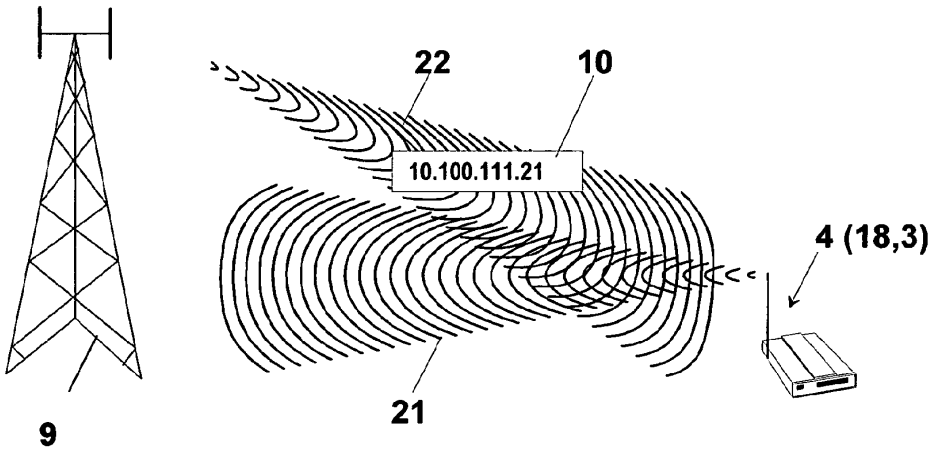


**Fig. 3A**

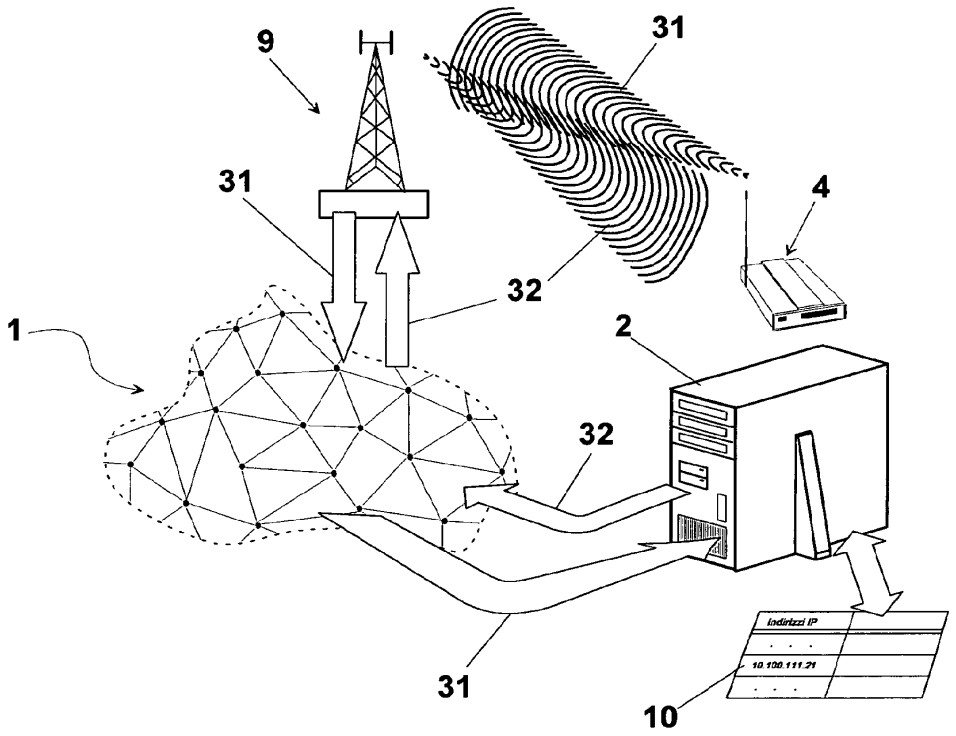


Fig. 3B

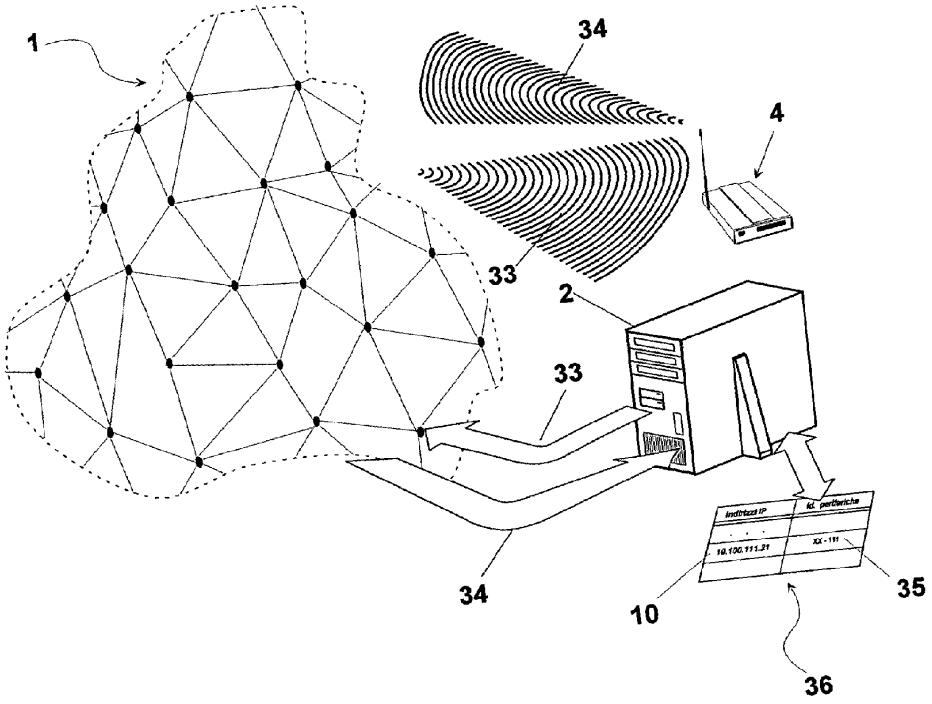


**Fig. 4**

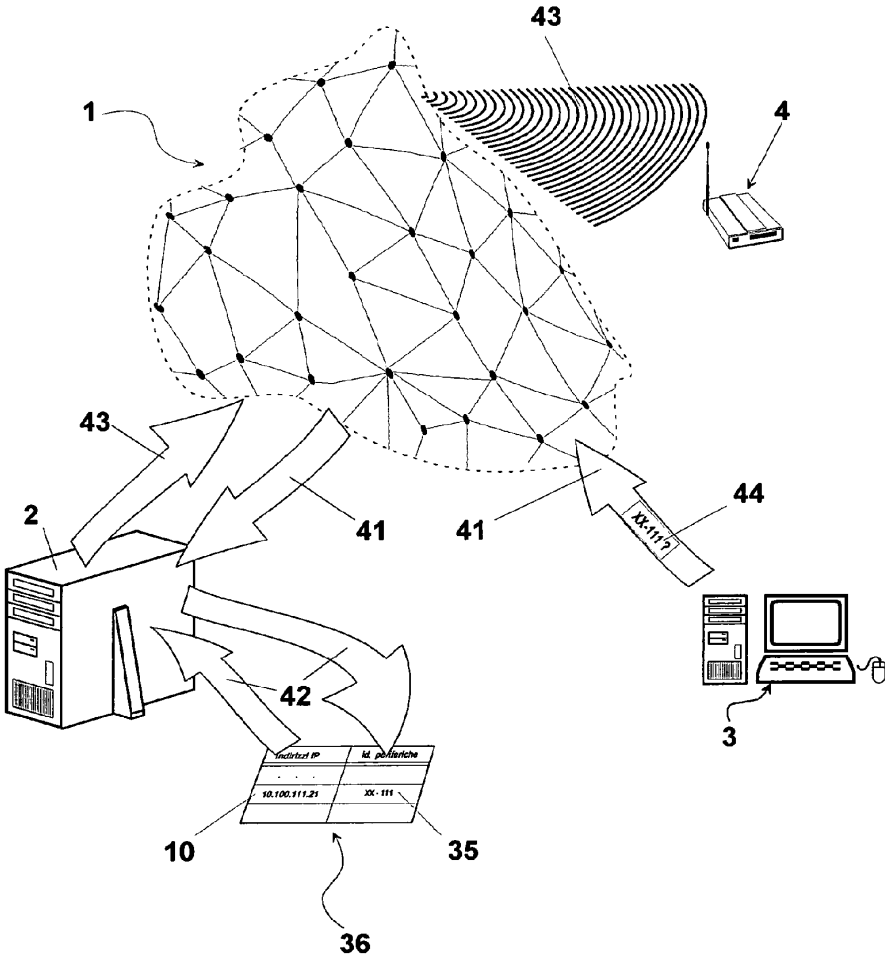
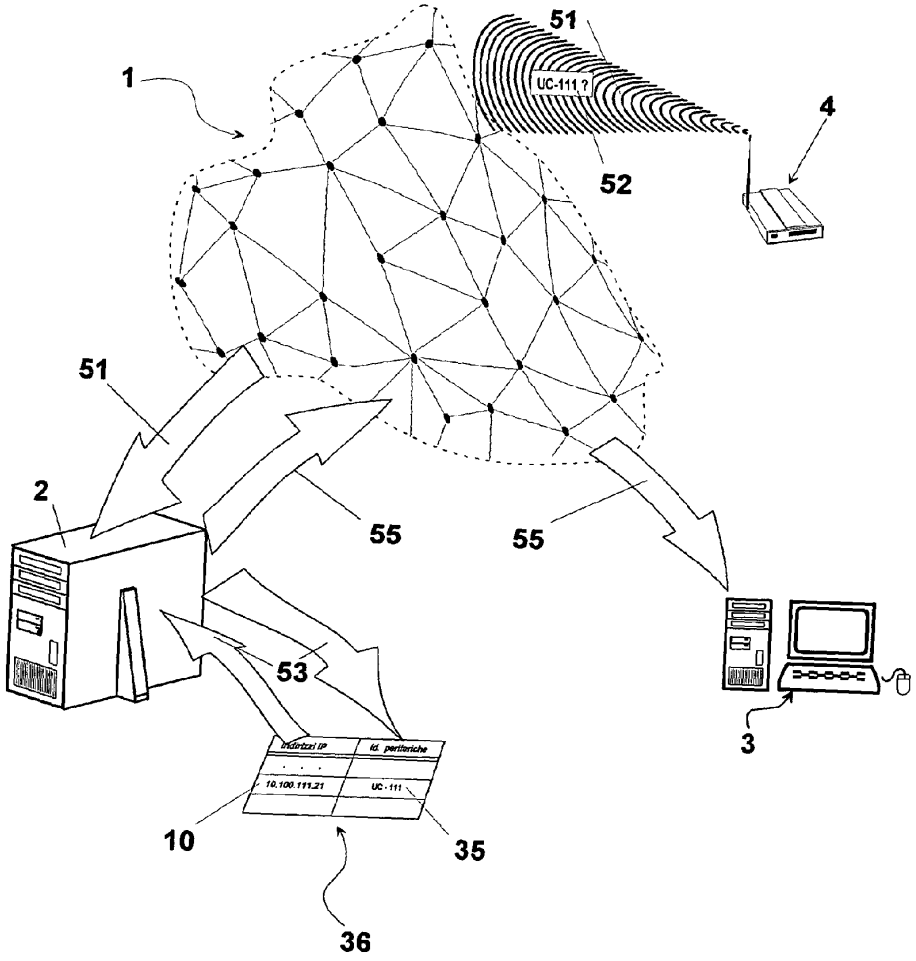


**Fig. 5**


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# EUROPEAN SEARCH REPORT

Application Number
EP 08 00 2184

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | JP 2006 290523 A (MITSUBISHI ELEC BUILDING TECHN) 26 October 2006 (2006-10-26) * abstract * | 1-10 | INV. G05B19/042 H04L29/00 |
| A | US 2002/062365 A1 (NISHIKAWA YOUICHIRO [JP] ET AL) 23 May 2002 (2002-05-23) * paragraph [0011] - paragraph [0022]; figure 2 * | 1-10 | |
| A | US 2005/150950 A1 (ASAI ARITO [JP]) 14 July 2005 (2005-07-14) * paragraph [0060] - paragraph [0064] * | 1 | |
| A | US 6 499 054 B1 (HESSELINK LAMBERTUS [US] ET AL) 24 December 2002 (2002-12-24) * the whole document * | 1 | |
| A | US 2004/249491 A1 (HOTT BRANDT POWELL [US]) 9 December 2004 (2004-12-09) * the whole document * | 1 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | G05B H04L G06F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 6 March 2009 | Kuntz, Jean-Marc |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 2184

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-03-2009

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| JP 2006290523 A | 26-10-2006 | NONE | |
| US 2002062365 A1 | 23-05-2002 | JP 2001359176 A | 26-12-2001 |
| US 2005150950 A1 | 14-07-2005 | JP 2005202459 A | 28-07-2005 |
| US 6499054 B1 | 24-12-2002 | AT 337670 T | 15-09-2006 |
| | | AU 1811901 A | 12-06-2001 |
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| | | EP 1247190 A1 | 09-10-2002 |
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | Aaron Phillips | 000314.000003 | 3874 |

35979 7590 03/07/2013

Bracewell & Giuliani LLP
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Houston, TX 77208-1389

| EXAMINER | |
|---|---|
| EVERETT, CHRISTOPHER E | |
| ART UNIT | PAPER NUMBER |
| 2121 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 03/07/2013 | ELECTRONIC |

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docketing@bgllp.com

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 13/708,557 | PHILLIPS ET AL. | |
| | Examiner | Art Unit | |
| | Christopher E. Everett | 2121 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *07 December 2012*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *07 December 2012* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/31/2012*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

### *Information Disclosure Statement*

1. The information disclosure statement filed 12/31/2012 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

### *Claim Objections*

2. Claims 1 and 17 are objected to because of the following informalities: "input/output" is ambiguous as to what limitations are included or excluded. Applicant is advised that the terminology should be clarified to remove the ambiguity (e.g., input or output module; input and output module). Appropriate correction is required.

3. Claims 15-16 are objected to because of the following informalities: "oil/water" is ambiguous as to what limitations are included or excluded. Applicant is advised that the terminology should be clarified to remove the ambiguity (e.g., oil or water; oil and water). Appropriate correction is required.

4. Claim 19 is objected to because of the following informalities: The limitation “the network interface” is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

5. Claim 19 is objected to because of the following informalities: The limitation "the fluid-handling device" is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

6. Claim 19 is objected to because of the following informalities: The limitation "the fluid-handling equipment" is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

7. Claim 19 is objected to because of the following informalities: The limitation "the command" is recited. There is insufficient antecedent basis for this limitation in the claim (e.g., Does the command refer back to the received command?; Does the command refer back to the translated command?). Appropriate correction is required.

8. Claim 20 is objected to because of the following informalities: The limitation "the network interface" is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

9. Claim 20 is objected to because of the following informalities: The limitation "the fluid-handling device" is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

10. Claim 20 is objected to because of the following informalities: The limitation "the fluid-handling equipment" is recited. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

11. Claim 20 is objected to because of the following informalities: The limitation "the command" is recited. There is insufficient antecedent basis for this limitation in the claim (e.g.,

Does the command refer back to the received command?; Does the command refer back to the translated command?). Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

12. 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 –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 1-8, 11-14, 17, and 19-20 are rejected under 35 U.S.C. 102(b) as being unpatentable by U.S. Patent Publication No. 2004/0262008 (Deans et al.).

Regarding claim 1, Deans et al. describes a system for remotely controlling fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising: **(Deans et al.: "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- an input/output module operable to communicate with a fluid-handling device; **(Deans et al.: "As shown in FIG. 5, a communication pod includes various components, including a device connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a**

**pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- a network interface; **(Deans et al.: "The pod also has a network connector 202 for connection to the subsea network 34." Paragraph 0062; paragraphs 0019, 0020, 0062, 0063, 0064; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- memory; and **(Deans et al.: "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software 214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in hardware without the use of software." Paragraph 0063; paragraphs 0062, 0063, 0064; figures 1, 5)**
- one or more processors communicatively coupled to the input/output module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising: **(Deans et al.: "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software 214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in**

**hardware without the use of software." Paragraph 0063; paragraphs 0062, 0063, 0064; figures 1, 5)**

- receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7)**
- translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and **(Deans et al.: "The triggers can include**

**increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the translated command to the local controller. (**Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

Regarding claim 2, Deans et al. describes the system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

- receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling equipment obtained by sensors of the fluid-handling device; and **(Deans et al.: "Also, various sensors 14, 16, 18 and control devices 20 are positioned downhole in the subsea well 10. Examples of sensors 14, 16, 18 include pressure sensors, temperature sensors, flow rate sensors, shock detectors, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0021; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- sending, to a remote data store, the received sensor data. **(Deans et al.: "Periodically, or in response to some triggering event, the electronics module 206 (under control of the software 212 214 and/or processor 208) communicates the stored data through the interface 212 and the network connector 202 to the subsea network 34. The data is transferred over the subsea network 34 to the surface facility 32. Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; paragraphs 0062, 0063, 0064, 0065, 0066, 0069; figures 1, 1b, 5, 6, 7)**

Regarding claim 3, Deans et al. describes the system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising: **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to**

**enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0062, 0063, 0064, 0065, 0066, 0069; figure 1, 5, 6, 7)**

- receiving, from a user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station coupled to the fluid-handling device; **(Deans et al.: "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0059, 0069, 0070; figures 1, 5, 6, 7)**
- retrieving, from the data store, data responsive to the request from the user device; and sending, to the user device, the retrieved data for presentation to the user. **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**

Regarding claim 4, Deans et al. describes the system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid. **(Deans et al.: "Also, various sensors 14, 16, 18 and control devices 20 are positioned downhole in the subsea well 10. Examples of sensors 14, 16, 18 include pressure sensors, temperature sensors, flow rate sensors, shock detectors, and so forth." Paragraph 0019; "During operation, data acquired by sensors are received over a line at the device connector 200, with such data provided to the electronics module 206 for storing in the storage 210. Periodically, or in response to some triggering event, the electronics module 206 (under control of the software 212 214 and/or processor 208) communicates the stored data through the interface 212 and the network connector 202 to the subsea network 34." Paragraph 0065; paragraphs 0019, 0020, 0021, 0063, 0064, 0065, 0066; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 5, Deans et al. describes the system of claim 3, wherein the request is a request to view alarms issued by the fluid-handling device, and wherein the retrieved data comprises data indicative of the alarms. **(Deans et al.: "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; "The data handling module 314 refers to a module for collection and storage of data**

**associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; "The subsea communication hub 28 can also be configured to conduct autonomous processing of data and pass along warnings to the subsea production control system 26, based upon preset criteria." Paragraph 0037; "The subsea communication hub 28 also has on-board diagnostic capabilities at the seabed. On-board diagnostics can be configured to send alerts to the surface facility 32 or to trigger some automated subsea event such as a downhole flow control device actuation or increased data acquisition log in rates to due flow interruptions or restarting." Paragraph 0039; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0037, 0038, 0039, 0059, 0069, 0070; figures 1, 5, 6, 7)**

Regarding claim 6, Deans et al. describes the system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms. **(Deans et al.: "The subsea communication hub 28 can also be configured to conduct autonomous processing of data and pass along warnings to the subsea production control system 26, based upon preset criteria." Paragraph 0037; "The subsea communication hub 28 also has on-board diagnostic capabilities at the seabed. On-board diagnostics can be configured to send alerts to the surface facility 32 or to trigger some automated subsea event such as a**

**downhole flow control device actuation or increased data acquisition log in rates to due flow interruptions or restarting." Paragraph 0039; "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraphs 0037, 0038, 0039, 0059, 0069, 0070; figures 1, 5, 6, 7)**

Regarding claim 7, Deans et al. describes the system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising: **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**

- receiving, from a user device, the command to change the state of the fluid-handling device; and **(Deans et al.: "The data handling module 314 refers to a module for collection and storage of data associated with sensors of the various wells. This may be implemented in a database to enable convenient user query and retrieval of measurement data, such as those collected by sensors associated with subsea wells." Paragraph 0069; paragraph 0069; figure 7)**
- determining a network address of the network interface; and **(Deans et al.: "Each sensor and/or control device can be considered an independent network node on an IP network, with the sensor and/or control device assigned an IP address for purposes**

**of communications." Paragraph 0030; "In addition to the payload, packet control information is inserted into each packet, including IP source and destination addresses as well as TCP control information." Paragraph 0066; paragraphs 0025, 0026, 0027, 0030, 0034, 0049, 0050, 0062, 0063, 0064, 0065, 0066; figures 1, 1B, 5)**

- sending the command to the network interface. **(Deans et al.: "The fiber optic laser in the transmitter 404 transmits optical signals down the transmit fiber 406, with the optical signals modulated to be indicative of the data or commands that are being transmitted." Paragraph 0072; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0062, 0063, 0064, 0065, 0066, 0071, 0072; figures 5, 6, 7)**

Regarding claim 8, Deans et al. describes the system of claim 1, wherein fluid-handling device comprises a pump, and wherein the command comprises a command to change a speed of the pump. **(Deans et al.: "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; "Also, subsea instrumentation of a pump, such as an ESP pump, can be used to change frequency, monitor vibration, optimize speed at the seabed and extend pump life." Paragraph 0041; paragraphs 0019, 0020, 0041, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 11, Deans et al. describes the system of claim 1, wherein receiving the command comprises receiving the command via a first network socket, and wherein sending the translated command comprises sending the translated command via a second network socket. **(Deans et al.: "The pod also has a network connector 202 for connection to the subsea network 34." Paragraph 0062; "The device connector 200 is connected to one or more cards 204, with each card associated with a particular device. Thus, for example, if there re N subsea or downhole devices that the pod is coupled to, then there would be N cards 204 provided in the pod. Alternatively, one card can be provided to communicate with multiple sensors or control devices." paragraph 0062; paragraphs 0026, 0027, 0028, 0062, 0063, 0064, 0065, 0071, 0072, 0073; figures 5, 6, 7)**

Regarding claim 12, Deans et al. describes the system of claim 1, wherein translating the command comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command. **(Deans et al.: "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34. The interface 212 includes the various layers that enable communications over the network, such as a physical layer, a data link layer (e.g., Ethernet layer), an IP layer, and a transport layer (e.g., TCP or UDP). More specifically, according to one example implementation, the interface 212 includes an Ethernet switch and an optical modem, as well as the TCP/IP stack for implementing TCP/IP communications." Paragraph 0064; paragraphs 0007, 0025, 0026, 0027, 0062, 0063, 0064; figure 5)**

Regarding claim 13, Deans et al. describes the system of claim 1, wherein the local controller comprises a processor operative to execute the translated command after losing a network connection to the network interface and before the fluid-handling device is in the target state. **(Deans et al.: "As a result, the subsea communication hub 28 can be removed from operation for service or repair without detrimental effects upon ongoing well production." Paragraph 0035; "In addition, the subsea communication hub 28 can be configured to conduct autonomous processing of data and control based upon input from a single or multiple instruments." Paragraph 0037; paragraphs 0035, 0036, 0037, 0038, 0041, 0042, 0062, 0063, 0064, 0065, 0069, 0070; figures 1, 1b, 5, 6, 7)**

Regarding claim 14, Deans et al. describes the system of claim 1, comprising one of the following coupled to the fluid-handling device: an oil well, a salt water disposal well, a carbon-capture well, or a pump station. **(Deans et al.: "artificial lifting of hydrocarbons from the wellbore" paragraph 0040; "This invention relates to communications with a subsea well, and in particular, communications with sensors and/or control devices associated with the subsea well." Paragraph 0002; paragraphs 0002, 0007, 0040; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Regarding claim 17, Deans et al. describes the system of claim 1, comprising:

- a remote server coupled to the network interface via the Internet; **(Deans et al.: production management as illustrated in figure 6; "Production management refers to the management of the production of one or more subsea wells. For example, a**

**well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0069, 0070; figures 6, 7)**

- a plurality of oil-wells, petro water disposal or re-injection facilities, or petroleum pumping station, each oil well, petro water disposal or re-injection facility, or petroleum pumping station coupled to a corresponding one of a plurality of systems, each respective system being in communication with the remote server via the Internet and comprising: **(Deans et al.: see wells in figure 1B; "in an SMC system for multiple wells" paragraph 0046; "FIG. 1B illustrates another embodiment of the subsea monitoring and control system that has multiple subsea communication hubs 50, 52, and 54 that are coupled by a subsea network 56 to the surface facility 32. The subsea communication hubs 50, 52, and 54 each has a processor 56 as well as communication equipment 58. Each subsea communication hub can be attached to either local or network-enabled sensors and/or control devices. A local sensor and/or control device is capable of communication only with the respective subsea communication hub." Paragraph 0049; figure 1B)**
    - a respective input/output module operable to communicate with a respective fluid-handling device; **(Deans et al.: see figure 1B; "As shown in FIG. 5, a communication pod includes various components, including a device**

**connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0046, 0047, 0048, 0049, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

- a respective network interface; **(Deans et al.: see figure 1B; "The pod also has a network connector 202 for connection to the subsea network 34." Paragraph 0062; paragraphs 0019, 0020, 0046, 0047, 0048, 0049, 0062, 0063, 0064; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- a respective memory; and **(Deans et al.: see figure 1B; "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software 214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in hardware without the use of software." Paragraph 0063; paragraphs 0046, 0047, 0048, 0049, 0062, 0063, 0064; figures 1, 5)**
- a respective set of one or more processors communicatively coupled to the respective input/output module, the respective network interface, and the respective memory, wherein the respective memory stores instructions that when executed by the respective processors cause the respective processors to effectuate

steps comprising: **(Deans et al.: see figure 1B; "The cards 204 are coupled to an electronics module 206. For example, the electronics module 206 can have slots to receive the multiple cards 204. The electronics module 206 includes a processor 208 and storage 210, such as random access memory (RAM), mass storage, and so forth. Also, the electronics module 206 may include software 214 that is executable on the processor 208. Alternatively, the tasks performed by the electronics module 206 can be implemented entirely in hardware without the use of software." Paragraph 0063; paragraphs 0046, 0047, 0048, 0049, 0062, 0063, 0064; figures 1, 5)**

- receiving, via the respective network interface, from the remote user device, a respective command to change a respective state of the respective fluid-handling device to a respective target state; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with**

**the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28).” Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7)**

- translating the received respective command into a respective translated command operative to cause a respective local controller of the respective fluid-handling device to drive the respective fluid-handling equipment to the respective target state; and **(Deans et al.: “The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors.” Paragraph 0038; “In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices.” Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the respective translated command to the respective local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

Regarding claim 19, Deans et al. describes a tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising:

- receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or**

**more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7)**

- translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and **(Deans et al.: "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

- sending the translated command to the local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

Regarding claim 20, Deans et al. describes a method, comprising:

- receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; **(Deans et al.: "Data and control information can also be communicated from the surface facility 32 for receipt by the pod." Paragraph 0065; "The interface 212 enables the pod to communicate according to packet-based communications (e.g., TCP/IP-based communications) over the subsea network 34." Paragraph 0064; "Production management refers to the management of the production of one or more subsea wells. For example, a well operator may decide to increase or decrease the amount of production from one or more wells." Paragraph 0069; "The data network 310 enables convenient communication between remote users (such as those associated with the data handling module 314 or production management module 312) and the topside**

**communication hub 300 (and ultimately the subsea communication hub 28)." Paragraph 0070; paragraphs 0062, 0063, 0064, 0065, 0069, 0070; figures 5, 6, 7**)

- translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and **(Deans et al.: "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5**)
- sending the translated command to the local controller. **(Deans et al.: "For example, the subsea communication hub 28 can be configured to trigger on predefined subsea events, such as choke adjustments or valve closures." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are**

**decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0036, 0037, 0038, 0065, 0066, 0067; figures 1, 1b, 5)**

***Claim Rejections - 35 USC § 103***

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

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent Publication No. 2004/0231851 (Silvers) (cited by Applicant).

Claim 9:

Deans et al. does not explicitly describe a serial bus with a corresponding process as described below. However, Silvers teaches the serial bus with the corresponding process as described below.

Regarding claim 9, Silvers describes the system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with the fluid-handling device, wherein translating the received command comprises: **(Silvers: see field station as illustrated in figure 1; "Well data and production control commands are transmitted from a remote**

**central data store to wells at a remote location with a well hopping system and method, preferably through a radio frequency (RF) network. Request packets are sent through a field station to one or more well units until it reaches the destination well unit." Abstract; "The data processor is programmed to transmit data through the internet or other suitable communication media to a field station. The field station has an internet connection, such as a satellite dish or a broad band connection, to receive data from the central data store and a converter for converting the received data, for example, into serial RS 232 format, and a transmitter to transmit the converted data to a well hopping communication system formed of two or more well units." Paragraph 0010; abstract; paragraphs 0010, 0011, 0015, 0016, 0027, 0029, 0038, 0049; figures 1, 5)**

- identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command; **(Silvers: see field station and units 12 as illustrated in figure 1; "In the practice of the invention, each of the wells is assigned a unique address and at least one well hoping path between each well and the central data store zone. Typically, each well is assigned a preferred well hopping path and one or more alternative well hopping paths in the event that one of the transmitters in the main path is not functioning." Paragraph 0016; paragraphs 0010, 0011, 0015, 0016, 0027, 0028, 0038, 0049; figures 1, 5)**
- identifying a command code operative to cause the component to execute the received command; and **(Silvers: "In another of its aspects, the invention relates to a wireless radio frequency communication system for transferring commands and data between wellheads and a central data store." Paragraph 0002; "The invention**

**further relates to a method for communicating between wells and a remote location comprising the steps of sending from a central data store to a field station via the Internet a request data packet intended for a destination well unit, transferring the request data packet from the field station to a first well unit via radio waves, determining if the first well unit is the destination well unit, if the first well unit is not the destination well unit, hopping the request data packet along a series of at least two well units, wherein the first well unit is part of the series, until the request data packet reaches the destination well unit." Paragraph 0018; paragraphs 0010, 0011, 0015, 0016, 0018, 0038, 0049; figures 1, 5)**

- sending to the address on the serial bus the command code. **(Silvers: see sending of packet through radio frequency network as illustrated in figure 3A; see field station and units 12 as illustrated in figure 1; "transferring the request data packet from the field station to a first well unit via radio waves, determining if the first well unit is the destination well unit, if the first well unit is not the destination well unit, hopping the request data packet along a series of at least two well units, wherein the first well unit is part of the series, until the request data packet reaches the destination well unit." Paragraph 0018; paragraphs 0011, 0015, 0016, 0018, 0030, 0038, 0049; figures 1, 5)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, with the known techniques of Silvers, namely, well control and monitoring system, would have yielded predictable results and resulted in an improved system. Accordingly, applying the

teachings of Deans et al. to provide communication and control mechanisms for the automated control and maintenance of an underwater oil platform with the teachings of Silvers to automated control and monitoring of well units in an oil field with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system (i.e., controlling fluid control devices using serial bus communication of Deans et al. based on the teachings of using serial communication in Silvers).

16. Claims 10 and 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of WO 2008/124765 (Roberson et al.) (cited by Applicant).

Claim 10:

Deans et al. does not explicitly describe a digital to analog converter and a valve connected to the digital to analog converter as described below. However, Roberson et al. teaches the digital to analog converter and a valve connected to the digital to analog converter as described below.

Regarding claim 10, Deans et al. and Roberson et al. describe the system of claim 1, comprising

- a digital-to-analog converter, **(Roberson et al.: "one or more digital-to-analog converters (DAC) 113 for generating analog output signals and a number of digital logic output gates 114" page 18, lines 8-9; page 18, lines 5-12; figures 5, 7)**

- wherein the fluid- handling device comprises a valve responsive to an output signal of the digital-to-analog converter, and **(Roberson et al.: "actuates or regulates a set of outputs for actuating hardware such as solenoids and variable speed motor drive circuitry." page 18, lines 6-7; page 18, lines 5-12; figures 5, 7; Deans et al.: "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; "The subsea production control system 26 is responsible for providing control commands to the various subsea sensors and/or control devices or downhole sensors and/or control devices. The production control system 26 may also provide commands to wellhead components, such as xmas tree valves." Paragraph 0022; paragraphs 0019, 0020, 0022, 0041, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**
- wherein translating the received command comprises changing an output signal of the digital-to-analog converter responsive to the receive command. **(Roberson et al.: "providing a control signal to regulate the speed of variable speed motor 12" page 18, lines 11-12; page 18, lines 5-12; figures 5, 7; Deans et al.: "The triggers can include increased data sampling rates, and/or compilations of data sets to develop data products such as pressure build up curves as well as fault prediction and failure avoidance functionality. Also, the subsea communication hub 28 has the capability of accepting a software download from the surface facility 32 of autonomous processing and action criteria. Software downloads from the**

**surface facility 32 to the subsea communication hub 28 can also be performed to revise instrumentation calibration factors." Paragraph 0038; "In the inbound direction (from surface facility to the pod), received IP packets are decapsulated by the interface 212 to extract the payload, which can contain control and/or data information to be communicated to subsea or downhole sensors and/or control devices." Paragraph 0067; paragraphs 0037, 0038, 0039, 0065, 0066, 0067; figures 1, 1b, 5)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, with the known techniques of Roberson et al., namely, well control and monitoring system, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automate control and maintenance of an underwater oil platform with the teachings of Roberson et al.to automated control and monitoring of pump controllers in an oil field with identical results would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system (i.e., controlling fluid control devices using digital to analog converters of Deans et al. based on the teachings of using digital to analog converters in Roberson et al.).

Claim 18:

Deans et al. does not explicitly describe a user account data store as described below. However, Roberson et al. teaches the user account data store as described below.

Regarding claim 18, Roberson et al. describes the system of claim 17, wherein the remote server comprises a user account data store storing data associating each of the respective systems with a single user account distinct from a plurality of other user accounts in the data store. **(Roberson et al.: "Web server 230 provides initial login access to a remote client computer 91. Once the remote client 91 is authenticated, an initial or default HTML file 224 is transmitted by web server 230 to the remote client computer." Page 23, lines 6-9; page 23, lines 3-22; page 22, lines 14-22; page 24, lines 13-22; figures 5, 8, 9)**

Deans et al. and Roberson et al. are combinable for the same rationale as set forth above with respect to claim 10.

17. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2004/0262008 (Deans et al.) in view of U.S. Patent No. 5,149,443 (Varnam).

Claim 15:

Deans et al. does not explicitly describe an oil/water separation unit as described below. However, Varnam teaches the oil/water separation unit as described below.

Regarding claim 15, Varnam describes the system of claim 1, wherein the fluid-handling device comprises an oil/water separation unit, and wherein the command comprises a command operative to change a level of the oil/water separation unit at which oil meets water. **(Varnam: "The nozzle, which is powered by a turbine, effectively induces oil or an oil-water mixture**

**into the nozzle and through a conduit that leads from the nozzle to a series of separation tanks that from a part of an oil-water separation sub-system that is indicated generally by the numeral 22." Col. 4, lines 43-48; "In effect, these sensors sense and measure the specific gravity of the liquid in the vicinity of each sensor. This specific gravity information is utilized by the computer logic control system 20 of the present invention to control valves 206 and 215. As particularly illustrated in FIG. 1, since the oil's specific gravity is less than water, oil will tend to settle about the top portions of the respective tanks 200. The object of the oil-water separation process is to expel oil of a threshold concentration through the oil outlet control valve 215 and to expel water or a high water-low oil mixture concentration through the bottom control valve 206 that joins water outlet line 208. The respective sensors 222 and 224 are effective to control the discharge of water from the respective tank. Thus, the sensors 222 and 224 are operative to effectuate the control of the oil outlet control valve 215 to assure that oil of a threshold concentration is discharged from the final tank." Col. 8, line 65 through col. 9, line 14; col. 4, lines 59-62; col. 12, lines 43-67; figures 7, 8, 10)**

One of ordinary skill in the art would have recognized that applying the known technique of Deans et al., namely, communication and control of a subsea oil well from a surface facility, with the known techniques of Varnam, namely, an oil recovery system using an oil and water separation unit, would have yielded predictable results and resulted in an improved system. Accordingly, applying the teachings of Deans et al. to provide communication and control mechanisms for the automated control and maintenance of an underwater oil platform with the teachings of Varnam to separate water and oil using a pumping system with identical results

would have been recognized by those of ordinary skill in the art as resulting in an improved subsea communication and control system for oil well processing (i.e., controlling fluid control devices including an oil and water separation unit of Deans et al. based on the teachings of controlling an oil and water separation unit using a controller in Varnam).

Claim 16:

Deans et al. does not explicitly describe a pump and control of the pump as described below. However, Varnam teaches the pump and control of the pump as described below.

Regarding claim 16, Deans et al. and Varnam describe the system of claim 15,

- wherein the oil/water separation unit comprises a pump having a variable-frequency drive, and **(Varnam: see water pump and/or oil pump as illustrated in figure 8; increase water pump speed and/or increase oil pump speed as illustrated in figure 10; col. 11, line 65 through col. 12, line 3; col. 12, lines 9-15; col. 12, lines 43-64; figures 1, 7, 8, 10)**
- wherein the local controller is operative to adjust a frequency of the variable frequency drive until the level of the oil/water separation unit reaches a target level corresponding to the target state. **(Varnam: see controller 156 as illustrated in figure 8; "Finally, the oil recovery system of the present invention includes a computer logic control system 20 that controls the nozzle sub-system 18 as well as the oil-water separation sub-system 22." Col. 4, lines 59-62; col. 4, lines 55-58; col. 11, line 65 through col. 12, line 3; col. 12, lines 9-15; col. 12, lines 43-64; figures 1, 7, 8, 10; Deans et al.: "As shown in FIG. 5, a communication pod**

**includes various components, including a device connector 200 that is connected to one or more communications lines to various subsea or downhole sensors and/or control devices." Paragraph 0062; "Examples of control devices 20 include a flow control device (e.g., a valve), a pump, and so forth." Paragraph 0019; paragraphs 0019, 0020, 0062; figures 1, 1B, 5, 6, 7, 8, 9, 10)**

Deans et al. and Varnam are combinable for the same rationale as set forth above with respect to claim 15.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher E. Everett whose telephone number is (571)272-2851. The examiner can normally be reached on Monday through Friday from 8:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kavita Padmanabhan can be reached on 571-272-8352. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/C. E. E./
Examiner, Art Unit 2121

/Kavita Padmanabhan/

Supervisory Patent Examiner, Art Unit 2121

| Notice of References Cited | Application/Control No. 13/708,557 | Applicant(s)/Patent Under Reexamination PHILLIPS ET AL. | |
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| | Examiner Christopher E. Everett | Art Unit 2121 | Page 1 of 2 |

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| * | C | US-5,732,776 A | 03-1998 | Tubel et al. | 166/250.15 |
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| * | G | US-6,801,135 B2 | 10-2004 | Schultz et al. | 340/853.1 |
| * | H | US-2004/0262008 A1 | 12-2004 | Deans et al. | 166/339 |
| * | I | US-2005/0096846 A1 | 05-2005 | Koithan et al. | 702/006 |
| * | J | US-6,913,083 B2 | 07-2005 | Smith, David Randolph | 166/336 |
| * | K | US-7,148,812 B2 | 12-2006 | Baggs, Christopher David | 340/853.7 |
| * | L | US-7,289,994 B2 | 10-2007 | Nixon et al. | 1/1 |
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| * | E | US-7,958,938 B2 | 06-2011 | Crossley et al. | 166/366 |
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| * | I | US-8,179,279 B2 | 05-2012 | Voss, Robert K. | 340/854.6 |
| * | J | US-8,290,737 B2 | 10-2012 | Davis, Julian R. | 702/119 |
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The emergence of ZigBee in building automation and industrial **control**
D Egan - Computing & **Control** Engineering Journal, 2005 - ieeexplore.ieee.org
... launched two new ZigBee- ready products; the most exciting of these products is a **remote control** for the ... Tyco Thermal Controls has been working for several years now on systems to **control oil** pipeline temperatures in ... IEE Computing & **Control** Engineering | April/May 2005 19 ...
Cited by 157 Related articles All 4 versions Cite

The Use of Fiber-Optic Distributed Temperature Sensing and **Remote** Hydraulically Operated Interval **Control** Valves for the Management of Water Production in the ...
M Tolan, M Boyle, G Williams - SPE Annual Technical Conference and ..., 2001 - onepetro.org
... The **remote** activation aspect holds significant value for operators where wireline operations are difficult, expensive, or impossible. ... wells, ESP applications, heavy **oil** or paraffin situations, etc.7,8 The features of this valve are shown in Table 2. The **control** line hydraulic ...
Cited by 27 Related articles Cite

[CITATION] Formal organization as representation: **remote control**, displacement and abbreviation
R Cooper - ... Organization: new directions in organization theory ..., 1992
Cited by 182 Related articles Cite

Application of a multisegment **well** model to simulate flow in advanced wells
JA Holmes, T Barkve, O Lund - European Petroleum Conference, 1998 - onepetro.org
... An initial **oil** rate of 4,000 sm3/d is applied in all simulations, but the **well** quickly changes to **control** by a maximum gas rate of one ... Two different types of completion **control** are investigated in the case study Inflow **Control Devices** (ICDS) and **Remote** Completion **Control** ...
Cited by 98 Related articles All 2 versions Cite

Review of **oil** spill **remote** sensing
MF Fingas, CE Brown - Spill Science & Technology Bulletin, 1997 - Elsevier
... In: Proceedings of First Workshop Sponsored by Working Group I of the Pilot Study on the Use of **Remote** Sensing for the **Control** of Marine Pollution, vol. ... Noerager, JA & Goodman, RH (1991). **Oil** tracking, contain- ment and recovery during the Exxon Valdez response. ...
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Supervisory **control** of **remote** manipulation
WR Ferrell, TB Sheridan - Spectrum, IEEE, 1967 - ieeexplore.ieee.org
... aintlipUlator uideri conditions of intermittent and de- **remote** manipulator and its assigned task. ... Of thle man11ipuilator is operaited by a stepping miotor.'Ihei fects were evident in the **control** and display of the task. ... oi **oil**' contirollier isalii analog o the manipulatorarm-sco. ...
Cited by 212 Related articles All 4 versions Cite

Production experience from smart wells in the Oseberg field
S Erlandsen - SPE Annual Technical Conference and Exhibition, 2000 - onepetro.org
... The surface **control** unit is used for handling all the monitored data and for **remote** operation of the downhole inflow **control** valves. ... Surface **control** system DHSV Inflow **control devices** Bergen Stavanger ... 5 - **Well** B-21B Fig. 6 -- Effect of smart completion on **oil** production rate. Fig. ...
Cited by 28 Related articles All 5 versions Cite

GLASS: **remote** monitoring of embedded systems in power engineering
R Itschner, C Pommerell, ... - Internet Computing, ..., 1998 - ieeexplore.ieee.org
... Larger facilities like **oil** refineries, chemical pro- duction sites, or combined-cycle (gas and steam tur- bines ... **Remote** access to the **control** system is desirable and often ... For these applications, **remote** monitoring is needed mainly because of its ability to give warnings of possible ...
Cited by 65 Related articles All 9 versions Cite

Hydrodynamic aspects of design and attachment of a back-mounted **device** in penguins [PDF] from biologists.org
R Wilson, B Culik - Journal of Experimental Biology, 1994 - jeb.biologists.org
... The **oil** formed small droplets before vaporising and producing a thin layer of parallel ... a consideration of the functional anatomy of penguins (Bannasch, 1986, 1987) as **well** as various ... using small hot-wire sensors (HFI) steered in three dimensions by electronic **remote control**. ...
Cited by 244 Related articles BL Direct All 8 versions Cite

Modeling **well** inflow **control** with flow in both annulus and tubing
K Neylon, E Reiso, J Holmes, OS Nesse - SPE Reservoir Simulation ..., 2009 - onepetro.org
... An FCV allows active and **remote control** of inflow or outflow in different zones along the wellbore or in the individual branches of multibranch wells. ... Henriksen, KH, Gule EI, Augustine J. 2006. Case Study: The Application of Inflow **Control Devices** in the Troll **Oil** Field, SPE ...
Cited by 15 Related articles Cite

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**Control** of subsea cyclone



www.google.com/patents/US20120312754
App. - Filed Dec 20, 2010 - Published Dec 13, 2012 - Klas Goran Eriksson - Aker Subsea As
The system is comprising a **control** valve in the **oil** outlet or **oil** outlet line from the ... at least one **control** device for **control** of the **water separation** effect; ... Cyclone separators are **well** known equipment using rotational effects, .... If the **pump** (14) speed is varied in response to a separator (12) **level** change, ...
Overview - Related - Discuss

**Pump**-off **controller**



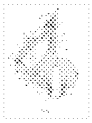
www.google.com/patents/EP0891468B1?cl=en
Grant - Filed Apr 4, 1997 - Issued Dec 20, 2000 - E. Robert Dutton - Micro Motion Incorporated
A **pump control** system (20) for use in terminating actuation of a **pumping unit** (22) while ... (22) to avoid actuation of the **pumping unit** while fluid **levels** (136) in a **well** bore are ... to the field of **control** systems for **pumping units** that lift **oil well** production fluids from ... Production fluids typically contain **oil**, **water**, and natural gas.
Overview - Related - Discuss

A separator tank for **separating oil** and gas from **water**



www.google.com/patents/EP2442882A1?cl=en
App. - Filed Jun 17, 2010 - Published Apr 25, 2012 - Finn Beckmann - Schlumberger Norge AS
In order to obtain the desired low **level** of **oil** and gas in the discharged **water** it is .... In an embodiment the individual separator tank **unit** has a pressure **control** valve ... separate from the actual **oil well** such as at a location where processed **water** is .... The **pump** 21 increases the gas pressure to be higher than the pressure in ...
Overview - Related - Discuss

Centrifugal separator with **control** equipment and a method of ...



www.google.com/patents/EP1163056B1?cl=en
Grant - Filed Nov 10, 1999 - Issued Sep 2, 2009 - Olev MÄEHANS - Alfa Laval Corporate Ab
Upon use of a nozzle centrifuge for **separating oil**, **water** and sand from a mixture ... **separated oil** and **separated** water, at a predetermined radial **level** (22). ... upon need to supply **control** liquid to the rotor only in an amount per **unit** of time such ... for introducing **control** liquid into the rotor from said supply conduit (24) as **well** ...
Overview - Related - Discuss

Method and apparatus for removing **oil** from **water** including ...



www.google.com/patents/EP1202935B1?cl=en
Grant - Filed Jun 7, 2000 - Issued May 21, 2003 - A. Michael Berger - Amcol International Corporation, Berger, Michael A.
A method of **separating water** from a liquid comprising a combination of **water** and ... conducting an electrical signal to a visual or audible **control** panel to provide a visual or ... clay-containing vessel is secured to an **oil well** platform support structure. ... of said **separating** means is within about 10 feet of an ocean **water level**.
Overview - Related - Discuss

Optimizing Heavy **Oil** Recovery Processes Using Electrostatic Desalters



www.google.com/patents/US20120217187
App. - Filed May 4, 2012 - Published Aug 30, 2012 - Michael F. Raterman -



Raterman Michael F, Sharma Arun K
The system may include a combined AC/DC desalter with a **control unit** for optimizing ... settling out at least a portion of the asphaltenes in a froth **separation unit** to ... Hot **Water** Extraction (CHWE) process represents an exemplary **well**- developed ... In the CHWE process, mined **oil** sands are mixed with hot **water** to create ...
Overview - Related - Discuss

A separator tank for **separating oil** and gas from **water**
www.google.com/patents/EP2442880A1?cl=en
App. - Filed Jun 17, 2010 - Published Apr 25, 2012 - Finn Beckmann - Schlumberger Norge AS
In order to obtain the desired low **level** of **oil** and gas in the discharged **water** .... In an embodiment the individual separator tank **unit** has a pressure **control** ... separate from the actual **oil well** such as at a location where processed **water** .... A gas line 20 with a **pump** 21 may re-circulate gas from the reject tank to inlet pipe 14.
Overview - Related - Discuss

**Oil** from **water separation** system
www.google.com/patents/EP1513774A4?cl=en
App. - Filed May 23, 2003 - Published May 24, 2006 - Balantyne Phineas Stone - Unisearch Limited
Attempts have been made in the prior art to **control** the **level** of the **oil**/**water** interface, ... coalescer **unit** whilst US 4554074 (Broughton) utilises **separation** plates. ..... This multiple tank arrangement, therefore, provides a "soft- fail" mode as **well** as .... accident on a road, and adequate time for the **oil** to be **pumped** out without it ...
Overview - Related - Discuss

Detection, measuring and **separation** system by stripping light ...
www.google.com/patents/EP2422055A1?cl=en
App. - Filed Apr 21, 2010 - Published Feb 29, 2012 - Bini Roberto - Turboden SRL
The diathermic **oils** which, furthermore, are widely used in the industry as a heat ... of the **oil** itself, or substances entered accidentally in the **oil** circuit, such as **water** or ... of cavitation phenomena in the circulation **pumps** of the diathermic **oil**, which .... of the modulation of the valve 31 under the **control** of a **level** calculator 49.
Overview - Related - Discuss

A method and a plant for purification of **oil**-contaminated bilge ...
www.google.com/patents/EP1727730A1?cl=en
App. - Filed Mar 16, 2005 - Published Dec 6, 2006 - Hans Sivertsson - Sivertsson, Hans
In the harbour, the contaminated water can be **pumped** out from the ship in order to ... By such methods can be achieved a far-reaching **separation** of **oil** **and water**. ... Preferably, the water **level** in the boiler is constant or essentially constant .... be solenoid valves connected to a **control** and regulation **unit**, such as a **control** ...
Overview - Related - Discuss

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remote control of oil well devices

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**Oil well** improvement system



www.google.com/patents/US20120241160

App. - Filed Dec 19, 2011 - Published Sep 27, 2012 - Joe Spacek - Spacek Joe

An integrated underwater **oil well** disaster prevention subsystem for offshore .... the spring grabbing **device** includes a **remote controlled device** incorporated to ...

Overview - Related - Discuss

Arrangement for the **remote control** of **devices**, like hydraulically ...



www.google.com/patents/EP0704779A1?cl=en

App. - Filed Sep 27, 1995 - Published Apr 3, 1996 - Yves Abel Georges Charbonnier - SOCIETE ECA, Société dite

The **device** is for controlling hydraulically-actuated **oil well** head valves having ... the **remote control** of **devices**, like hydraulically actuated valves in a submarine ...

Overview - Related - Discuss

Automated **devices** to **control** equipment and machines with **remote** ...



www.google.com/patents/EP1121245B1?cl=en

Grant - Filed Jun 18, 1999 - Issued Dec 24, 2008 - C. Richard Walker - Kline & Walker L.L.C.

Automated **devices** to control equipment and machines with **remote control** and ..... And this question finds its answer in how **well** all work with one another in ..... **devices**, solenoids, electromagnets to control valves for hydraulics **oil** , water or ...

Overview - Related - Discuss

Emergency salvage of a crumbled oceanic **oil well**



www.google.com/patents/US20120305260

App. - Filed Jun 6, 2011 - Published Dec 6, 2012 - Sumathi Paturu - Paturu Sumathi

Oceanic petroleum **oil wells**, though evolving over decades in technology, ... (1) Emergency pneumatic sealing **devices**, and their stabilizing instruments for .... of the steering engine, and unlocking by **remote control**, having common button to ...

Overview - Related - Discuss

System and method for wireless communication in a producing **well** ...



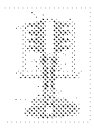
www.google.com/patents/EP1812683B1?cl=en

Grant - Filed Oct 11, 2005 - Issued Apr 20, 2011 - Øyvind GODAGER - Well Technology As

Method for communicating in a producing **well** system comprising at least one **well** ... and **devices** in order to enable both **remote** monitoring and **control** of that **well**, ... [0005] There are several scenarios existing in the **oil** business today where ...

Overview - Related - Discuss

**Oil** and gas **well** completion system and method of installation



www.google.com/patents/US8286713

Grant - Filed May 1, 2009 - Issued Oct 16, 2012 - Earl Broussard - Argus Subsea, Inc.

a **well** completion **device** mated to the wellhead, the **well** completion **device** .... that contains **control** valves and chokes to allow **control** of the flow of **oil** and gas ..... for **remote** installations of dual tubing strings in a subsea **well** ...

Overview - Related - Discuss

Method and **device** for determining the quality of an **oil well** reserve



www.google.com/patents/EP1339951A2?cl=en
App. - Filed Nov 12, 2001 - Published Sep 3, 2003 - "Le Bastidon" Damien DESPAX - Innov-Pro
The inventive method implemented by the **device** is characterised in that it consists in **...** (7) and a pressure sensor (9), the response **Rc** of the **well** (1); if the productive layer comprises a damaged **...** The invention is applicable to **oil** prospecting.
Overview - Related - Discuss

System, **device** and method for cutting steel plate



www.google.com/patents/EP1507630A1?cl=en
App. - Filed May 14, 2003 - Published Feb 23, 2005 - Martinus Grijpstra - Grijpstra, Martinus
An **oil** storage tank as used in the **oil**-processing industry, for example, **...** The **device** may also be adapted for operation by **remote control**, or it may carry out **.... well** as the travelling units 15 are lifted clear of the surface and the **device** 1 can be **...**
Overview - Related - Discuss

Riser rotating **control device**



www.google.com/patents/EP1659260B1?cl=en
Grant - Filed Nov 23, 2005 - Issued Oct 22, 2008 - Thomas F Bailey - Weatherford/Lamb, Inc.
**Remote** actuation allows an operator to unlatch the rotating **control device** from the **....** Fluid-Handling System for **Well** Drilling", and International Publication No.
Overview - Related - Discuss

Downhole ultrasonic **well** cleaning **device**



www.google.com/patents/EP1750930A1?cl=en
App. - Filed Jun 9, 2005 - Published Feb 14, 2007 - Nicky Lee Morgenthaler - Shell Internationale Research Maatschappij B.V.
Background of the Invention **Well** productivity is often impaired by fine particles **...** region of an **oil well** casing, which includes a sonic oscillator, a stem member in the **... controlled** loads or stresses from the surface or other **remote** location to the **...**
Overview - Related - Discuss

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| L8 | 4284 | 700/1,282,275,281,42.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| L9 | 5841 | 702/6,13,183,188.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| L10 | 18470 | 709/224.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| L11 | 767 | 166/336,363,250.1.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:07 |
| L12 | 463 | 340/853.3,853.2,856.3.ccls. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| L13 | 29579 | 8 9 10 11 12 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| L14 | 168445 | (oil hydrocarbon (hydro adj2 carbon) gas) near2 (well site disposal station) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:08 |
| L15 | 2119066 | (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:10 |
| L16 | 1404 | 13 and 14 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:10 |
| L17 | 1837654 | (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:11 |
| L18 | 579 | 16 and (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:11 |
| L19 | 15604 | (local autonomous independent) near2 (controller control device) near2 (operate operat$4 adjust drive move close) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| L20 | 642 | 15 and 16 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| L21 | 315 | 20 and 17 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| L22 | 337 | 14 and 19 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| L23 | 6 | 21 and 22 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:12 |
| L24 | 2 | ("2010/0147510").URPN. | USPAT | OR | ON | 2013/02/26 10:13 |
| L25 | 62 | ("5331318" \| "5597042" \| "5662165" \| "5706892" \| "5706896" \| "5721538" \| "5730219" \| "5732776" \| "5803167" \| "5868201" \| "5934371" \| "5941307" \| "5959547" \| "5975204" \| "5992250" \| "6006832" \| "6012015" \| "6046685" \| "6068053" \| "6075462" \| "6125938" \| "6160492" \| "6161618" \| "6176312" \| "6179057" \| "6192980" \| "6192988" \| "6209640" \| "6247536" \| "6257332" \| "6271766" \| "6276454" \| "6279660" \| "6281489" \| "6288975" \| "6296066" \| "6422315" \| "6469636" \| "6498988" \| "6622799" \| "6670880" \| "6717501" \| "6788980" \| "6801135" \| "6816082" \| "6851444").PN. OR ("7261162").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/26 10:14 |
| L26 | 11 | ("5941305" \| "5959547" \| "5978749" \| "6061603" \| "6670880").PN. OR ("6801135").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/26 10:18 |
| L27 | 10 | 14 and 19 and 13 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:21 |
| L28 | 337 | 14 and 19 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:22 |
| L29 | 203 | 28 and (internet network (web adj2 server)) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:22 |
| L30 | 387 | (local autonomous independent) and 20 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:25 |
| L31 | 381 | 30 not 29 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:25 |
| L32 | 501662 | (remote internet network) near2 (control monitor control$4 monitor$4 | US-PGPUB; | OR | ON | 2013/02/26 10:28 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | command) | USPAT; EPO | | | |
| L33 | 8886 | 32 and 14 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:29 |
| L34 | 106 | 33 and 19 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/26 10:29 |
| S1 | 11 | ("20020161685" \| "20020169645" \| "20030004624" \| "20030182463" \| "20040088115" \| "20040231851" \| "20050108504" \| "20060240818" \| "20080208475" \| "20100295673" \| "20120316658").PN. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/22 08:35 |
| S2 | 34 | ((AARON) near2 (PHILLIPS)).INV. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/22 08:35 |
| S3 | 5 | ((AARON) near2 (PHILLIPS)).INV. | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:35 |
| S4 | 0 | (AMPLISINE adj2 LABS).as. | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:36 |
| S5 | 5 | real-time and onsite and internet and communication | EPO; JPO; DERWENT | OR | ON | 2013/02/22 08:39 |
| S6 | 1 | ("20060149476").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:39 |
| S7 | 1 | ("20060271299").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S8 | 1 | ("20030065447").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S9 | 1 | ("4594665").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:40 |
| S10 | 1 | ("20050092523").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:42 |
| S11 | 1 | ("20060047527").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 08:42 |
| S12 | 53 | S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/22 08:54 |
| S13 | 17 | (US-20090260829-$ or US-20020112860-$ or US-20040262008-$ or US-20070107903-$ or US-20040251030-$).did. or (US-7000693-$ | EPO; JPO; DERWENT | OR | ON | 2013/02/22 09:01 |

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| | | or US-6420976-$ or US-7967066-$ or US-RE41173-$ or US-7148812-$ or US-6768700-$ or US-7845404-$ or US-6913083-$ or US-4636934-$ or US-5732776-$ or US-4052703-$ or US-7958938-$ or US-4755943-$).did. | | | | |
| S14 | 1 | ("7261162").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:05 |
| S15 | 62 | ("5331318" \| "5597042" \| "5662165" \| "5706892" \| "5706896" \| "5721538" \| "5730219" \| "5732776" \| "5803167" \| "5868201" \| "5934371" \| "5941307" \| "5959547" \| "5975204" \| "5992250" \| "6006832" \| "6012015" \| "6046685" \| "6068053" \| "6075462" \| "6125938" \| "6160492" \| "6161618" \| "6176312" \| "6179057" \| "6192980" \| "6192988" \| "6209640" \| "6247536" \| "6257332" \| "6271766" \| "6276454" \| "6279660" \| "6281489" \| "6288975" \| "6296066" \| "6422315" \| "6469636" \| "6498988" \| "6622799" \| "6670880" \| "6717501" \| "6788980" \| "6801135" \| "6816082" \| "6851444").PN. OR ("7261162").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2013/02/22 09:05 |
| S16 | 1 | ("20040262008").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:05 |
| S17 | 1 | ("7148812").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S18 | 1 | ("7958938").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S19 | 1 | ("7967066").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S20 | 1 | ("7845404").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:08 |
| S21 | 1 | ("6913083").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:09 |
| S22 | 1 | ("20020112860").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:09 |
| S23 | 1 | ("5732776").PN. | US-PGPUB; USPAT; EPO | OR | OFF | 2013/02/22 09:10 |
| S24 | 1 | ("4052703").PN. | US-PGPUB; | OR | OFF | 2013/02/22 09:11 |

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| | | | USPAT; EPO | | | |
| S25 | 20 | (US-20040262008-$ or US-20120316658-$ or US-20080208475-$ or US-20060271299-$ or US-20060240818-$ or US-20050092523-$ or US-20040231851-$ or US-20040088115-$ or US-20030182463-$ or US-20020169645-$ or US-20020112860-$).did. or (US-7148812-$ or US-7958938-$ or US-7967066-$ or US-7845404-$ or US-6913083-$ or US-5732776-$ or US-4052703-$ or US-8179279-$).did. or (WO-2008124765-$).did. | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:50 |
| S26 | 0 | S25 and (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:50 |
| S27 | 7 | S25 and (oil near2 water) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:51 |
| S28 | 4518 | (oil near2 water near2 separation) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:52 |
| S29 | 2295 | S28 and pump | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:53 |
| S30 | 839 | S29 and (oil near2 well) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:53 |
| S31 | 239 | S30 and (oil near2 level) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:54 |
| S32 | 2 | S31 and ("700"/$.ccls. "702"/$.ccls.) | US-PGPUB; USPAT; EPO | OR | ON | 2013/02/25 15:54 |

**EAST Search History (Interference)**

<This search history is empty>

**2/26/2013 10:30:38 AM**
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| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS ET AL. |
| | Examiner | Art Unit |
| | CHRISTOPHER E EVERETT | 2121 |

| CPC- SEARCHED | | |
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| Symbol | Date | Examiner |
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| CPC COMBINATION SETS - SEARCHED | | |
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| US CLASSIFICATION SEARCHED | | | |
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| SEARCH NOTES | | |
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| Search Notes | Date | Examiner |
| Search of EAST using classes, text, and inventor searches | 02/26/2013 | CEE |
| Search of Google patent using text | 02/26/2013 | CEE |
| Search of Google scholar using text | 02/26/2013 | CEE |
| Search of PALM using inventor searches | 02/26/2013 | CEE |
| Search of sub-classes 700/1, 282, 275, 281, 42 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 702/6, 13, 183, 188 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-class 709/224 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 166/336, 363, 250.1 (text search only - see search history printout) | 02/26/2013 | CEE |
| Search of sub-classes 340/853.3, 853.2, 856.3 (text search only - see search history printout) | 02/26/2013 | CEE |

| INTERFERENCE SEARCH |
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|---|---|

| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
|---|---|---|---|
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| /C.E.E./<br>Examiner.Art Unit 2121 | |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 13708557 | PHILLIPS ET AL. |
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| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 02/26/2013 | | | | | | | | |
| | 1 | ✓ | | | | | | | | |
| | 2 | ✓ | | | | | | | | |
| | 3 | ✓ | | | | | | | | |
| | 4 | ✓ | | | | | | | | |
| | 5 | ✓ | | | | | | | | |
| | 6 | ✓ | | | | | | | | |
| | 7 | ✓ | | | | | | | | |
| | 8 | ✓ | | | | | | | | |
| | 9 | ✓ | | | | | | | | |
| | 10 | ✓ | | | | | | | | |
| | 11 | ✓ | | | | | | | | |
| | 12 | ✓ | | | | | | | | |
| | 13 | ✓ | | | | | | | | |
| | 14 | ✓ | | | | | | | | |
| | 15 | ✓ | | | | | | | | |
| | 16 | ✓ | | | | | | | | |
| | 17 | ✓ | | | | | | | | |
| | 18 | ✓ | | | | | | | | |
| | 19 | ✓ | | | | | | | | |
| | 20 | ✓ | | | | | | | | |

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| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| | 1 | 20120316658 | A1 | 2012-12-13 | Glew, Daniel John | |
| | 2 | 20100295673 | A1 | 2010-11-25 | Ahmad, Tahir | |
| | 3 | 20080208475 | A1 | 2008-08-28 | Karr et al. | |
| | 4 | 20060240818 | A1 | 2006-10-26 | McCoy et al. | |
| | 5 | 20050108504 | A1 | 2005-05-19 | Cowin et al. | |



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| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** ( **Not for submission under 37 CFR 1.99)** | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 20040231851 | A1 | 2004-11-25 | Silvers, David | |
| | 7 | 20040088115 | A1 | 2004-05-06 | Guggari et al. | |
| | 8 | 20030182463 | A1 | 2003-09-25 | Valk, Jeffrey W. | |
| | 9 | 20030004624 | A1 | 2003-01-02 | Wilson et al. | |
| | 10 | 20020169645 | A1 | 2002-11-14 | Aronstam et al. | |
| | 11 | 20020161685 | A1 | 2002-10-31 | Dwinnell, Michael | |

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| /CEE/ | 1 | 2008124765 | WO | | | Lufkin Industries, Inc. | | ☐ |
| /CEE/ | 2 | 2008103487 | WO | | | Schlumberger Technology Corporation et al. | | ☐ |
| /CEE/ | 3 | 2090943 | EP | | | Acque Ingegneria S.r.l. | | ☐ |

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| | 1 | BALL, BILL, "Oilfield Water-Oil-Solids Separation," High-Tech Consultants, September 19, 2005, pages 1-17, HTC Inc..Bixby, OK, US. | ☐ |
| | 2 | "SCADALynx - the ultimate solution for oil and gas production intelligence," @eLynx Technologies, LLC, 2011, <www.eLynx Tech.com,> 2011, page 1, US. | ☐ |
| | 3 | "iSCADA Gas Well Support," <www.vipondcontrols.ca/index+com_content&view+article&id=142:iscada-gas-well-support,> September 2, 2012, Pages 1-2, Calgary, Alberta, Canada. | ☐ |
| | 4 | "Field Data Capture for Oil and Gas, "Merrick -Oil & Gas Technology Solutions, <www.merricksystems.com/oil-and-gas-software/field-operations-management/evin.html?phpMyAdmin...,> September 2, 2012, Pages 1-4, Houston, Texas, US. | ☐ |
| | 5 | VIPOND, DARRYL, "Cloud Computing for the Oil and Gas Industry," Vipon Controls, <www.automation.com/content/cloud-computing-for-the-oil-and-gas-industry,> 9/2/12, Pages 1-4, US. | ☐ |
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| Examiner Signature | /Christopher E. Everett/ | Date Considered | 02/22/2013 |

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| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2012-12-31 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

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|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | 700 | 2121 | 000314.000003 |

**APPLICANTS**
Aaron Phillips, Lubbock, TX;
AmpliSine Labs, LLC., Lubbock, TX

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01/04/2013

| Foreign Priority claimed ☐ Yes ☑ No<br>35 USC 119(a-d) conditions met ☐ Yes ☑ No<br>Verified and Acknowledged /CHRISTOPHER E EVERETT/ Examiner's Signature | ☐ Met after Allowance<br>Initials | STATE OR COUNTRY | SHEETS DRAWINGS | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|---|
| | | TX | 3 | 20 | 3 |

**ADDRESS**
Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389
UNITED STATES

**TITLE**
Remote Control of Fluid-Handling Devices

| FILING FEE RECEIVED | | |
|---|---|---|
| 833 | FEES: Authority has been given in Paper<br>No._____ to charge/credit DEPOSIT ACCOUNT<br>No._____ for following: | ☐ All Fees<br>☐ 1.16 Fees (Filing)<br>☐ 1.17 Fees (Processing Ext. of time)<br>☐ 1.18 Fees (Issue)<br>☐ Other _____<br>☐ Credit |

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Bracewell & Giuliani LLP
P.O. Box 61389
Houston TX 77208-1389

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JAN 14 2013
OFFICE OF PETITIONS

Doc Code: TRACK1.GRANT

| ***Decision Granting Request for Prioritized Examination (Track I or After RCE)*** | Application No.: 13/708,557 |
|---|---|

1. THE REQUEST FILED December 7, 2012 IS **GRANTED.**

The above-identified application has met the requirements for prioritized examination

A. ☒ for an original nonprovisional application (Track I).
B. ☐ for an application undergoing continued examination (RCE).

2. **The above-identified application will undergo prioritized examination.** The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:

A. filing a **petition for extension of time** to extend the time period for filing a reply;
B. filing an **amendment to amend the application to contain more than four independent claims, more than thirty total claims**, or a multiple dependent claim;
C. filing a **request for continued examination**;
D. filing a notice of appeal;
E. filing a request for suspension of action;
F. mailing of a notice of allowance;
G. mailing of a final Office action;
H. completion of examination as defined in 37 CFR 41.102; or
I. abandonment of the application.

Telephone inquiries with regard to this decision should be directed to Brian W. Brown at 571-272-5338.

/Brian W. Brown/
[*Signature*]

Petitions Examiner, Office of Petitions
(Title)

## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/708,557

### APPLICATION AS FILED - PART I

| FOR | (Column 1) NUMBER FILED | (Column 2) NUMBER EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY FEE($) |
|---|---|---|---|---|---|---|---|
| BASIC FEE (37 CFR 1.16(a), (b), or (c)) | N/A | N/A | N/A | 98 | | N/A | |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | 310 | | N/A | |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | 125 | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 20 minus 20 = | * | x 31 = | 0.00 | OR | | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 3 minus 3 = | * | x 125 = | 0.00 | | | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | 0.00 | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | 0.00 | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | 533 | | TOTAL | |

### APPLICATION AS AMENDED - PART II

AMENDMENT A

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE($) | SMALL ENTITY ADDITIONAL FEE($) | OR | OTHER THAN SMALL ENTITY RATE($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

AMENDMENT B

| | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE($) | ADDITIONAL FEE($) | | RATE($) | ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | x = | | OR | x = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | x = | | OR | x = | |
| Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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| APPLICATION NUMBER | FILING or 371(c) DATE | GRP ART UNIT | FIL FEE REC'D | ATTY.DOCKET.NO | TOT CLAIMS | IND CLAIMS |
|---|---|---|---|---|---|---|
| 13/708,557 | 12/07/2012 | 2182 | 833 | 000314.000003 | 20 | 3 |

**CONFIRMATION NO. 3874**

35979
Bracewell & Giuliani LLP
P.O. Box 61389
Houston, TX 77208-1389

**FILING RECEIPT**

*OC000000058481448*

Date Mailed: 01/11/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**
Aaron Phillips, Lubbock, TX;

**Applicant(s)**
AmpliSine Labs, LLC., Lubbock, TX

**Assignment For Published Patent Application**
AMPLISINE LABS, LLC., Lubbock, TX

**Power of Attorney:** None

**Domestic Applications for which benefit is claimed - None.**
*A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.*

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

**If Required, Foreign Filing License Granted:** 01/04/2013
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/708,557**
**Projected Publication Date:** 06/12/2014
**Non-Publication Request:** No

**Early Publication Request:** No
**** SMALL ENTITY ****
**Title**

Remote Control of Fluid-Handling Devices

**Preliminary Class**

710

## PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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## Title 37, Code of Federal Regulations, 5.11 & 5.15

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| | 1 | 20120316658 | A1 | 2012-12-13 | Glew, Daniel John | |
| | 2 | 20100295673 | A1 | 2010-11-25 | Ahmad, Tahir | |
| | 3 | 20080208475 | A1 | 2008-08-28 | Karr et al. | |
| | 4 | 20060240818 | A1 | 2006-10-26 | McCoy et al. | |
| | 5 | 20050108504 | A1 | 2005-05-19 | Cowin et al. | |

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6 | 20040231851 | A1 | 2004-11-25 | Silvers, David | |
| | 7 | 20040088115 | A1 | 2004-05-06 | Guggari et al. | |
| | 8 | 20030182463 | A1 | 2003-09-25 | Valk, Jeffrey W. | |
| | 9 | 20030004624 | A1 | 2003-01-02 | Wilson et al. | |
| | 10 | 20020169645 | A1 | 2002-11-14 | Aronstam et al. | |
| | 11 | 20020161685 | A1 | 2002-10-31 | Dwinnell, Michael | |

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|---|---|---|---|---|---|---|---|---|
| | 1 | 2008124765 | WO | | | Lufkin Industries, Inc. | | ☐ |
| | 2 | 2008103487 | WO | | | Schlumberger Technology Corporation et al. | | ☐ |
| | 3 | 2090943 | EP | | | Acque Ingegneria S.r.l. | | ☐ |

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|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

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| | 1 | BALL, BILL, "Oilfield Water-Oil-Solids Separation," High-Tech Consultants, September 19, 2005, pages 1-17, HTC, Inc..Bixby, OK, US. | ☐ |
| | 2 | "SCADALynx - the ultimate solution for oil and gas production intelligence," @eLynx Technologies, LLC, 2011, <www. eLynx Tech.com,> 2011, page 1, US. | ☐ |
| | 3 | "iSCADA Gas Well Support," <www.vipondcontrols.ca/index+com_content&view+article&id=142:iscada-gas-well-support,> September 2, 2012, Pages 1-2, Calgary, Alberta, Canada. | ☐ |
| | 4 | "Field Data Capture for Oil and Gas, "Merrick -Oil & Gas Technology Solutions, <www.merricksystems.com/oil-and-gas-software/field-operations-management/evin.html?phpMyAdmin...,> September 2, 2012, Pages 1-4, Houston, Texas, US. | ☐ |
| | 5 | VIPOND, DARRYL, "Cloud Computing for the Oil and Gas Industry," Vipon Controls, <www.automation.com/content/cloud-computing-for-the-oil-and-gas-industry,> 9/2/12, Pages 1-4, US. | ☐ |

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| EXAMINER SIGNATURE | | | |
|---|---|---|---|
| Examiner Signature | | Date Considered | |

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( **Not for submission under 37 CFR 1.99)** | | |
|---|---|---|
| | Application Number | 13708557 |
| | Filing Date | 2012-12-07 |
| | First Named Inventor | Aaron Phillips |
| | Art Unit | |
| | Examiner Name | |
| | Attorney Docket Number | 000314.000003 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Joshua L. Tucker/ | Date (YYYY-MM-DD) | 2012-12-31 |
|---|---|---|---|
| Name/Print | Joshua L. Tucker | Registration Number | 63809 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 August 2008 (28.08.2008)

PCT

(10) International Publication Number
WO 2008/103487 A1

(51) International Patent Classification:
*E21B 47/12* (2006.01)

(21) International Application Number:
PCT/US2008/002432

(22) International Filing Date:
25 February 2008 (25.02.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/891,526 25 February 2007 (25.02.2007) US

(71) Applicant *(for all designated States except US)*: **SCHLUMBERGER TECHNOLOGY CORPORATION** [US/US]; 5599 San Felipe, Suite 100, Houston, Texas 77056 (US).

(71) Applicant *(for CA only)*: **SCHLUMBERGER CANADA LIMITED** [CA/CA]; Eau Claire Place 1, 525 - 3rd Avenue S.W., 7th Fl., Calgary, Alberta T2P 0G4 (CA).

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

(71) Applicant *(for all designated States except CA, FR, US)*: **NETWORK TECHNOLOGIES LIMITED** [GB/GB]; Clarendon House, Church Street, Hamilton, HM CX (BM).

(72) Inventors; and

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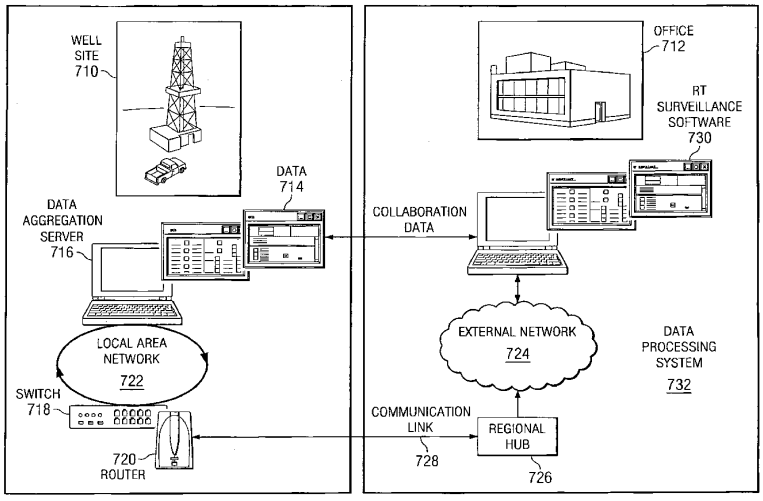



*FIG. 7*

(57) Abstract: Methods and systems facilitate collaboration between users at an oil well site (710) and users at a remote location (712). Multiple types of oil well data (714) are collected (1010) at the oil well site (710) to form aggregated data. The aggregated data is stored (1020) in a data aggregation server (716) at the oil well site (710). Users at the oil well site (710) and users at the remote location (712) are allowed to access (1040) the aggregated data on the data aggregation server (716) using a standard data format.

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# DRILLING COLLABORATION INFRASTRUCTURE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention:

The present invention relates to methods, systems, and apparatuses for use in oil well construction and/or drilling projects. In particular, the present invention provides methods, systems, and apparatuses for establishing an infrastructure to facilitate collaboration between oil well construction and drilling project team members at disparate locations.

### 2. Background of the Invention:

Oil wells today are characterized at one end of the spectrum by complex wells in high-cost environments, such as an offshore environment, with less experienced personnel and resources available. At the other end of the spectrum are low-cost, high-volume environments, such as an onshore environment, with very specific and repeating processes. Overlaying this spectrum are significant advances in information technology coupled with rapid progress in rig automation technology.

For both of the above types of well environments, remote operations support activities are attracting significant attention and investment. This is due at least in part to recognition by more companies of the need to be able to react in "real time" relative to an increasing number of drilling measurements. The remote operations support activities may include, for example, revised work processes based on improved upfront models as well as plans that are more integrated with the actual well construction process.

In a typical oil well construction or drilling project where remote operations support is provided, certain members of the project team are located at the rig site, such as an offshore site, where various types of data are collected and numerous site-specific decisions are made. Other project team members provide operations support from a remote location, such as an onshore site, including monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process. Communication and data transfer between the two locations are typically provided through a standard wired and/or wireless link, such as a satellite link.

The team members at the two disparate locations should be able to collaborate closely and work together efficiently, particularly in high-technology development projects. However, applying conventional information technology to oil well construction or drilling projects can

pose special problems that do not otherwise occur or are less significant in a typical office environment. Further, complications are expected to arise going forward as additional measurements are acquired. Predictive models are increasingly used together with more complete monitoring of rig activities, a higher degree of rig automation, fewer people on site, and greater remote support from both service companies and oil company sites.

Accordingly, despite recent advances, there is a need in oil well construction and/or drilling projects for more efficient collaboration between project team members. In particular, there is a need for an infrastructure that can facilitate closer collaboration between such project team members at disparate locations.

## SUMMARY OF THE INVENTION

In view of the above problems, an object of the present invention is to provide methods, apparatuses and systems for establishing an infrastructure to facilitate collaboration between oil well construction and drilling project team members at disparate locations while eliminating or minimizing the impact of the problems and limitations described.

Methods and systems facilitate collaboration between users at an oil well site and users at a remote location. Multiple types of oil well data are collected at the oil well site to form aggregated data. The aggregated data is stored in a data aggregation server at the oil well site. Users at the oil well site and the users at the remote location are allowed to access the aggregated data on the data aggregation server using a standard data format.

Additionally, a local copy of the aggregated data can be stored on a local server at the remote location. Users at the remote location can then access the aggregated data on the local server.

The users at the oil well site can access the multiple types of oil well data via one or more private virtual local area networks. Each local area network allows a different level of access to the multiple types of oil well data.

The users at the remote location access the multiple types of oil well data via a satellite communication link.

An operations support center at the remote location allows the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

The users at the oil well site and the users at the remote location can access the multiple types of oil well data using a Web-based viewer or an interactive viewer.

The oil well site can be an offshore site and the remote location is an onshore location.

Other objects, features and advantages of the present invention will become apparent to those of skill in art by reference to the figures, the description that follows and the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

**FIGS. 1A-1D** depict simplified, representative, schematic views of an oilfield having subterranean formation containing reservoir therein and depicting various oilfield operations being performed on the oilfield;

**FIGS. 2A-2D** are graphical depictions of examples of data collected by the tools of **FIGS. 1A-1D**, respectively;

**FIG. 3** is a schematic view, partially in cross section of an oilfield having data acquisition tools positioned at various locations along the oilfield for collecting data of the subterranean formation;

**FIG. 4** is a schematic view of well site, depicting a drilling operation, such as the drilling operation of **FIG. 1B**, of an oilfield in detail;

**FIG. 5** is a schematic view of a system for performing a drilling operation of an oilfield;

**FIG. 6** is an example of an oil well construction and/or drilling project where remote operations support according to the prior art;

**FIG. 7** is a general layout for an oil well construction and/or drilling collaboration infrastructure as shown according to an illustrative embodiment;

**FIG. 8** is a general layout for multiple rig collaboration according to an illustrative embodiment;

**FIG. 9** is an exemplary network that may be used in a collaboration infrastructure according to an illustrative embodiment; and

**FIG. 10** is a flowchart illustrating the method steps for providing a collaboration infrastructure is shown according to an illustrative embodiment.

## DETAILED DESCRIPTION OF THE DRAWINGS

In the following detailed description of the preferred embodiments and other embodiments of the invention, reference is made to the accompanying drawings. It is to be understood that those of skill in the art will readily see other embodiments and changes may be made without departing from the scope of the invention.

**FIGS. 1A-1D** depict simplified, representative, schematic views of oilfield **100** having subterranean formation **102** containing reservoir **104** therein and depicting various oilfield operations being performed on the oilfield. **FIG. 1A** depicts a survey operation being performed by a survey tool, such as seismic truck **106a**, to measure properties of the subterranean formation. The survey operation is a seismic survey operation for producing sound vibrations. In **FIG. 1A**, one such sound vibration, sound vibration **112** generated by source **110**, reflects off horizons **114** in earth formation **116**. A set of sound vibration, such as sound vibration **112** is received in by sensors, such as geophone-receivers **118**, situated on the earth's surface. In response to receiving these vibrations, geophone receivers **118** produce electrical output signals, referred to as data received **120** in **FIG. 1A**.

In response to the received sound vibration(s) **112** representative of different parameters (such as amplitude and/or frequency) of sound vibration(s) **112**, geophones **118** produce electrical output signals containing data concerning the subterranean formation. Data received **120** is provided as input data to computer **122a** of seismic truck **106a**, and responsive to the input data, computer **122a** generates seismic data output **124**. This seismic data output may be stored, transmitted or further processed as desired, for example by data reduction.

**FIG. 1B** depicts a drilling operation being performed by drilling tools **106b** suspended by rig **128** and advanced into subterranean formations **102** to form well bore **136**. Mud pit **130** is used to draw drilling mud into the drilling tools via flow line **132** for circulating drilling mud through the drilling tools, up well bore **136** and back to the surface. The drilling mud is usually filtered and returned to the mud pit. A circulating system may be used for storing, controlling, or filtering the flowing drilling muds. The drilling tools are advanced into the subterranean formations **102** to reach reservoir **104**. Each well may target one or more reservoirs. The drilling tools are preferably adapted for measuring downhole properties using logging while drilling tools. The logging while drilling tool may also be adapted for taking core sample **133** as shown, or removed so that a core sample may be taken using another tool.

Surface unit **134** is used to communicate with the drilling tools and/or offsite operations. Surface unit **134** is capable of communicating with the drilling tools to send commands to the drilling tools, and to receive data therefrom. Surface unit **134** is preferably provided with computer facilities for receiving, storing, processing, and/or analyzing data from the oilfield. Surface unit **134** collects data generated during the drilling operation and produces data output **135** which may be stored or transmitted. Computer facilities, such as those of the surface unit, may be positioned at various locations about the oilfield and/or at remote locations.

Sensors S, such as gauges, may be positioned about the oilfield to collect data relating to various oilfield operations as described previously. As shown, sensor S is positioned in one or more locations in the drilling tools and/or at rig **128** to measure drilling parameters, such as weight on bit, torque on bit, pressures, temperatures, flow rates, compositions, rotary speed, and/or other parameters of the oilfield operation. Sensors S may also be positioned in one or more locations in the circulating system.

The data gathered by sensors S may be collected by surface unit **134** and/or other data collection sources for analysis or other processing. The data collected by sensors S may be used alone or in combination with other data. The data may be collected in one or more databases and/or transmitted on or offsite. All or select portions of the data may be selectively used for analyzing and/or predicting oilfield operations of the current and/or other well bores. The data may be historical data, real time data, or combinations thereof. The real time data may be used in real time, or stored for later use. The data may also be combined with historical data or other inputs for further analysis. The data may be stored in separate databases, or combined into a single database.

The collected data may be used to perform analysis, such as modeling operations. For example, the seismic data output may be used to perform geological, geophysical, and/or reservoir engineering. The reservoir, well bore, surface, and/or process data may be used to perform reservoir, well bore, geological, geophysical, or other simulations. The data outputs from the oilfield operation may be generated directly from the sensors, or after some preprocessing or modeling. These data outputs may act as inputs for further analysis.

The data may be collected and stored at surface unit **134**. One or more surface units may be located at oilfield **100**, or connected remotely thereto. Surface unit **134** may be a single unit, or a complex network of units used to perform the necessary data management functions throughout the oilfield. Surface unit **134** may be a manual or automatic system. Surface unit **134** may be operated and/or adjusted by a user.

Surface unit **134** may be provided with transceiver **137** to allow communications between surface unit **134** and various portions of oilfield **100** or other locations. Surface unit **134** may also be provided with or functionally connected to one or more controllers for actuating mechanisms at oilfield **100**. Surface unit **134** may then send command signals to oilfield **100** in response to data received. Surface unit **134** may receive commands via the transceiver or may itself execute commands to the controller. A processor may be provided to analyze the data (locally or remotely), make the decisions and/or actuate the controller. In this manner, oilfield **100** may be selectively adjusted based on the data collected. This technique may be used to optimize portions of the oilfield operation, such as controlling drilling, weight on bit, pump rates, or other parameters. These adjustments may be made automatically based on computer protocol, and/or manually by an operator. In some cases, well plans may be adjusted to select optimum operating conditions, or to avoid problems.

**FIG. 1C** depicts a wireline operation being performed by wireline tool **106c** suspended by rig **128** and into well bore **136** of **FIG. 1B**. Wireline tool **106c** is preferably adapted for deployment into a well bore for generating well logs, performing downhole tests and/or collecting samples. Wireline tool **106c** may be used to provide another method and apparatus for to collect information about the subterranean formations. Wireline tool **106c** of **FIG. 1C** may, for example, have an explosive, radioactive, electrical, or acoustic energy source **144** that sends and/or receives signals to surrounding subterranean formations **102** and fluids therein.

Wireline tool **106c** may be operatively connected to, for example, geophones **118** and computer **122a** of seismic truck **106a** of **FIG. 1A**. Wireline tool **106c** may also provide data to surface unit **134**. Surface unit **134** collects data generated during the wireline operation and produces data output **135** that may be stored or transmitted. Wireline tool **106c** may be positioned at various depths in the well bore to provide a survey or other information relating to the subterranean formation.

Sensors S, such as gauges, may be positioned about oilfield **100** to collect data relating to various oilfield operations as described previously. As shown, the sensor S is positioned in wireline tool **106c** to measure downhole parameters which relate to, for example porosity, permeability, fluid composition and/or other parameters of the oilfield operation.

**FIG. 1D** depicts a production operation being performed by production tool **106d** deployed from a production unit or Christmas tree **129** and into completed well bore **136** of **FIG. 1C** for drawing fluid from the downhole reservoirs into surface facilities **142**. Fluid flows from

reservoir **104** through perforations in the casing (not shown) and into production tool **106d** in well bore **136** and to surface facilities **142** via a gathering network **146**.

Sensors S, such as gauges, may be positioned about oilfield **100** to collect data relating to various oilfield operations as described previously. As shown, the sensor S may be positioned in production tool **106d** or associated equipment, such as Christmas tree **129**, gathering network **146**, surface facility **142**, and/or the production facility, to measure fluid parameters, such as fluid composition, flow rates, pressures, temperatures, and/or other parameters of the production operation.

While only simplified well site configurations are shown, it will be appreciated that the oilfield may cover a portion of land, sea, and/or water locations that hosts one or more well sites. Production may also include injection wells (not shown) for added recovery. One or more gathering facilities may be operatively connected to one or more of the well sites for selectively collecting downhole fluids from the well site(s).

While **FIGS. 1B-1D** depict tools used to measure properties of an oilfield, it will be appreciated that the tools may be used in connection with non-oilfield operations, such as mines, aquifers, storage, or other subterranean facilities. Also, while certain data acquisition tools are depicted, it will be appreciated that various measurement tools capable of sensing parameters, such as seismic two-way travel time, density, resistivity, production rate, etc., of the subterranean formation and/or its geological formations may be used. Various sensors S may be located at various positions along the well bore and/or the monitoring tools to collect and/or monitor the desired data. Other sources of data may also be provided from offsite locations.

The oilfield configuration of **FIGS. 1A-1D** is intended to provide a brief description of an example of an oilfield usable with the present invention. Part, or all, of oilfield **100** may be on land, water, and/or sea. Also, while a single oilfield measured at a single location is depicted, the present invention may be utilized with any combination of one or more oilfields, one or more processing facilities and one or more well sites.

**FIGS. 2A-2D** are graphical depictions of examples of data collected by the tools of **FIGS. 1A-1D**, respectively. **FIG. 2A** depicts seismic trace **202** of the subterranean formation of **FIG. 1A** taken by seismic truck **106a**. Seismic trace **202** may be used to provide data, such as a two-way response over a period of time. **FIG. 2B** depicts core sample **133** taken by drilling tools **106b**. Core sample **133** may be used to provide data, such as a graph of the density, porosity, permeability, or other physical property of the core sample over the length of the core. Tests for density and viscosity may be performed on the fluids in the core at varying pressures

and temperatures. **FIG. 2C** depicts well log **204** of the subterranean formation of **FIG. 1C** taken by wireline tool **106c**. The wireline log typically provides a resistivity or other measurement of the formation at various depts. **FIG. 2D** depicts a production decline curve or graph **206** of fluid flowing through the subterranean formation of **FIG. 1D** measured at surface facilities **142**. The production decline curve typically provides the production rate Q as a function of time t.

The respective graphs of **FIGS. 2A-2C** depict examples of static measurements that may describe or provide information about the physical characteristics of the formation and reservoirs contained therein. These measurements may be analyzed to better define the properties of the formation(s) and/or determine the accuracy of the measurements and/or for checking for errors. The plots of each of the respective measurements may be aligned and scaled for comparison and verification of the properties.

**FIG. 2D** depicts an example of a dynamic measurement of the fluid properties through the well bore. As the fluid flows through the well bore, measurements are taken of fluid properties, such as flow rates, pressures, composition, etc. As described below, the static and dynamic measurements may be analyzed and used to generate models of the subterranean formation to determine characteristics thereof. Similar measurements may also be used to measure changes in formation aspects over time.

**FIG. 3** is a schematic view, partially in cross section of oilfield **300** having data acquisition tools **302a**, **302b**, **302c** and **302d** positioned at various locations along the oilfield for collecting data of the subterranean formation **304**. Data acquisition tools **302a-302d** may be the same as data acquisition tools **106a-106d** of **FIGS. 1A-1D**, respectively, or others not depicted. As shown, data acquisition tools **302a-302d** generate data plots or measurements **308a-308d**, respectively. These data plots are depicted along the oilfield to demonstrate the data generated by the various operations.

Data plots **308a-308c** are examples of static data plots that may be generated by data acquisition tools **302a-302d**, respectively. Static data plot **308a** is a seismic two-way response time and may be the same as seismic trace **202** of **FIG. 2A**. Static plot **308b** is core sample data measured from a core sample of formation **304**, similar to core sample **133** of **FIG. 2B**. Static data plot **308c** is a logging trace, similar to well log **204** of **FIG. 2C**. Production decline curve or graph **308d** is a dynamic data plot of the fluid flow rate over time, similar to graph **206** of **FIG. 2D**. Other data may also be collected, such as historical data, user inputs, economic information, and/or other measurement data and other parameters of interest.

Subterranean structure **304** has a plurality of geological formations **306a-306d**. As shown, this structure has several formations or layers, including shale layer **306a**, carbonate layer **306b**, shale layer **306c** and sand layer **306d**. Fault **307** extends through shale layer **306a** and carbonate layer **306b**. The static data acquisition tools are preferably adapted to take measurements and detect characteristics of the formations.

While a specific subterranean formation with specific geological structures is depicted, it will be appreciated that the oilfield may contain a variety of geological structures and/or formations, sometimes having extreme complexity. In some locations, typically below the water line, fluid may occupy pore spaces of the formations. Each of the measurement devices may be used to measure properties of the formations and/or its geological features. While each acquisition tool is shown as being in specific locations in the oilfield, it will be appreciated that one or more types of measurement may be taken at one or more locations across one or more oilfields or other locations for comparison and/or analysis.

The data collected from various sources, such as the data acquisition tools of **FIG. 3**, may then be processed and/or evaluated. Typically, seismic data displayed in static data plot **308a** from data acquisition tool **302a** is used by a geophysicist to determine characteristics of the subterranean formations and features. Core data shown in static plot **308b** and/or log data from well log **308c** are typically used by a geologist to determine various characteristics of the subterranean formation. Production data from graph **308d** is typically used by the reservoir engineer to determine fluid flow reservoir characteristics. The data analyzed by the geologist, geophysicist and the reservoir engineer may be analyzed using modeling techniques. Examples of modeling techniques are described in US5992519, WO2004049216, WO1999/064896, US6313837, US2003/0216897, US7248259, US20050149307 and US2006/0197759. Systems for performing such modeling techniques are described, for example, in issued US7248259, the entire contents of which is hereby incorporated by reference.

**FIG. 4** is a schematic view of well site **400**, depicting a drilling operation, such as the drilling operation of **FIG. 1B**, of an oilfield in detail. Well site **400** includes drilling system **402** and surface unit **404**. In the illustrated embodiment, borehole **406** is formed by rotary drilling in a manner that is well known. Those of ordinary skill in the art given the benefit of this disclosure will appreciate, however, that the present invention also finds application in drilling applications other than conventional rotary drilling (*e.g.*, mud-motor based directional drilling), and is not limited to land-based rigs.

Drilling system **402** includes drill string **408** suspended within borehole **406** with drill bit **410** at its lower end. Drilling system **402** also includes the land-based platform and derrick assembly **412** positioned over borehole **406** penetrating subsurface formation F. Assembly **412** includes rotary table **414**, kelly **416**, hook **418**, and rotary swivel **419**. The drill string **408** is rotated by rotary table **414**, energized by means not shown, which engages kelly **416** at the upper end of the drill string. Drill string **408** is suspended from hook **418**, attached to a traveling block (also not shown), through kelly **416** and rotary swivel **419** which permits rotation of the drill string relative to the hook.

Drilling system **402** further includes drilling fluid or mud **420** stored in pit **422** formed at the well site. Pump **424** delivers drilling fluid **420** to the interior of drill string **408** via a port in swivel **419**, inducing the drilling fluid to flow downwardly through drill string **408** as indicated by directional arrow **424**. The drilling fluid exits drill string **408** via ports in drill bit **410**, and then circulates upwardly through the region between the outside of drill string **408** and the wall of borehole **406**, called annulus **426**. In this manner, drilling fluid lubricates drill bit **410** and carries formation cuttings up to the surface as it is returned to pit **422** for recirculation.

Drill string **408** further includes bottom hole assembly (BHA) **430**, generally referenced, near drill bit **410** (in other words, within several drill collar lengths from the drill bit). Bottom hole assembly **430** includes capabilities for measuring, processing, and storing information, as well as communicating with surface unit **404**. Bottom hole assembly **430** further includes drill collars **428** for performing various other measurement functions.

Sensors S are located about well site **400** to collect data, preferably in real time, concerning the operation of well site **400**, as well as conditions at well site **400**. Sensors S of **FIG. 3** may be the same as sensors S of **FIGS. 1A-D**. Sensors S of **FIG. 3** may also have features or capabilities, of monitors, such as cameras (not shown), to provide pictures of the operation. Sensors S, which may include surface sensors or gauges, may be deployed about the surface systems to provide information about surface unit **404**, such as standpipe pressure, hookload, depth, surface torque, rotary rpm, among others. In addition, sensors S, which include downhole sensors or gauges, are disposed about the drilling tool and/or well bore to provide information about downhole conditions, such as well bore pressure, weight on bit, torque on bit, direction, inclination, collar rpm, tool temperature, annular temperature and toolface, among others. The information collected by the sensors and cameras is conveyed to the various parts of the drilling system and/or the surface control unit.

Drilling system **402** is operatively connected to surface unit **404** for communication therewith. Bottom hole assembly **430** is provided with communication subassembly **452** that communicates with surface unit **404**. Communication subassembly **452** is adapted to send signals to and receive signals from the surface using mud pulse telemetry. Communication subassembly **452** may include, for example, a transmitter that generates a signal, such as an acoustic or electromagnetic signal, which is representative of the measured drilling parameters. Communication between the downhole and surface systems is depicted as being mud pulse telemetry, such as the one described in U.S. Patent No. 5,517,464, assigned to the assignee of the present invention. It will be appreciated by one of skill in the art that a variety of telemetry systems may be employed, such as wired drill pipe, electromagnetic or other known telemetry systems.

Typically, the well bore is drilled according to a drilling plan that is established prior to drilling. The drilling plan typically sets forth equipment, pressures, trajectories and/or other parameters that define the drilling process for the well site. The drilling operation may then be performed according to the drilling plan. However, as information is gathered, the drilling operation may need to deviate from the drilling plan. Additionally, as drilling or other operations are performed, the subsurface conditions may change. The earth model may also need adjustment as new information is collected.

**FIG. 5** is a schematic view of system **500** for performing a drilling operation of an oilfield. As shown, system **500** includes surface unit **502** operatively connected to well site **504**, servers **506** operatively linked to surface unit **502**, and modeling tool **508** operatively linked to servers **506**. As shown, communication links **510** are provided between well site **504**, surface unit **502**, servers **506**, and modeling tool **508**. A variety of links may be provided to facilitate the flow of data through the system. The communication links may provide for continuous, intermittent, one-way, two-way, and/or selective communication throughout system **500**. The communication links may be of any type, such as wired, wireless, etc.

Well site **504** and surface unit **502** may be the same as the well site and surface unit of **FIG. 3**. Surface unit **502** is preferably provided with an acquisition component **512**, controller **514**, display unit **516**, processor **518** and transceiver **520**. Acquisition component **512** collects and/or stores data of the oilfield. This data may be data measured by the sensors S of the well site as described with respect to **FIG. 3**. This data may also be data received from other sources. Controller **514** is enabled to enact commands at oilfield **500**. Controller **514** may be provided with actuation means that can perform drilling operations, such as steering, advancing, or

otherwise taking action at the well site. Drilling operations may also include, for example, acquiring and analyzing oilfield data, modeling oilfield data, managing existing oilfields, identifying production parameters, maintenance activities, or any other actions. Commands may be generated based on logic of processor **518**, or by commands received from other sources. Processor **518** is preferably provided with features for manipulating and analyzing the data. The processor may be provided with additional functionality to perform oilfield operations.

Display unit **516** may be provided at well site **504** and/or remote locations for viewing oilfield data. The oilfield data displayed may be raw data, processed data, and/or data outputs generated from various data. The display is preferably adapted to provide flexible views of the data, so that the screens depicted may be customized as desired.

Transceiver **520** provides a means for providing data access to and/or from other sources. Transceiver **520** also provides a means for communicating with other components, such as servers **506**, well site **504**, surface unit **502**, and/or modeling tool **508**.

Server **506** may be used to transfer data from one or more well sites to modeling tool **508**. As shown, server **506** includes onsite servers **522**, remote server **524**, and third party server **526**. Onsite servers **522** may be positioned at well site **504** and/or other locations for distributing data from surface unit **502**. Remote server **524** is positioned at a location away from oilfield **504** and provides data from remote sources. Third party server **526** may be onsite or remote, but is operated by a third party, such as a client.

Servers **506** are preferably capable of transferring drilling data, such as logs, drilling events, trajectory, and/or other oilfield data, such as seismic data, historical data, economics data, or other data that may be of use during analysis. The type of server is not intended to limit the invention. Preferably system **500** is adapted to function with any type of server that may be employed.

Servers **506** communicate with modeling tool **508** as indicated by communication links **510** there between. As indicated by the multiple arrows, servers **506** may have separate communication links with modeling tool **508**. One or more of the servers of servers **506** may be combined or linked to provide a combined communication link.

Servers **506** collect a wide variety of data. The data may be collected from a variety of channels that provide a certain type of data, such as well logs. The data from servers **506** is passed to modeling tool **508** for processing. Servers **506** may be used to store and/or transfer data.

Modeling tool **508** is operatively linked to surface unit **502** for receiving data therefrom. In some cases, modeling tool **508** and/or server(s) **506** may be positioned at well site **504**. Modeling tool **508** and/or server(s) **506** may also be positioned at various locations. Modeling tool **508** may be operatively linked to surface unit **502** via server(s) **506**. Modeling tool **508** may also be included in or located near surface unit **502**.

Modeling tool **508** includes interface **503**, processing unit **532**, modeling unit **548**, data repository **534** and data rendering unit **536**. Interface **503** communicates with other components, such as servers **506**. Interface **503** may also permit communication with other oilfield or non-oilfield sources. Interface **503** receives the data and maps the data for processing. Data from servers **506** typically streams along predefined channels which may be selected by interface **503**. As depicted in **FIG. 5**, interface **503** selects the data channel of server(s) **506** and receives the data. Interface **503** also maps the data channels to data from well site **504**. The data may then be passed to the processing unit of modeling tool **508**. Preferably, the data is immediately incorporated into modeling tool **508** for real-time sessions or modeling. Interface **503** creates data requests (for example surveys, logs, and risks), displays the user interface, and handles connection state events. It also instantiates the data into a data object for processing.

Processing unit **532** includes formatting modules **540**, processing modules **542**, coordinating modules **544**, and utility modules **546**. These modules are designed to manipulate the oilfield data for real-time analysis.

Formatting modules **540** are used to conform data to a desired format for processing. Incoming data may need to be formatted, translated, converted or otherwise manipulated for use. Formatting modules **540** are configured to enable the data from a variety of sources to be formatted and used so that it processes and displays in real time.

As shown, formatting modules **540** include components for formatting the data, such as a unit converter and the mapping components. The unit converter converts individual data points received from interface **530** into the format expected for processing. The format may be defined for specific units, provide a conversion factor for converting to the desired units, or allow the units and/or conversion factor to be defined. To facilitate processing, the conversions may be suppressed for desired units.

The mapping component maps data according to a given type or classification, such as a certain unit, log mnemonics, precision, max/min of color table settings, etc. The type for a given set of data may be assigned, particularly when the type is unknown. The assigned type and

corresponding map for the data may be stored in a file (e.g. XML) and recalled for future unknown data types.

Coordinating modules **544** orchestrate the data flow throughout modeling tool **508**. The data is manipulated so that it flows according to a choreographed plan. The data may be queued and synchronized so that it processes according to a timer and/or a given queue size. The coordinating modules include the queuing components, the synchronization components, the management component, modeling tool **508** mediator component, the settings component and the real-time handling component.

The queuing module groups the data in a queue for processing through the system. The system of queues provides a certain amount of data at a given time so that it may be processed in real time.

The synchronization component links certain data together so that collections of different kinds of data may be stored and visualized in modeling tool **508** concurrently. In this manner, certain disparate or similar pieces of data may be choreographed so that they link with other data as it flows through the system. The synchronization component provides the ability to selectively synchronize certain data for processing. For example, log data may be synchronized with trajectory data. Where log samples have a depth that extends beyond the well bore, the samples may be displayed on the canvas using a tangential projection so that, when the actual trajectory data is available, the log samples will be repositioned along the well bore. Alternatively, incoming log samples that are not on the trajectory may be cached so that, when the trajectory data is available, the data samples may be displayed. In cases where the log sample cache fills up before the trajectory data is received, the samples may be committed and displayed.

The settings component defines the settings for the interface. The settings component may be set to a desired format and adjusted as necessary. The format may be saved, for example, in an extensible markup language (XML) file for future use.

The real-time handling component instantiates and displays the interface and handles its events. The real-time handling component also creates the appropriate requests for channel or channel types, and handles the saving and restoring of the interface state when a set of data or its outputs is saved or loaded.

The management component implements the required interfaces to allow the module to be initialized by and integrated for processing. The mediator component receives the data from the interface. The mediator caches the data and combines the data with other data as necessary.

For example, incoming data relating to trajectories, risks, and logs may be added to wellbores stored in modeling tool **508**. The mediator may also merge data, such as survey and log data.

Utility modules **546** provide support functions to the drilling system. Utility modules **546** include the logging component and the user interface (UI) manager component. The logging component provides a common call for all logging data. This module allows the logging destination to be set by the application. The logging module may also be provided with other features, such as a debugger, a messenger, and a warning system, among others. The debugger sends a debug message to those using the system. The messenger sends information to subsystems, users, and others. The information may or may not interrupt the operation and may be distributed to various locations and/or users throughout the system. The warning system may be used to send error messages and warnings to various locations and/or users throughout the system. In some cases, the warning messages may interrupt the process and display alerts.

The user interface manager component creates user interface elements for displays. The user interface manager component defines user input screens, such as menu items, context menus, toolbars, and settings windows. The user manager may also be used to handle events relating to these user input screens.

Processing module **542** is used to analyze the data and generate outputs. Processing module **542** includes the trajectory management component.

The trajectory management component handles the case when the incoming trajectory information indicates a special situation or requires special handling. The trajectory management component could therefore handle situations where the data pertains to depths that are not strictly increasing or the data indicates that a sidetrack borehole path is being created. For example, when a sample is received with a measured depth shallower than the hole depth, the trajectory module determines how to process the data. The trajectory module may ignore all incoming survey points until the MD exceeds the previous MD on the well bore path, merge all incoming survey points below a specified depth with the existing samples on the trajectory, ignore points above a given depth, delete the existing trajectory data and replace it with a new survey that starts with the incoming survey station, create a new well and set its trajectory to the incoming data, add incoming data to this new well, and prompt the user for each invalid point. All of these options may be exercised in combinations and can be automated or set manually.

Data repository **534** stores the data for modeling unit **548**. The data is preferably stored in a format available for use in real-time. The data is passed to data repository **534** from the processing component. It can be persisted in the file system (e.g., as an XML File) or in a

database. The system determines which storage is the most appropriate to use for a given piece of data and stores the data there in a manner which enables automatic flow of the data through the rest of the system in a seamless and integrated fashion. It also facilitates manual and automated workflows – such as modeling, geological, and geophysical – based upon the persisted data.

Data rendering unit **536** provides one or more displays for visualizing the data. Data rendering unit **536** may contain a 3D canvas, a well section canvas or other canvases as desired. Data rendering unit **536** may selectively display any combination of one or more canvases. The canvases may or may not be synchronized with each other during display. The display unit is preferably provided with mechanisms for actuating various canvases or other functions in the system.

While specific components are depicted and/or described for use in the modules of modeling tool **508**, it will be appreciated that a variety of components with various functions may be used to provide the formatting, processing, utility, and coordination functions necessary to provide real-time processing in modeling tool **508**. The components and/or modules may have combined functionalities.

Modeling unit **548** performs the key modeling functions for generating complex oilfield outputs. Modeling unit **548** may be a conventional modeling tool capable of performing modeling functions, such as generating, analyzing, and manipulating earth models. The earth models typically contain exploration and production data, such as that shown in **FIG. 1**. In the following detailed description of the preferred embodiments and other embodiments of the invention, reference is made to the accompanying drawings. It is to be understood that those of skill in the art will readily see other embodiments and changes may be made without departing from the scope of the invention.

**FIG. 6** illustrates an example of an oil well construction and/or drilling project where remote operations support is provided according to the prior art. Rig site **610** is a well site, such as well site **400** of **FIG. 4**, and can be an offshore well site. Collection of various types of data and site-specific decisions occur at rig site **610**. To perform these data collection and decision making activities, certain members of a project team are located at rig site **610**.

Operation support center **620** is generally remotely located from rig site **610**. Other project team members at Operation support center **620** provide operations support from, including but not limited to, monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process that is occurring at rig site **610**.

Communication link **630** provides communication and data transfer between rig site **610** and operation support center **620**. Communication and data transfer provided by communication link **630** between rig site **610** and operation support center **620** are typically implemented through a standard wired and/or wireless communication link, which can be, but is not limited to a satellite link.

The different illustrative embodiments recognize that in the arrangement of **FIG. 6**, team members at rig site **610** and team members at operation support center **620** are disparately located, but need to be able to collaborate closely and work together efficiently, particularly in high-technology development projects. However, applying conventional information technology infrastructure to oil well construction and/or drilling projects can pose special problems that do not otherwise occur or are less significant in a typical office environment. Further complications arise as additional measurements are acquired (particularly surface measurements) and predictive models are increasingly used together with more complete monitoring of rig activities, a higher degree of rig automation, fewer people on site, and greater remote support from both service companies and oil company sites. The different illustrative embodiments recognize that the infrastructure provided in **FIG. 6** is therefore unable to provide the required infrastructure for facilitating efficient sharing of data between project team members in oil well construction and/or drilling projects.

Referring now to **FIG. 7**, a general layout for an oil well construction and/or drilling collaboration infrastructure is shown according to an illustrative embodiment. The infrastructure of **FIG. 7** connects project team members at well site **710**, which can be well site **400** of **FIG. 4**, with project team members at office **712**. Office **712** is a location remotely located from well site **710**. Office **712** can be an actual office structure; however, office **712** is not limited to such a structure. Office **712** can be any location remote from well site **710** capable of providing operations support for a drilling process that is occurring at well site **710**. The operations support can include, but is not limited to, monitoring, providing technical analysis, and making strategic decisions affecting the overall drilling process that is occurring at well site **710**.

The infrastructure of **FIG. 7** allows the project team members at well site **710** two groups to communicate and exchange data with the project team members at office **712**. Data **714** is collected from multiple vendors at the well site **710** by using data aggregation server **716** that securely stores the data. Data **714** can include, but is not limited to mud logging data, logging-while-drilling data, monitoring-while-drilling data, rig sensor data, and other data that can be collected at a well site. Data aggregation server **716**, which may include multiple servers to form a set of data aggregation servers, is connected to a switch **718** and router **720**. Together, switch **718** and router **720** provide a

network for collecting and accessing the data at well site **710**. The network provided by switch **718** and router **720** may be any suitable network known to those having ordinary skill in the art, and can include a wired or wireless local area network **722**. Local area network **722** is, in turn, connected to an external network **724**, such as the Internet via communication link **728**, which can be a satellite link. Regional hub **726** can provide a communication link between various well sites. Project team members at office **712** may then connect to data aggregation server **716** over external network **724** to access data **714** on data aggregation server **716**.

Office **712** can include an operation support center, such as operation support center **620** of **FIG. 6**. The operation support center may be set up in a predefined area at Office **712** to provide space and computing equipment for project team members to work. Project team members at office **712** conduct various activities at the operations support center in support of the project team members at well site **710**.

In a typical arrangement, surveillance engineers at office **712** are provided with real-time surveillance of various activities taking place at well site **710**. The surveillance may be conducted using real-time surveillance software **730** running on data processing system **732** at the operations support center of office **712** and at well site **710**. The collaboration infrastructure facilities shown in **FIG. 7** allow for closer collaboration between the project team members at well site **710** and the project team members at office **712**.

Referring now to **FIG. 8**, a general layout for multiple rig collaboration infrastructures is shown according to an illustrative embodiment. Well sites **810**, **812**, and **814** can be a well site such as well site **710** of **FIG. 7**. The replication of collaboration infrastructures at multiple rigs in a given oilfield allows multiple well sites to be remotely supported from a single operations support center, such as the operation support center at office **712** of **FIG. 7**. Project team members at the various well sites **810**, **812**, and **814** may then work together using the collaboration infrastructure to manage the overall drilling process for an entire oilfield asset, thereby providing huge potential increases in efficiency across the entire asset.

The collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment may be used regardless of whether the wells are being drilled in a high-volume, low-cost land environment or a high-cost, low-volume offshore environment. While drilling projects are typically is part of a multi-location "virtual" team, the illustrative collaboration infrastructure facilitates cooperation between the various personnel involved, including an asset management team in office **816**, a company man on a rig at well sites **810**, **812**, and **814**, rig contractors and other vendors on the rig at well sites **810**, **812**, and **814**, and engineers and support personnel located at

both locations. In preferred embodiments, the collaboration infrastructure communicates between well sites **810**, **812**, and **814** and office **816** via regional hub **818**, which can be regional hub **726** of **FIG. 7**. The collaboration infrastructure uses enterprise class components coupled with processes and support institutions commensurate with the challenges and difficulties of an oil well environment.

In general, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment provide a secure, hosted, managed solution with efficient global data access and backup and recovery services for all data.

The collaboration infrastructure at the rig at well sites **810**, **812**, and **814**, aggregates data from a variety of information sources into aggregated data **820**, **822**, and **824**. These sources can include, but are not limited to, information from a rig contractor, mud logger data, measurements-while-drilling data, logging-while-drilling data, information received from a company man, data from pore pressure monitoring, drilling optimization information, and episodic data, such as including wireline data, cementing data, and drill-string testing data.

The collaboration infrastructure also preferably provides real-time access to aggregated data **820**, **822**, and **824** by the collaboration team regardless of their location at either well sites **810**, **812**, and **814** or office **816**. Aggregated data **820**, **822**, and **824** can be accessed in real-time by processes such as web-based viewers, interactive viewers, import to analysis applications, and handheld access.

The collaboration infrastructure can also facilitate communication between collaboration team members at similar or identical sites, such as between rig team members of a single well site, such as one of well sites **810**, **812**, and **814**. The collaboration infrastructure, therefore, can provide a number of application and/or functions, such as, for example, electronic chat applications, instant message applications, shared data analysis, fax, reporting, email, and voice over internet protocol communication. The collaboration infrastructure can additionally provide other applications such as, but not limited to, wired and/or wireless local area networks, video monitoring, facsimile receipt and transmission, private network access, links to sub networks, hazardous area and other real-time displays, integration of personal digital assistants, remote administration, and remote monitoring and support.

The collaboration infrastructure also provides various security features to limit access to aggregated data **820**, **822**, and **824**. The various security features in one illustrative embodiment can include, but are not limited to, a firewall, a security patch management, personalized access control,

hazardous area certification, bandwidth allocation and Quality of Service (QoS), and the ability to track malicious activity.

At office **816**, the collaboration infrastructure of **FIG. 8** preferably provides flexible deployment internal and external to a corporate network (i.e., hosted), ease of integration with existing company infrastructure, access to multiple rigs at well sites **810**, **812**, and **814** as required, sufficient viewing area and real-time displays, rapid assimilation of aggregated data **820**, **822**, and **824**, and ease of context switching. The collaboration infrastructure of **FIG. 8** also preferably provides real-time access to aggregated data **820**, **822**, and **824** by the remote team at office **816**. Real-time access to aggregated data **820**, **822**, and **824** can include, but is not limited to, web-based viewers, interactive viewers, import to analysis applications, and handheld access. Inter-communication between remote team members at office **816** is also preferably provided, including chat, instant messaging, shared data analysis, facsimile, reporting, email, and voice-over-internet protocol communication. Other services provided by the collaboration infrastructure may include wired and/or wireless local area networks, video monitoring, Personal Digital Assistants, Flexible Administration (Remote/Local), and Flexible Monitoring and Support (Remote/Local). As for security, the collaboration infrastructure preferably provides a firewall, security patch management, access control, hazardous area certification, bandwidth allocation and Quality of Service (QoS), and can easily conform to client environment.

Many of the above features can be delivered using small office/home office (SOHO) equipment with very little management or configuration. However, in order to provide a secure, managed and extensible local area network that can provide the required features, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiment, use enterprise class router and switch.

With respect to the aggregation of aggregated data **820**, **822**, and **824** and access to this at office **816**, although there are many possible infrastructure solutions for data aggregation, one illustrative embodiment utilizes data aggregation servers **826**, **828**, and **830** on individual rigs at well sites **810**, **812**, and **814**. Locating data aggregation servers **826**, **828**, and **830** on individual rigs at well sites **810**, **812**, and **814** provides benefits that outweigh most logistics issues. For example, data aggregation servers **826**, **828**, and **830** at the rig provide an interface to the various vendor systems on the rig and also provide local access to aggregated data **820**. Locating data aggregation servers **826**, **828**, and **830** at the rig eliminates potential traffic across a communication link, such as communication link **728** of **FIG. 7**, from the rig to office **816**. If the data aggregation servers **826**, **828**, and **830** were located remotely from the rig, such as at office **816**, team members

at well site **810** would have to access data aggregation servers **826**, **828**, and **830** through the via the relatively scarce and expensive bandwidth of the communication link, such as communication link **728** of **FIG. 7**.

Data aggregation servers **826**, **828**, and **830** aggregate data together to create aggregated data **820** in a way that aggregated data **820** can be viewed and analyzed using a consistent set of tools. That is, aggregated data **820** is not limited strictly to the native tools and software environments provided by the various vendors.

Data aggregation servers **826**, **828**, and **830** combine aggregated data **820**, **822**, **824** into a consistent and vendor neutral data delivery format. By using the data aggregation servers **826**, **828**, and **830** to aggregate the data into a standard repository with a standard set of analysis tools, the value of the data is immediately enhanced. Time that was previously spent analyzing data in the so that the data can be prepared and implemented into a usable format is eliminated. Therefore, all of the data collected on rigs at well sites **810**, **812**, and **814** can be utilized. With the different illustrative embodiments, data is not simply eliminated because of the complexity of learning the different tools from each vendor or for each data type.

By limiting the transmission of aggregated data **820**, **822**, and **824**, the load across communication link, such as communication link **728** of **FIG. 7**, can be reduced. For example, if aggregated data **820**, **822**, and **824** is strictly collected at the rig and stored locally at well sites **810**, **812**, and **814**, then remote users at office 816 are forced to access aggregated data **820**, **822**, and **824** through the high latency and potentially scarce bandwidth of the satellite connection to the rig, such as communication link **728** of **FIG. 7**. By contrast, if aggregated data **820**, **822**, and **824** is only stored onshore, such as at office **816**, users on rigs at well sites **810**, **812**, and **814** must retrieve aggregated data **820**, **822**, and **824** from the onshore location in order to use it effectively.

Locating the data aggregation servers **826**, **828**, and **830** on a rig at well sites **810**, **812**, and **814** allows for controlled and facilitated access to aggregated data **820**, **822**, and **824**. In one illustrative embodiment, data to form aggregated data **820**, **822**, and **824** may be collected into the data aggregation server at the rig and transmitted to the remote team at office **816** only once, to be stored at local storage **832**. Users at a rig at one of well sites **810**, **812**, and **814** may access aggregated data **820** in real time locally on data aggregation server **826** and users onshore may access aggregated data **820** from local storage **832** at office **816**, thus minimizing the traffic over the satellite communication link, such as communication link **728** of **FIG. 7**, or other rig connectivity. Local storage **832** is a data storage medium that locally mirrors data that is stored at data aggregation server **826**. Local storage **832** can be any persistent or non-persistent type storage, such

as for example, but not limited to, magnetic memory such as hard disk drives, removable disks, optical storage, such as CD-ROMs and DVD-ROMs, as well as semiconductor type storage, such as random access memory chips, read only memory chips, and flash memory. This bifurcated storage of aggregated data **820** helps eliminate contention for connectivity and bandwidth between office **816** and well sites **810**, **812**, and **814**.

Combining data from well sites **810**, **812**, and **814** into aggregated data **820**, **822**, and **824** requires collecting data from a variety of vendors and systems and using various data sharing standards available for rigs. In one illustrative embodiment, the data collaboration infrastructure of **FIG. 8** acquires data in a standard data format. The standard data format can be, for example, but is not limited to, the Wellsite Information Transfer Standard (WITS) format, the WITSML format, or the markup language based evolution of the Wellsite Information Transfer Standard format.

In one illustrative embodiment, data aggregation server **826** includes a standard qualification process **830** for new vendors. Standard qualification process **830** is a software process that maps previously collected sample Wellsite Information Transfer Standard data with associated data descriptions. Once data is mapped, the mapped data is stored in a knowledge base so that data from that vendor may be acquired and comprehended anywhere. Mapped data obtained from the standard qualification process **830** can be transferred between well sites **810**, **812**, **814** and office **816** to extend the comprehension of the acquired data.

Referring now to **FIG. 9**, an exemplary network that may be used in a collaboration infrastructure is shown according to an illustrative embodiment. Network **900** of **FIG. 9** is the network between the various components of the collaboration infrastructure of **FIGs. 6-8**.

Voice-over-internet protocol is enabled by wired internet protocol telephones **910-912** and wireless internet protocol telephone **914**. Internet protocol telephones **910-912** connect to enterprise class router **916**. Enterprise class router **916** provides access from internet protocol telephones **910-912**, and other networked devices, to off-site voice over internet protocol telephone servers. Enterprise class router **916** can also provide access to a foreign exchange service, a foreign exchange office, or a local exchange in order to enable telephone communication to the rig. Wireless internet protocol telephone **914** wirelessly connects to hub **918**. Hub **918** is connected to enterprise class switch **920**. Enterprise class switch **920** is connected to enterprise class router **916**.

Enterprise class wireless local area network controller (local area network controller) **922** is also connected to enterprise class switch **920**. Enterprise class wireless local area network controller **922** provides the rig with system-wide wireless local area network functions, such as for example, but not limited to, security policies, intrusion prevention, RF management, quality of

service (QoS), and mobility. Users can wirelessly connect to the network of **FIG. 9** through the use of wireless personal digital assistant **936**, or through a wireless ethernet card installed into a data processing system.

The network of **FIG. 9** can also connect with various terminals running proprietary or public software systems for monitoring of data from the well site, or predicting operations of the well site operations based on aggregated data. Terminals can also be provided for connecting to various public and private networks. These terminals can include, but are not limited to, InterACT™ terminal **924**, Hazardous Substance Process Management terminal **926**, PTK Local Viewer terminal **928**, siNET terminal **930**, and internet terminal **932**. A site administrator can connect to the infrastructure using an administration access terminal **934**.

In some embodiments, in order to access the data and services on the rig, access external connectivity, and use global resources to improve the performance of the team, users on the rig are segmented according to their requirements and access to resources are limited unless access is required and approved. This may be accomplished by categorizing users according to their requirements and permissions and then using virtual local area networks (VLANs) to accommodate and constrain each group. For example, one group of users may need access to data on the rig and other users on the rig, but do not need or want Internet access for security reasons (the "Rig Access users"). Another group of users may require Internet access, but do not require, nor are allowed to access resources on the rig (the "Internet Access users"). Still another group of users may need access to the Internet as well as all rig resources (the "Full Access users").

To accommodate the above user groups, wired virtual local area networks may be set up for each group to provide the access goals defined. For example, a first virtual local area network may be set up for the Rig Access users and will connect certain ports on the switch labeled "Rig Access" to the specific port on the rig labeled "Rig Server." A second virtual local area network for the Internet Access users may be set up that connects certain other ports on the switch to the router and onto the external Internet connection. Still further, a third virtual local area network may be set up that connects still other ports on the switch to both the Rig Server and Router ports. The defined access goals can be implemented by limiting physical access to the switch. Physical access to the switch can be controlled by plugging users into the specific ports assigned to their level of capability.

For a wireless local area network, a similar network scheme is created, except, instead of ports on the switch, the user selects the network they are allowed to connect to by a unique log-in identification. Each unique log-in identification is associated with a virtual local area network

connecting to the specific resources allowed. The log-in identification can be associated with assignment to the virtual local area networks using any known data structures and methods. For example, team members belonging to a Rig Access group would have a first level of access that allows for connection to a Rig Access network. Team members belonging to an Internet Access group would have a second level of access that allows for connection to an Internet Access network. Each different level of access is an authorization to use or access various systems and components of the infrastructure. Team members that are allowed full access would have a third level of access that allows for connection to the Full Access network. Access to each network can be controlled through passwords, or by association of the unique log-in identification with a certain level of access.

In addition to the standard virtual local area networks to control access, the network setup of **FIG. 9** may connect to dedicated subnets set up on the rig for the various vendors. Various data processing systems collecting data during mud logging might be connected together on a simple local area network. By creating a virtual local area network dedicated to bringing data from those data processing systems performing mud logging to the a rig access local area network, traffic through only the mud logging network can be limited to only traffic required for communication with the mud logging data processing systems. Alternatively, a second network card having its own internet protocol address could be inserted for connecting the mud logging subnet to the rig access local area network. However, such a solution would require additional hardware and configuration within one of the mud logging data processing systems, and further runs the risk of exposing those mud logging data processing systems to external access or viruses.

The network of **FIG. 9** manages the use of scarce bandwidth resources, such as the external Internet link, to prioritize the traffic on that link. The network of **FIG. 9** can give bandwidth priority to critical data delivery, which is the primary reason for having external access. Critical data is data which is critical to drilling operations, that is not accessible from another location, such as office **816** of **FIG. 8**. Critical data delivery along with voice communications are provided at least a minimum certain allocated bandwidth. Whenever critical data delivery or voice communication is in use, they would be assured of having at least that minimum certain allocated bandwidth. The bandwidth allocation may be accomplished by such methods as, for example, but not limited to, using a quality of service and bandwidth filtering on the router. Additionally, the router can also monitor bandwidth consumption to determine what processes or users are utilizing the available bandwidth.

In general, the collaboration infrastructure methods, systems, and apparatuses of the illustrative embodiments ensure wireless connectivity around the area where the equipment rack is located and on a rig floor. If total coverage on the rig is desirable, a site survey to design the placement, number, and type of access points and antennas required for full coverage can be performed. The access points may be placed on the rig with a wire connecting each one back to the switch. These access points may be powered locally by a power injector close to where they are mounted, or powered over Ethernet through the cable connecting them to the switch. Rather than connecting each access point by cable to the switch, the access points can be deployed in a grid or mesh where the first access point is wired to the switch, the second access point connects wirelessly to that access point, and the third connects wirelessly to the second, and so forth. Some mesh access points have only one radio so when they are deployed in a mesh, they can only operate in half duplex (i.e. they can only receive or transmit at any given time, but not both). Some access points have two radios so that they can operate in full duplex and transmit and receive at the same time. In order to provide good quality VOIP through the wireless local area network, the collaboration infrastructure methods, systems, and apparatuses of the invention use access points with two radios, or the access point may also be wired back to the switch. Mesh access points operating in half duplex may not give the necessary quality of service for good quality voice.

The collaboration infrastructure methods, systems, and apparatuses of the invention can also support video monitoring on the rig via video cameras, including wireless video cameras certified for hazardous areas. The output from these cameras can be tailored for the available bandwidth and the application requirements. The size of the picture, the resolution and the frequency of the updates can be reduced to accommodate the available bandwidth for transmission and storage.

Once a user has access to the Internet, they are free to initiate client based virtual private network sessions with the virtual private network gateways set up to access their company's private network. Each user may be securely connected back to their company's internal network. In addition, router based virtual private networks may be connected that would be more permanent and could allow specific subnets on the rig to be linked as if they were connected into their private networks.

As for VOIP, there are many ways to do VOIP today, that provide varying levels of reliability, clarity and flexibility. Each of these levels of service may have application in certain situations. The collaboration infrastructure methods, systems, and apparatuses of the invention are flexible enough to support all of them in appropriate situations, as described below.

The lowest level of VOIP allows communication from computer to computer using a microphone and the sound card in the computer. This capability is typically available for free using Net Meeting or one of several available free VOIP services. This level can be workable if a decent headphone or microphone is provided, but the quality is typically not very good.

The next level is a paid service where the user can connect from their computer to a phone by using the gateway that connects the Internet, to the public switched telephone network. This provides additional capability, however the quality is still subject to the quality of the network connection.

The third level of VOIP uses an analog phone connected to the router and a call manager remotely routes calls from the network to the public switched telephone network. In order to connect the phone to the router, a special card that does the analog to digital conversion is required, as well as, the router must have sufficient digital signal processing capability to compress and massage large volumes of digital information for transmission. If the remote connectivity provider for the rig also provides the call manager, then it is also providing the link from the rig to the hub and can provide the call gateway at the hub that links to the phone network. In that case, the service provider controls the whole path from the rig to the phone network and can prioritize the voice traffic in order to provide high quality voice. The reliability of the voice in this configuration would be much higher than in the previous cases, but of course is still limited by the bandwidth, latency, and quality of the remote network link. A major benefit of this configuration is that the solution can also support FAX, which is still a very popular way for transmitting images and documents.

Finally, the highest quality level of VOIP service involves the use of IP phones connected directly to the rig local area network. This level requires the use of more expensive digital IP phones connected directly to the network. These phones may be harder to get in the event of a failure or damage to the phone, which is another attraction to the previous level where an analog phone can be found in almost any consumer electronics store. This level of service requires a remote call manager like the third level, and this option can be a fairly expensive component of the infrastructure. This level can also support the new WIFI IP phones that connect to the wireless local area network on the rig and provide mobile communications. However, supporting VOIP on the wireless local area network, it has implications on how the wireless local area network is implemented, as discussed above. Another consideration when deciding which level of VOIP to implement is the issue of resilience of the phones on the rig during a remote connectivity outage. There are certain features in the router that can support local phone functions on the rig even if the

remote call manager cannot be reached. This feature is called Survivable Remote Site Telephony (SRST) and is an additional cost for the infrastructure at the rig.

The collaboration infrastructure methods, systems, and apparatuses of the invention also account for issues related to hazardous area certification. For example, with respect to rig cabling, there are generally two acceptable ways to cable Ethernet on a rig. The first is to use shielded and armored cable for runs on the rig. This type of cable is certified and is protected from being cut by the armor. The shielding provides noise protection to keep electrical and RF noise from degrading the signal. The second is an acceptable way is to use isolation barriers at each end of the Ethernet cable that limit the amount of power that can be used to transmit the signal. These barriers are available commercially and should be used any time a standard Cat 5 cable is run around a rig.

There are also several issues with wireless communications or related to wireless communications. First, any wireless installation must be capable of shutting down completely during explosive operations such as perforating or certain stuck pipe manipulations. While it is very difficult to eliminate all RF sources during these operations, any precaution that can be taken to minimize risk should be taken. Thus, for example, the collaboration infrastructure methods, systems, and apparatuses of the invention provide formal notification to rig management (e.g., company man, driller, etc.) that wireless connectivity is in operation and that it needs to be turned off during these hazardous operations.

Second are hazardous issues related to clients of the wireless networks. These clients must be certified if they are used in the hazardous areas. There are Zone 1 certified PDAs and rig floor displays available for this purpose. Also, these clients are RF sources and the collaboration infrastructure methods, systems, and apparatuses of the invention require them to be powered off during the hazardous operations on the rig. Just as all cell phones are turned off during explosive operations, so must WIFI clients be powered off.

Wireless access points may be used that are certified such that they cannot provide enough energy through their antenna and thus cannot cause an explosion. Similarly, certified antennas may also be used that can be connected to any access point in a pressurized or safe area and then run outside into the hazardous area.

There are many aspects of IT security that are also accounted for by the collaboration infrastructure methods, systems, and apparatuses of the invention. For example, there are several major activities required to protect any server connected to the Internet. This is especially true if the server is using Microsoft operating systems and tools, but is equally true for any server. First, the collaboration infrastructure methods, systems, and apparatuses of the invention ensure that security

patches are applied in a consistent way. Critical security patches protect the system from vulnerabilities that can be exploited by malicious hackers. Typically these patches are released monthly and should be applied in a timely manner. Of course, it is possible that some patches may break some software and are therefore tested before they are deployed in a production environment.

Second is virus protection. Servers on the rig must be set up to automatically update their .dat files on a regular basis and maintain their protection against new viruses being developed daily.

Third is firewall and access protection. The collaboration infrastructure methods, systems, and apparatuses of the invention preferably provide firewall protection via an external firewall appliance. To this end, enterprise class routers can provide firewall protection as well as a detailed control of who can access a server, from where, and on which ports and services. In addition, depending on the operating system deployed, there are software firewalls available that can provide some protection from attacks. Many Internet service providers and remote connectivity providers can also provide "clean" Internet access and protect customers from port scans and other malicious activity by having their own firewalls and security systems.

Servers on rigs will require some level of remote administration. The collaboration infrastructure methods, systems, and apparatuses of the invention preferably implement this administration through a series of options on Microsoft systems, including, but not limited to, Microsoft® Remote Terminal Server, NetMeeting® Remote Desktop Sharing, available from Microsoft Corporation, Timbuktu®, available from Netopia, Inc., RealVNC, available from RealVNC, Ltd., and PCAnywhere® available from Symantec, Corp. Any of these packages allow an administrator to take control of the machine remotely. Each has certain performance and security benefits and issues. In addition to these packages, administration can also be done using Web access to the server. Still other administration can be better done through a command line. All these packages may be susceptible to intermittent network issues and sometimes it will be necessary to reboot the server to clear crashed or hung services. This can be done through a command line using telnet and the like if the Windows interface is hung. There are a number of commercial and shareware packages available that provide these types of services on Windows computers. Remote administration through commercially available appliances that can provide out of band access to the server in the event of network outage or the need to power off and restart the server is also contemplated by the collaboration infrastructure methods, systems, and apparatuses of the invention.

Referring now to **FIG. 10**, a flowchart illustrating the method steps for providing a collaboration infrastructure is shown according to an illustrative embodiment. Process **1000** facilitates the infrastructure of **FIG. 8**.

Process **1000** begins by collecting multiple types of oil well data at the oil well site to form an aggregated data (step **1010**). Process **1000** then stores the aggregated data in a data aggregation server at the oil well site (step **1020**).

Process **1000** then stores a local copy of the aggregated data on a local server at the remote location (step **1030**). Process **1000** then allows a first user at the oil well site and a second user at the remote location to access the aggregated data on the data aggregation server using a standard data format (step **1040**).

Process **1000** allows the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center (step **1050**). Process **1000** allows the users at the remote location to access the aggregated data on the local server (step **1060**), with the process terminating thereafter.

The collaboration infrastructure methods, systems, and apparatuses of the invention also provide real-time monitoring to ensure problems with the infrastructure are detected before they delay drilling operations, and to facilitate fast and straightforward troubleshooting. Monitoring is also performed to provide objective measures of whether the infrastructure is delivering the service levels agreed in any contract.

In one implementation, commercially available basic server monitoring is used to provide early detection of problems related to server load, disk space, memory consumption or other common problems related to server management. To this end, commercial tools are available that can give early warning of disk space issues or processor overload.

Network monitoring is also performed to detect network abuse or configuration issues or even hardware failures causing reduced performance. Network monitoring can identify bottlenecks or problems due to viruses or worms, or other compromises of the security of the infrastructure. Monitoring the wireless network can detect rogue access points, unauthorized users or outages, or connectivity issues with the access points.

The collaboration infrastructure methods, systems, and apparatuses of the invention also perform application monitoring in order to measure the overall effectiveness of the infrastructure and detect problems with data delivery before users or applications are affected.

Furthermore, as drilling rigs are operating around-the-clock and teams need to collaborate together during critical periods regardless of the time of day or night, a solid support hierarchy must

be in place. To this end, the collaboration infrastructure methods, systems, and apparatuses of the invention also provide an around-the-clock help desk that can take phone calls, log issues in an issue tracking system, and either resolve the issue or escalate it to the appropriate resource. Detailed troubleshooting procedures implemented by the collaboration infrastructure methods, systems, and apparatuses of the invention allow this first line of support to begin resolution immediately and effectively route the problem for resolution as needed.

A second line of support involves network and remote connectivity support or a dedicated engineer assigned to the rig. The second line of support is invoked if the first line of support is unable to resolve the issue, but it can be determined that connectivity is the cause. If the problem is still unresolved, then it is escalated to the remote connectivity vendor.

Remote connectivity from the rig to the remote location is required in order for the virtual team to communicate. In one implementation, the collaboration infrastructure methods, systems, and apparatuses of the invention provide this remote connectivity via mobile satellite connections that offer varying amounts of bandwidth as required. These mobile satellite connections can typically provide Internet access or direct access to a private corporate network.

In addition to satellite, other solutions based on wireless technologies like WiMax and long range WiFi may also be used to provide broadband connectivity to the rig. These alternative solutions have the benefits of potentially lower bandwidth charges and higher ultimate throughput as well as reduced latency due to the lack of satellite hops.

Although the foregoing is provided for purposes of illustrating, explaining and describing certain embodiments of the invention in particular detail, modifications and adaptations to the described methods, systems and other embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of the invention.

## CLAIMS

What is claimed is:

1. A method of facilitating collaboration between users at an oil well site and users at a remote location, comprising:

collecting multiple types of oil well data at the oil well site to form an aggregated data;

storing the aggregated data in a data aggregation server at the oil well site; and

allowing a first user at the oil well site and a second user at the remote location to access the aggregated data on the data aggregation server using a standard data format.

2. The method of claim 1, further comprising:

conforming the aggregated data to the standard data format in a data repository;

storing a local copy of the aggregated data on a local server at the remote location; and allowing the users at the remote location to access the aggregated data on the local server.

3. The method according to claim 1, wherein the users at the oil well site access the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

4. The method according to claim 1, wherein the users at the remote location access the multiple types of oil well data via a satellite communication link.

5. The method according to claim 1, further comprising providing an operations support center at the remote location and allowing the users at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

6. The method according to claim 1, wherein the users at the oil well site and the users at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

7. The method according to claim 1, wherein the oil well site is an offshore site and the remote location is an onshore location.

8. A system for facilitating collaboration between users at an oil well site and users at a remote location, comprising:

a set of data aggregation servers configured to collect multiple types of oil well data at the oil well site, wherein the set of data aggregation servers is configured to store the multiple types of oil well data as aggregated data;

a first set of subsystems configured to conform the aggregated data to a standard data format in a data repository; and

a second set of subsystems configured to allow a first user at the oil well site and a second user at the remote location to access the aggregated data using the standard data format.

9. The system according to claim 8, wherein the first user at the oil well site accesses the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

10. The system according to claim 8, wherein the second user at the remote location accesses the multiple types of oil well data via a secured satellite connection.

11. The system according to claim 8, further comprising:

an operations support center located at the remote location, wherein the operations support center comprises a third set of subsystems configured to allow a third user at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

12. The system according to claim 8, further comprising a fourth set of subsystems certified for use at the oil well site for hazardous areas, wherein the fourth set of subsystems includes computing and communication equipment.

13. The system according to claim 8, wherein the first user at the oil well site and the users at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

14. The system according to claim 8, wherein the oil well site is an offshore site and the remote location is an onshore location.

15. An oil rig located at a well site for facilitating collaboration between users at the well site and users at a remote location, the oil rig comprising:

a drilling tool advanced into a subterranean formation with geological structures and reservoirs therein;

a set of data aggregation servers configured to collect multiple types of oil well data at the oil well site, wherein at least one data aggregation server is configured to store the multiple types of oil well data as aggregated data;

a first set of subsystems configured to conform the aggregated data to a standard data format in a data repository; and

a second set of subsystems configured to allow a first user at the oil well site and a second user at the remote location to access the aggregated data using the standard data format.

16. The oil rig of claim 15, wherein the first user at the oil well site accesses the multiple types of oil well data via one or more private virtual local area networks, each local area network allowing a different level of access to the multiple types of oil well data.

17. The oil rig of claim 15, wherein the second user at the remote location accesses the multiple types of oil well data via a secured satellite connection.

18. The oil rig of claim 15, further comprising

a third set of subsystems certified for use at the oil well site for hazardous areas, the at least one subsystem including computing and communication equipment.

19. The oil rig of claim 15, wherein the first user at the oil well site and the second user at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

20. The oil rig of claim 15, wherein the oil well site is an offshore site and the remote location is an onshore location.

21. A method for controlling a drilling operation for an oilfield, the oilfield having a wellsite with a drilling tool advanced into a subterranean formation with geological structures and reservoirs therein, comprising:

collecting multiple types of oil well data at the oil well site to form an aggregated data;

storing the aggregated data in a data aggregation server at the oil well site; allowing a first user at the oil well site and a second user at a remote location to access the aggregated data on the data aggregation server using a standard data format; and

controlling drilling operations based on the aggregated data.

22. The method of claim 21, further comprising:

storing a local copy of the aggregated data on a local server at the remote location; and

allowing the second user at the remote location to access the aggregated data on the local server.

23. The method according to claim 21, wherein the users at the oil well site access the multiple types of oil well data via a set of private virtual local area networks and wherein each private virtual local area network in the set of private virtual local area networks allows a different level of access to the multiple types of oil well data.

24. The method according to claim 21, wherein the second user at the remote location accesses the multiple types of oil well data via a satellite communication link.

25. The method according to claim 21, further comprising providing an operations support center at the remote location and allowing the second user at the remote location to monitor collection of the multiple types of oil well data in real time from the operations support center.

26. The method according to claim 21, wherein the users at the oil well site and the second user at the remote location access the multiple types of oil well data using one or more of: a Web-based viewer and an interactive viewer.

27. The method according to claim 21, wherein the oil well site is an offshore site and the remote location is an onshore location.

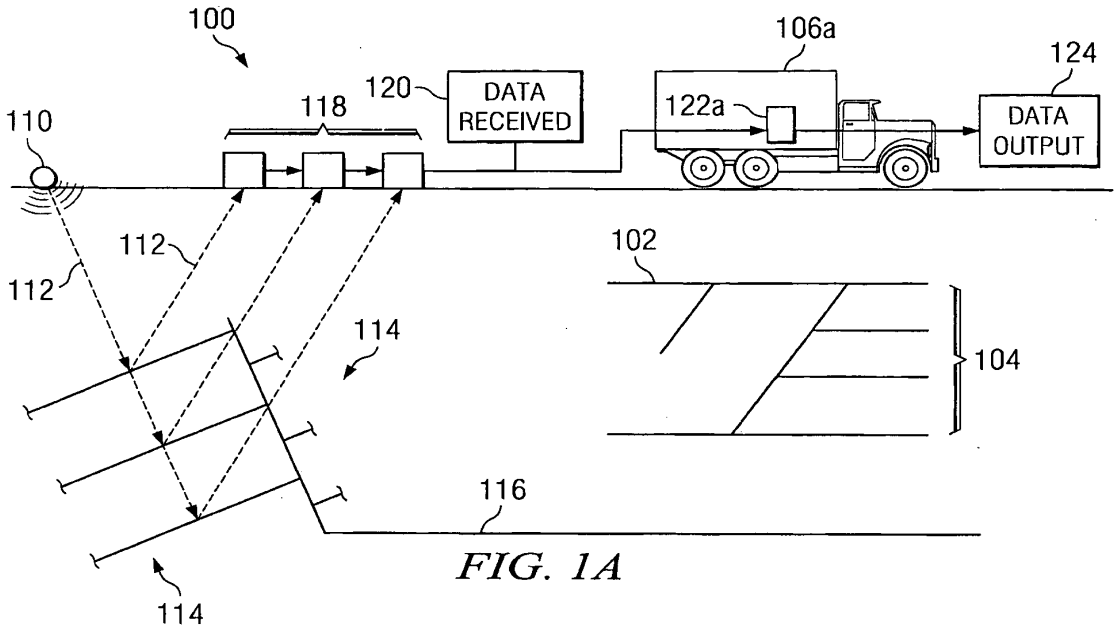

100
106a
124
120
DATA RECEIVED
118
122a
DATA OUTPUT
110
112
112
102
114
104
116
114

FIG. 1A

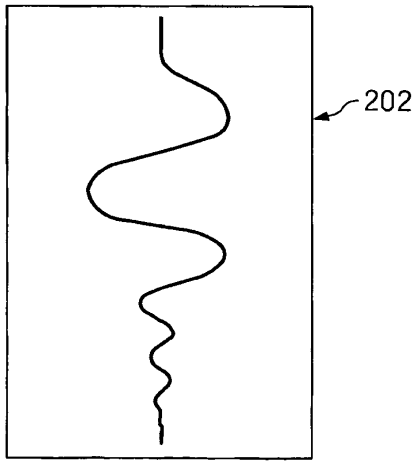

202

FIG. 2A

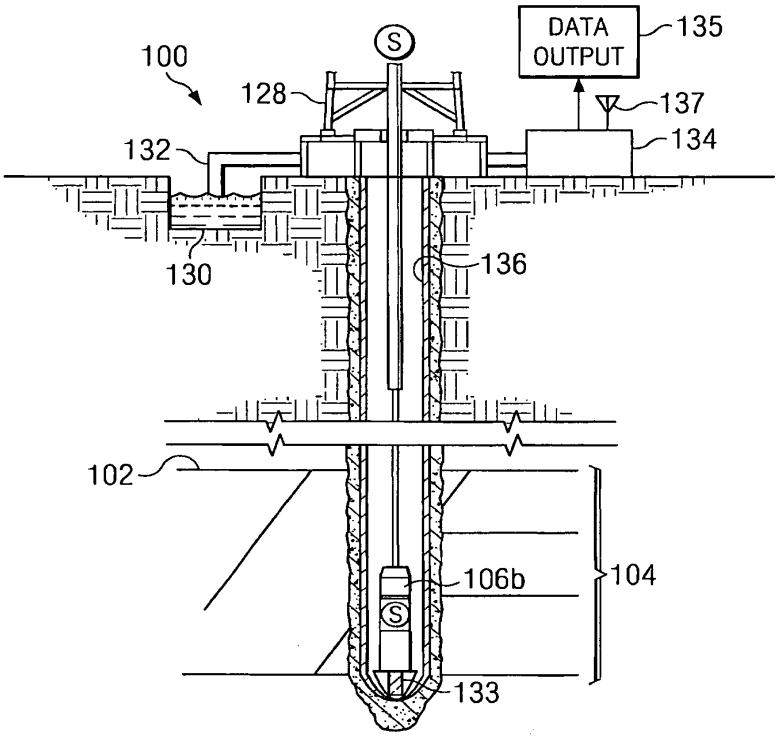

DATA
OUTPUT
135
100
128
137
134
132
130
136
102
104
106b
133

FIG. 1B

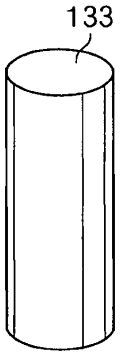

133

FIG. 2B

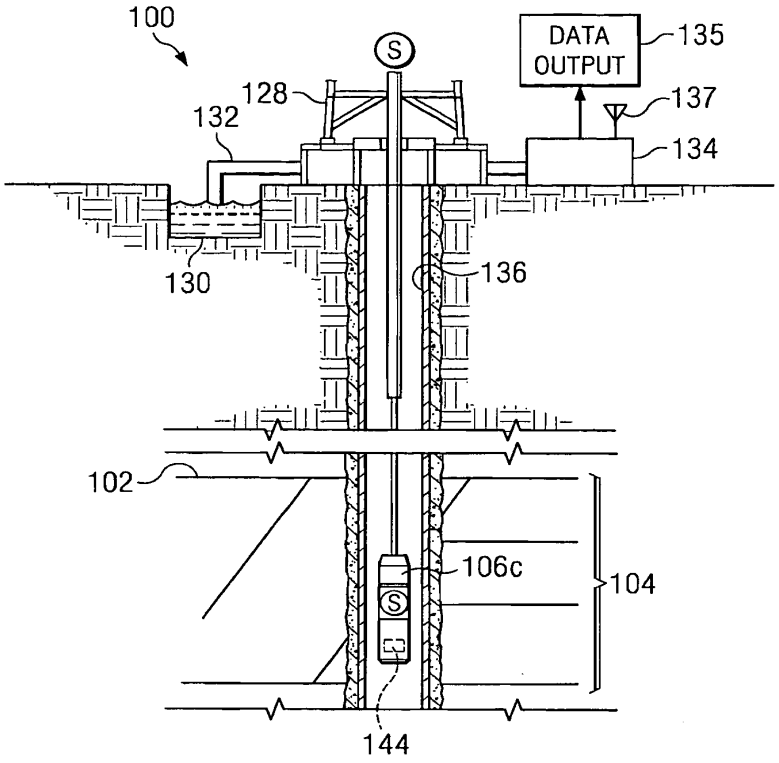

100
S
DATA OUTPUT
135
128
137
132
134
130
136
102
106c
104
144

FIG. 1C

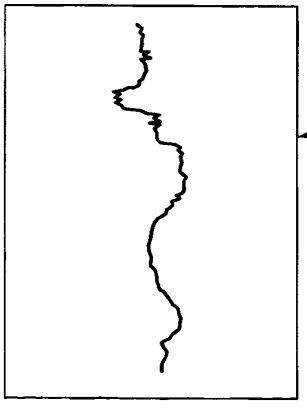

204

FIG. 2C

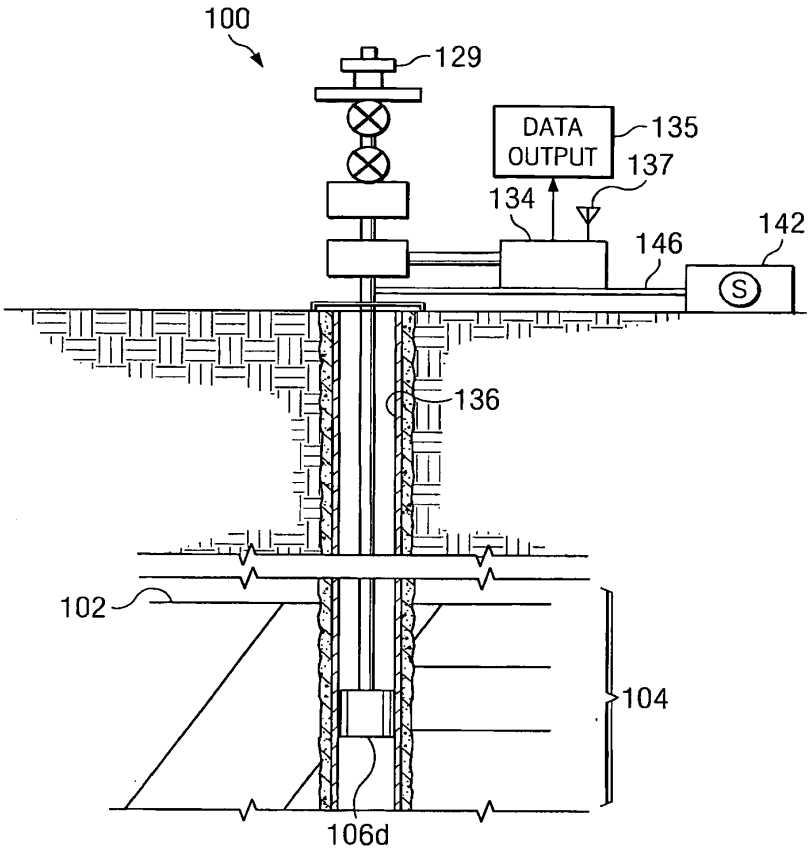

100
129
DATA OUTPUT
135
137
134
142
146
S
136
102
104
106d

FIG. 1D

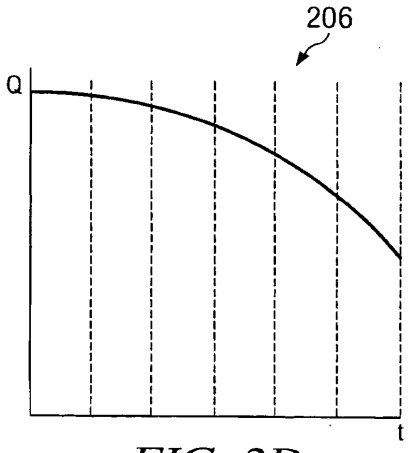

206
Q
t

FIG. 2D

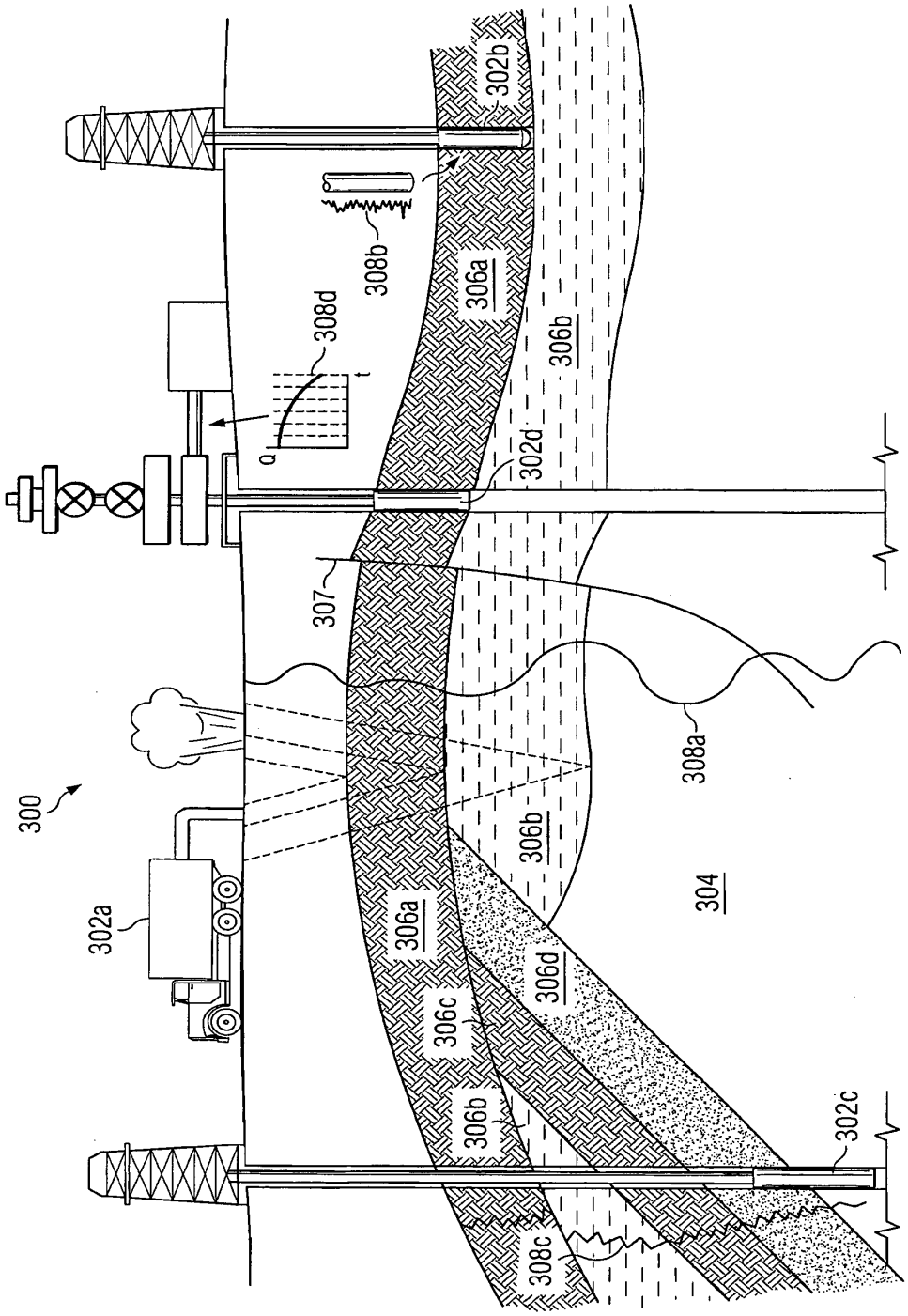

300
302a
302b
302c
302d
304
306a
306b
306c
306d
307
308a
308b
308c
308d
q
t

FIG. 3

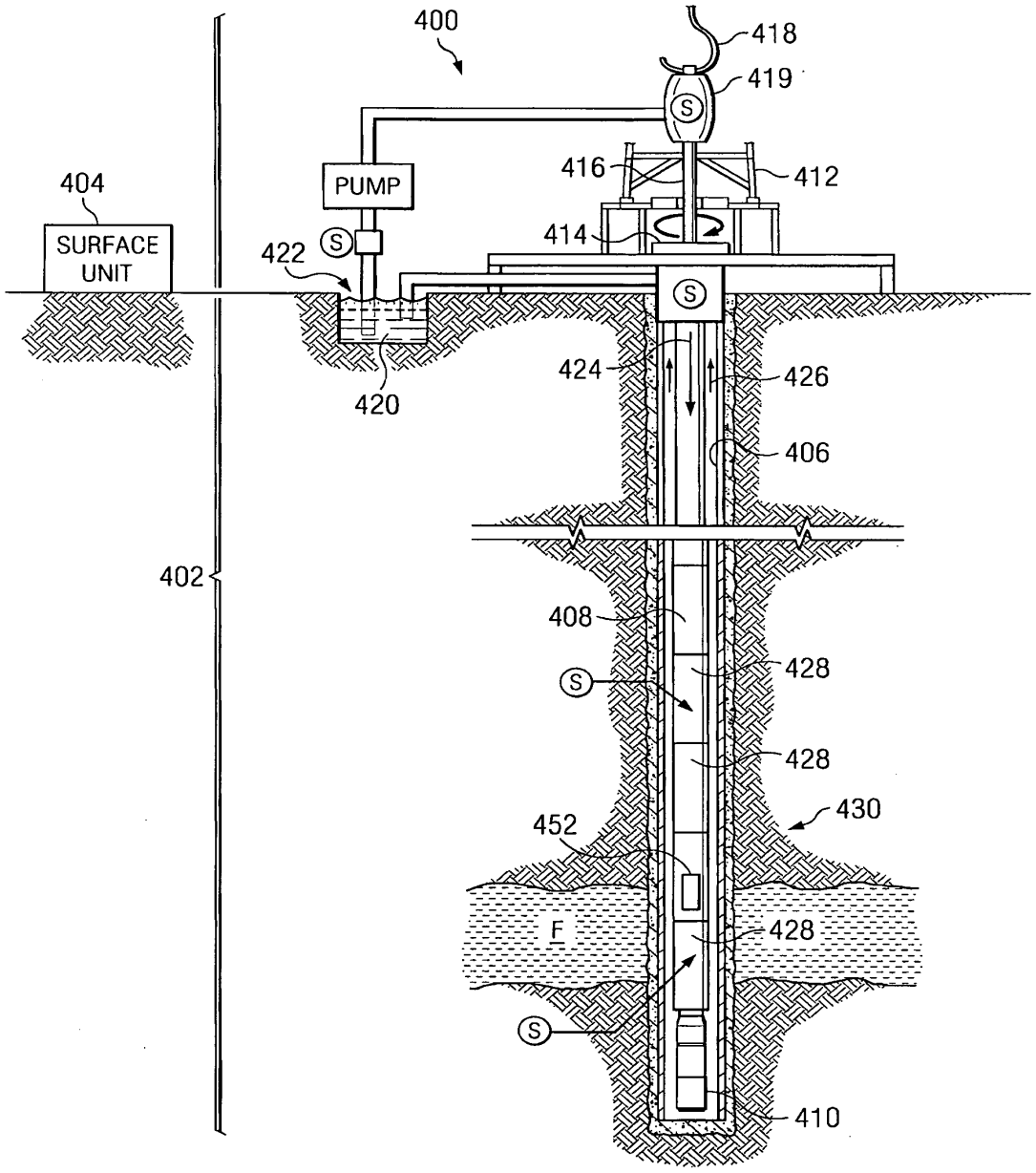

400
418
419
S
416
412
404
PUMP
SURFACE UNIT
422
S
414
S
424
426
420
406
402
408
S
428
428
430
452
F
428
S
410

*FIG. 4*

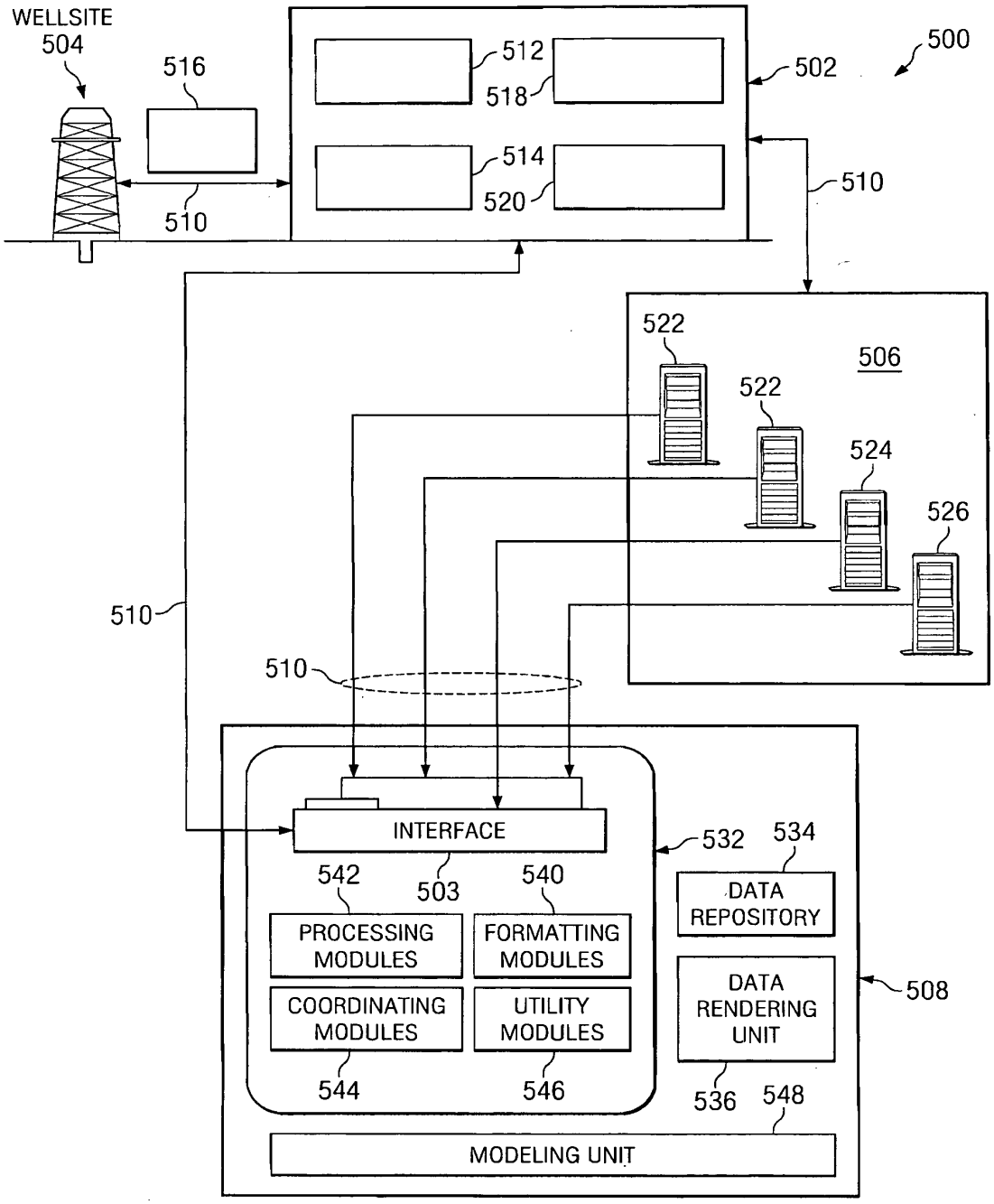

WELLSITE
504
516
512
518
502
500
514
520
510
510
522
506
522
524
526
510
510
INTERFACE
532
534
542
503
540
DATA
REPOSITORY
PROCESSING
MODULES
FORMATTING
MODULES
DATA
RENDERING
UNIT
508
COORDINATING
MODULES
UTILITY
MODULES
544
546
536
548
MODELING UNIT

*FIG. 5*

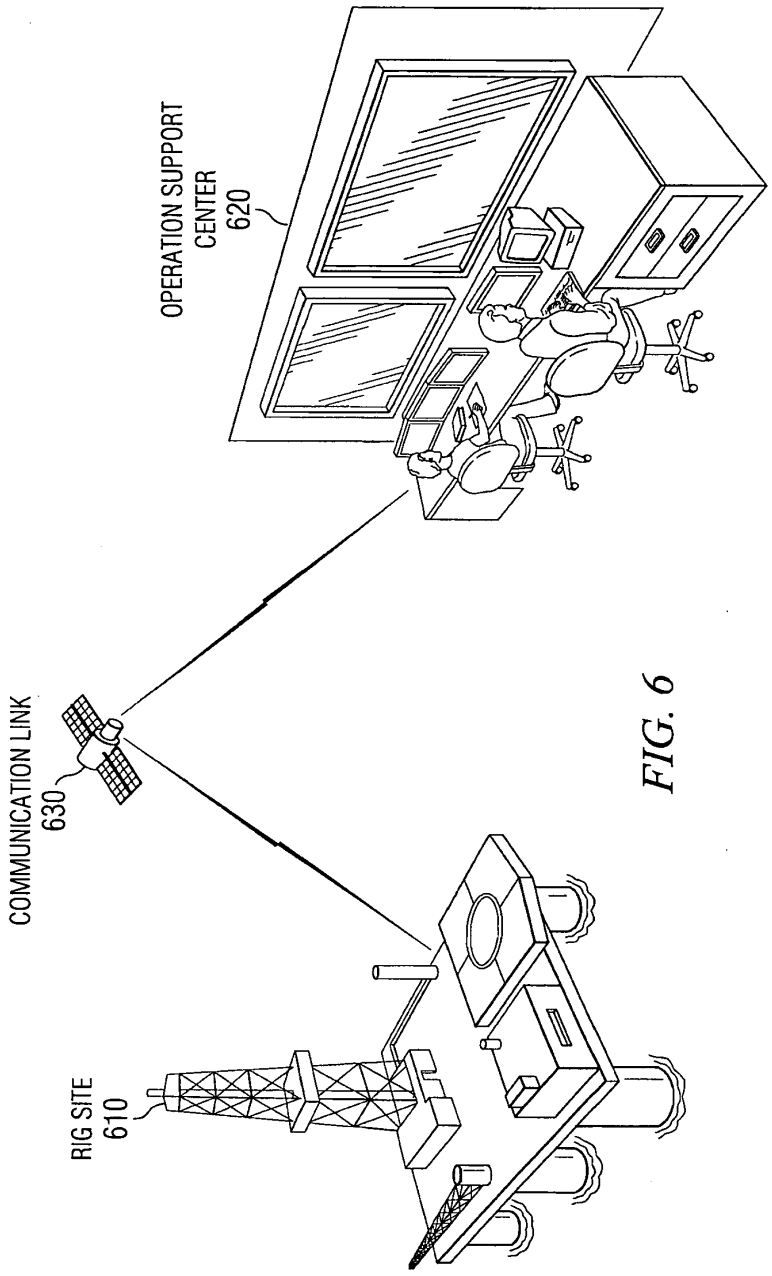

OPERATION SUPPORT CENTER
620
COMMUNICATION LINK
630
RIG SITE
610

FIG. 6

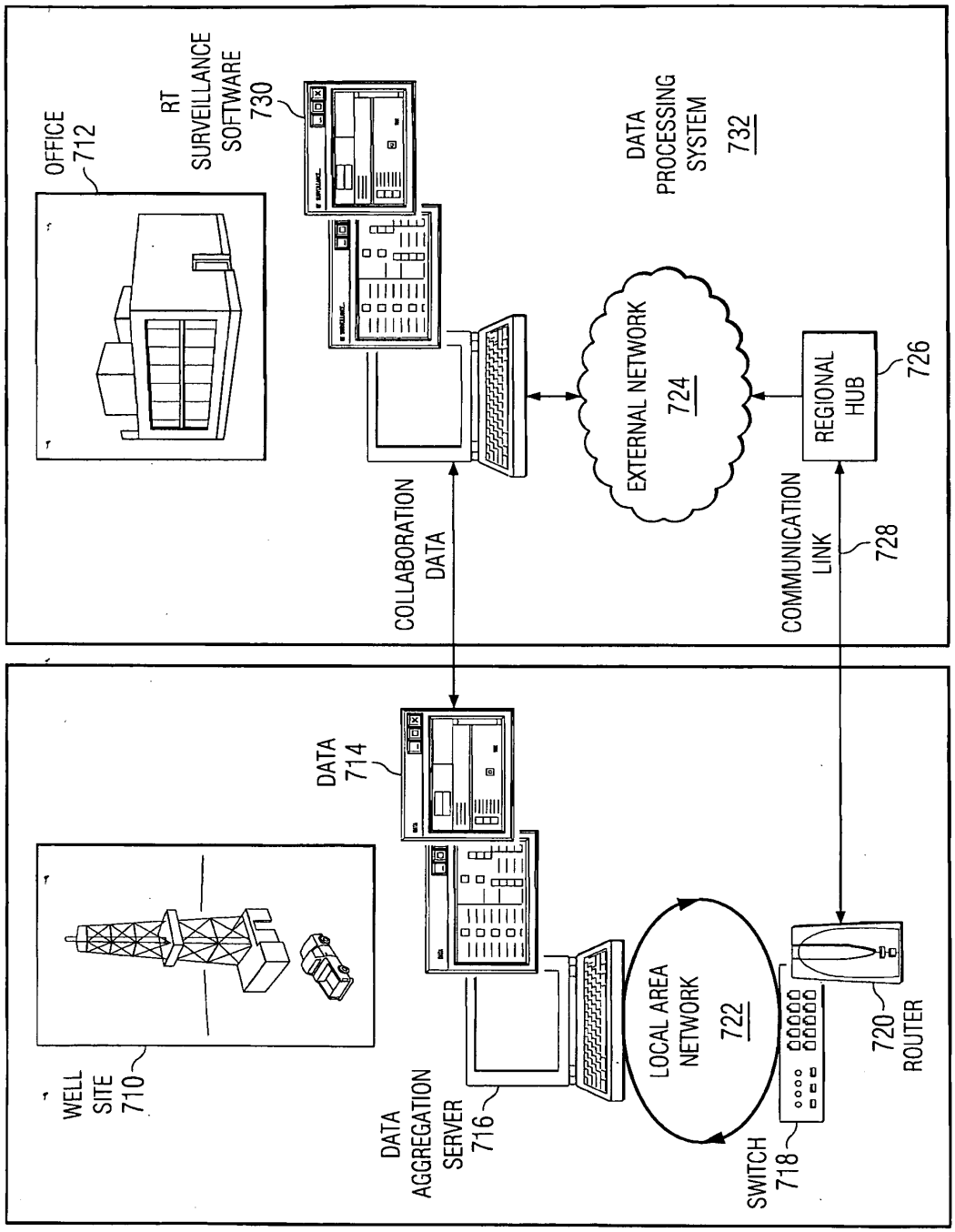

OFFICE
712
RT
SURVEILLANCE
SOFTWARE
730
DATA
PROCESSING
SYSTEM
732
EXTERNAL NETWORK
724
REGIONAL
HUB
726
COLLABORATION
DATA
COMMUNICATION
LINK
728
DATA
714
WELL
SITE
710
DATA
AGGREGATION
SERVER
716
LOCAL AREA
NETWORK
722
SWITCH
718
720
ROUTER

*FIG. 7*

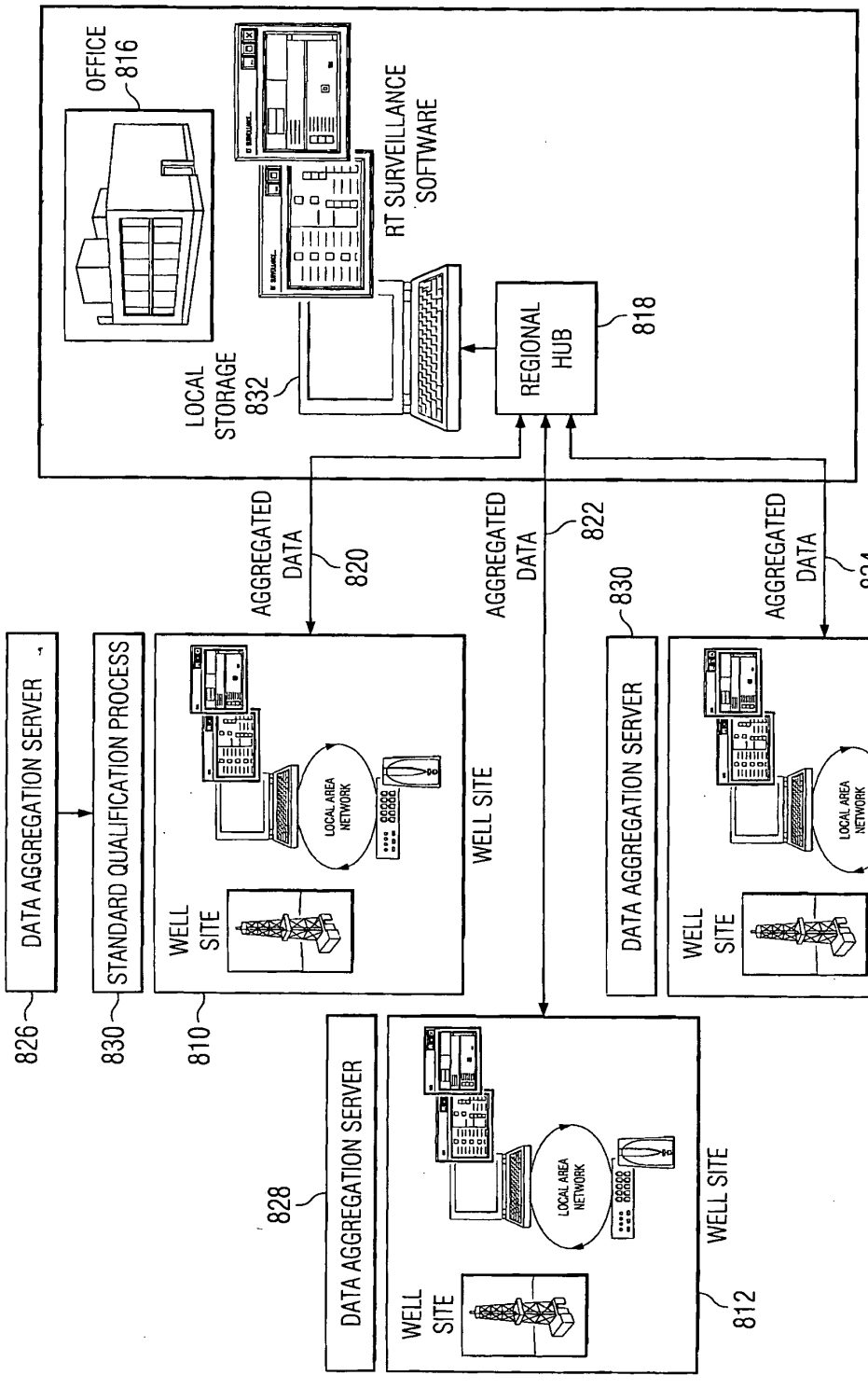

OFFICE
816
RT SURVEILLANCE SOFTWARE
LOCAL STORAGE
832
REGIONAL HUB
818
AGGREGATED DATA
820
AGGREGATED DATA
822
AGGREGATED DATA
824
DATA AGGREGATION SERVER
826
STANDARD QUALIFICATION PROCESS
830
WELL SITE
810
LOCAL AREA NETWORK
DATA AGGREGATION SERVER
828
WELL SITE
812
DATA AGGREGATION SERVER
830
WELL SITE
814

FIG. 8

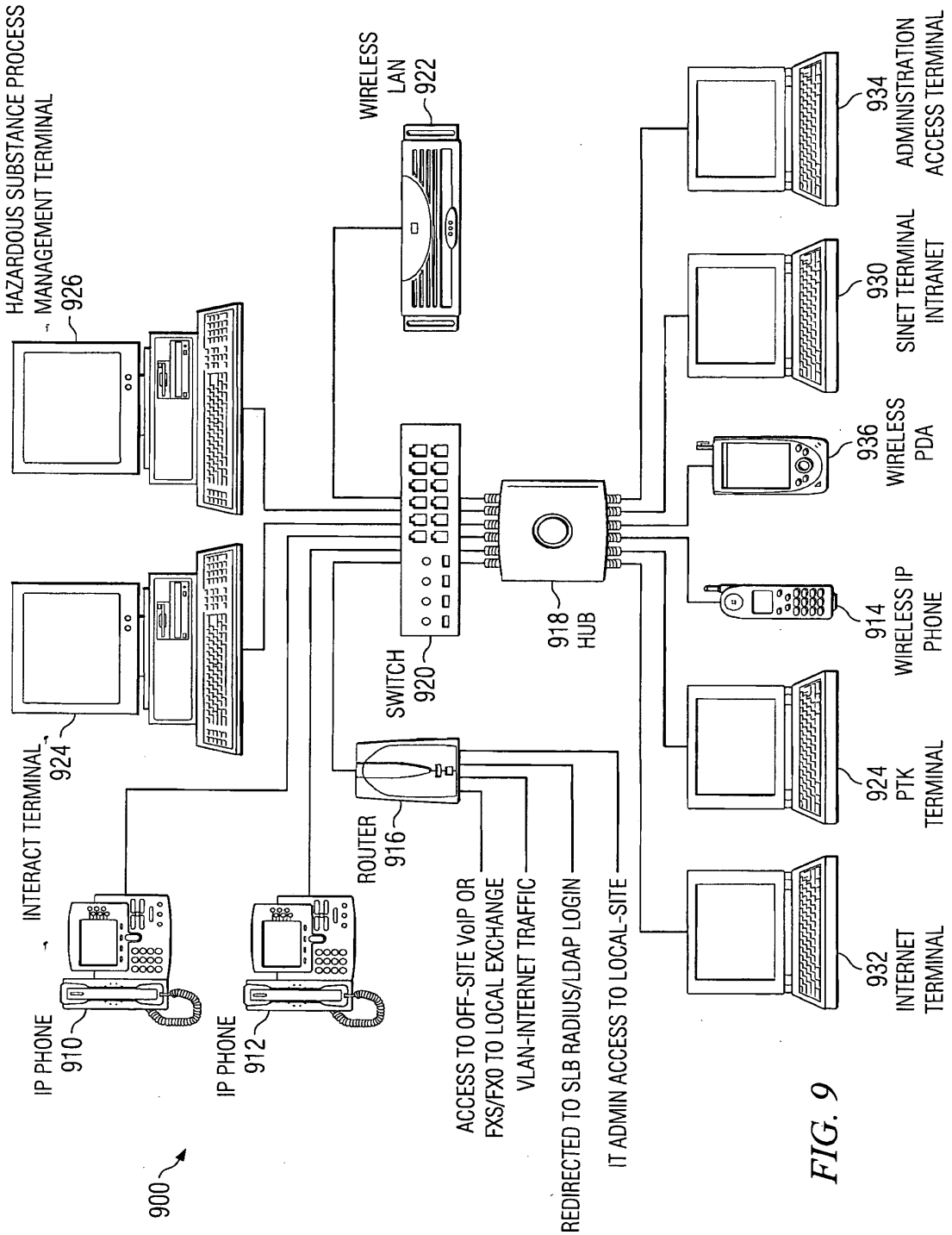

HAZARDOUS SUBSTANCE PROCESS MANAGEMENT TERMINAL
926
WIRELESS LAN
922
934
ADMINISTRATION ACCESS TERMINAL
930
SINET TERMINAL INTRANET
936
WIRELESS PDA
914
WIRELESS IP PHONE
924
PTK TERMINAL
932
INTERNET TERMINAL
INTERACT TERMINAL
924
IP PHONE
910
IP PHONE
912
ROUTER
916
SWITCH
920
918
HUB
ACCESS TO OFF-SITE VoIP OR FXS/FXO TO LOCAL EXCHANGE
VLAN-INTERNET TRAFFIC
REDIRECTED TO SLB RADIUS/LDAP LOGIN
IT ADMIN ACCESS TO LOCAL-SITE
900

*FIG. 9*

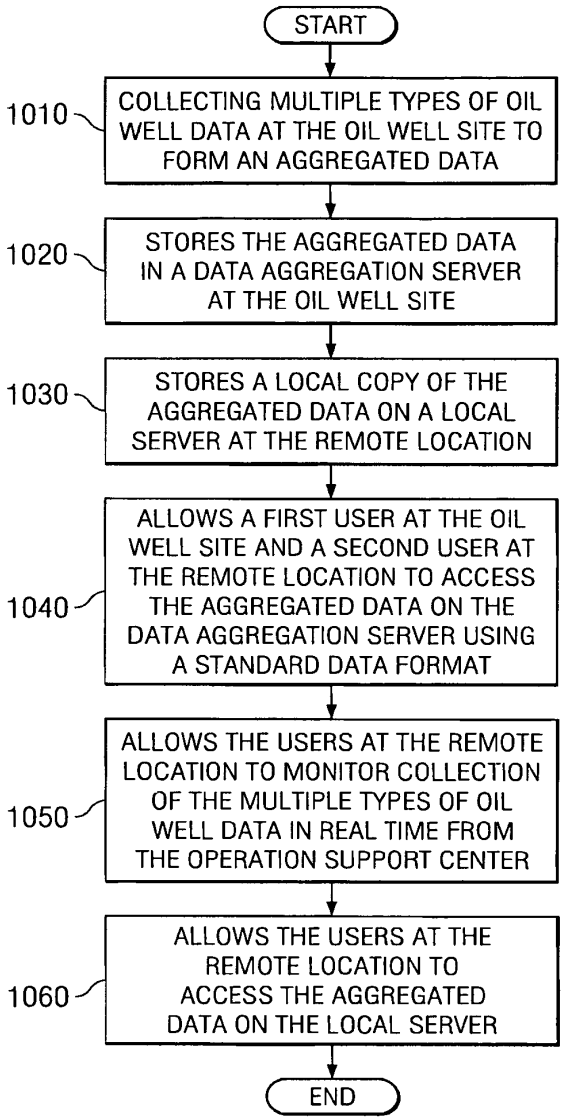

START
1010
COLLECTING MULTIPLE TYPES OF OIL WELL DATA AT THE OIL WELL SITE TO FORM AN AGGREGATED DATA
1020
STORES THE AGGREGATED DATA IN A DATA AGGREGATION SERVER AT THE OIL WELL SITE
1030
STORES A LOCAL COPY OF THE AGGREGATED DATA ON A LOCAL SERVER AT THE REMOTE LOCATION
1040
ALLOWS A FIRST USER AT THE OIL WELL SITE AND A SECOND USER AT THE REMOTE LOCATION TO ACCESS THE AGGREGATED DATA ON THE DATA AGGREGATION SERVER USING A STANDARD DATA FORMAT
1050
ALLOWS THE USERS AT THE REMOTE LOCATION TO MONITOR COLLECTION OF THE MULTIPLE TYPES OF OIL WELL DATA IN REAL TIME FROM THE OPERATION SUPPORT CENTER
1060
ALLOWS THE USERS AT THE REMOTE LOCATION TO ACCESS THE AGGREGATED DATA ON THE LOCAL SERVER
END

*FIG. 10*

# INTERNATIONAL SEARCH REPORT

International application No
PCT/US2008/002432

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B47/12

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 2005/092523 A1 (MCCASKILL JOHN W [US] ET AL) 5 May 2005 (2005-05-05) paragraphs [0044] - [0047]; figure 6 | 1-27 |
| X | WO 02/25319 A (WEATHERFORD LAMB [US]; HARDING RICHARD PATRICK [GB]; LONGBOTTOM JAMES) 28 March 2002 (2002-03-28) page 5, line 20 - page 8, line 2; figures 1,6 | 1-27 |
| X | WO 2004/104373 A (SILVERS DAVID [US]; SILVERSMITH INC [US]) 2 December 2004 (2004-12-02) claim 1; figure 1 | 1-27 |
| A | US 2006/047527 A1 (CAVENY WILLIAM J [US] ET AL) 2 March 2006 (2006-03-02) paragraph [0026]; figure 2 | 1-27 |

-/--

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

[X] See patent family annex.

* Special categories of cited documents :

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

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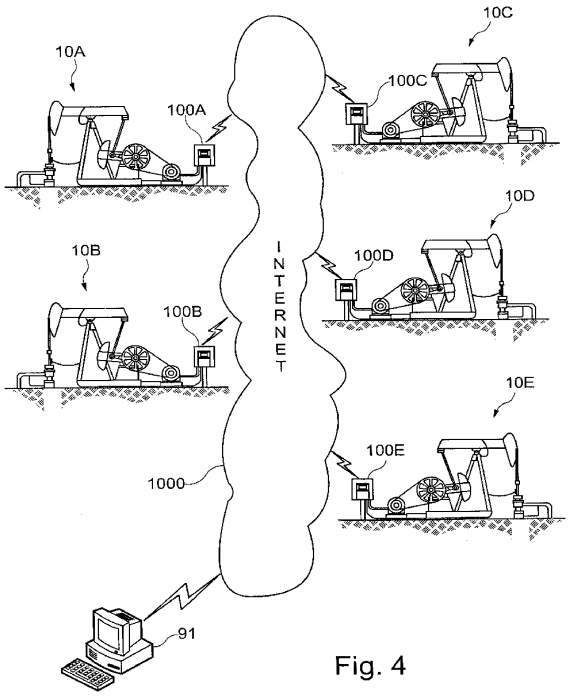



Fig. 4

(57) Abstract: An apparatus and method for well control and monitoring including an independent web server computer integrated with a pump controller located at each well in an oil field. The well controller locally controls the well pump, processes well and pump data, generates surface and downhole cards, and communicates production reports, recommendations for production improvements, and production statistics to remote sites via the internet. The controller can be queried remotely to provide production reports, etc. Furthermore, the controller can initiate alerts via email, text messaging, or internet messaging, for example, during fault conditions.

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# REAL-TIME ONSITE INTERNET COMMUNICATION WITH WELL MANAGER FOR CONSTANT WELL OPTIMIZATION

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates generally to methods and apparatus for remotely monitoring, controlling, and automating the operation of pumps for the production of hydrocarbons and dewatering, for example, and more specifically to a controller for rod pumps, progressing cavity pumps, injection well control, variable speed drives, well gas measurement, et cetera, for continuous optimization thereof.

### 2. Description of the Prior Art

Hydrocarbons are often produced from well bores by sucker rod pumps, reciprocating pumps driven from the surface by pumping units that move a polished rod up and down through a packing gland at a wellhead. The units may be of the predominant beam type or any other type that reciprocates the polished rod.

Because the incremental cost of larger sucker rod pumps is usually less than the added value realized by producing oil from the wells at the highest possible rate, sucker rod pumping units are typically sized to pump faster than the wells can produce. Consequently, sucker rod pumps periodically run out of liquids to pump and draw gas into the cylinders through the standing valves. The term "pumped-off" is used to describe the condition where the fluid level in the well is not sufficient to completely fill the pump barrel on the upstroke. On the next down stroke the plunger will impact the fluid surface in the incompletely filled barrel and send shock waves through the rod string and other components of the pumping system. This "fluid pound"

lowers well production efficiency and over time can cause damage to the drive unit or downhole pump, such as broken rods.

To minimize running pumped-off, sucker rod pumps are generally operated with some type of controller. Early controllers consist of simple controllers, such as clock timers that start and stop the pumping unit in response to a user selectable program, allowing the well to fill during the times when the pump is switched off. However, simple clock timers are not responsive to actual well conditions and do not detect actual pump-off conditions.

Thus, in the early 1970s, a viable well control method evolved using more sophisticated controllers that stop the rod pump when a well actually pumps-off. This method is known as pump off control (POC). Over the years, POC has employed different algorithms to sense pump-off conditions. Some of these involve measurement of changes in surface load, motor current, or motor speed.

In addition to running a rod pump in a pumped-off state, other abnormal conditions of the pump operation reduce well production efficiency. Common abnormal conditions include tubing movement, gas interference, an inoperative pump, the pump hitting up or down, a bent barrel, a sticking pump, a worn plunger or traveling valve, a worn standing valve, a worn or split barrel, fluid friction, and drag friction. As many of these problems gradually appear and progressively worsen, early detection of these problems can often minimize the cost of maintenance, minimize the cost of inefficient operation, and prevent or minimize the loss of production.

Traditionally, troubleshooting and repair of pump problems requires lifting the entire down-hole unit to the surface. It is not unusual to have a mile or more of sucker rods or tubing that must be lifted and disassembled by a single or pair of twenty-five or thirty foot long sections

at a time. This method of pump diagnosis and troubleshooting is costly both in terms of labor costs and lost revenue from the well.

Fortunately, many pump health indications and abnormal operating conditions can be detected by accurate monitoring of the pump operation, reducing the need for physical inspection of the downhole pump components and lowering the cost of well troubleshooting. Thus, from its humble beginning of merely stopping the well to prevent the mechanical damage of fluid pound and the inefficiency associated with operating an incompletely filled pump, POC has evolved in the last quarter century into a diagnostic system with robust well management capabilities. Gradually the phrase "pump off control" has been replaced with terms like "well manager," "rod pump controller," et cetera. (Lufkin Automation uses the trademark SAM® Well manager to identify its rod pump control system.) These newer terms connote more than pump off control. The later systems generally include diagnostic capability and collection and analysis of performance data for operation of the well in an economic fashion.

Many of these intelligent well controllers monitor work performed, or something that relates to work performed, as a function of polished rod position. This information is used, for example, to determine if the well is in a pumped-off condition, if valves are leaking or stuck, or for troubleshooting a wide variety of other problems. This information is generally presented and analyzed in the form of a plot of polished rod load versus polished rod position as measured at the surface. For a normally operating pump, the shape of this plot, known as a "surface card" or "surface dynagraph," is generally an irregular elliptical shape. The area bounded by this curve, often referred to as the surface card area, is proportional to the work performed by the pump. Many pump-off controllers utilize a surface dynagraph plot to determine when the sucker rod pump is not filling to shutdown the pump for a time period. For example, U.S. Pat. No.

3,951,209, issued Apr. 20, 1976 to Gibbs, describes a controller that measures at the surface both the load on the rod string and the displacement of the rod string to determine a pump-off condition and is incorporated herein by reference.

However, because the surface card is not always an accurate representation of the load and displacement of the downhole rod string, particularly for deep wells, more accurate well control is achieved by using a "downhole card," i.e., a plot of load versus rod string displacement as measured at the downhole pump. The downhole card is immensely useful. Its shape reveals defective pumps, completely filled pumps, gassy or pounding wells, unanchored tubing, parted rods, etc. Furthermore, the downhole card can be used to sense tubing leaks. Quantitative computation of pump leakage from downhole cards is described in "Quantitative Determination of Rod-Pump Leakage with Dynamometer Techniques," Nolen, Gibbs, SPE Production Engineering, August 1990.

When first developed in 1936, the downhole pump card was directly measured by a dynamometer located at the subsurface pump. The measured data was retrieved by the costly process of pulling the rods and pump. Because even today these measurements are not easily directly obtained, requiring a costly telemetry system to relay the data to the surface, methods have been developed to calculate the downhole dynagraph from the more easily obtained surface card. One such method is described in U.S. patent 3,343,409 (Gibbs), which is incorporated herein by reference. Gibbs utilizes surface measurements of load and position of the rod string to construct a downhole pump card; to produce the downhole card, solutions to a wave equation to satisfy dynamometer time histories of surface rod load and position are calculated by the use of a computer.

In addition to identification of abnormal well conditions or pump malfunctions, the most advanced of today's well managers can also infer well production rates with considerable accuracy by using the subsurface pump as a flow meter and the downhole card to compute producing pressure, liquid and gas throughput, and oil shrinkage effects. In other words, production rates can be determined continuously without the use of traditional metering equipment or production tests. For example, a decline in production rate can corroborate a mechanical problem indicated by a downhole card; the downhole pump may be worn or a tubing leak may have developed. The decline may also be caused by a change in reservoir conditions in the drainage area of the well; the receptivity of an offset injection well may have diminished, which may have resulted in a producing pressure decline and a decrease in production rate. Conversely, an increase in productivity as calculated by a well manager may indicate that the well is responding to secondary recovery efforts; the well should be pumped more aggressively to obtain the increased production that is available. These sophisticated well managers are instrumental in many facets of oil production including economic operation of the oilfield as a business venture, compliance with governmental regulations, well troubleshooting, and estimation of reservoir reserves. A method of inferred production using a well manager is taught by Gibbs in co-pending U.S. Patent Application No. 10/940,273, which is incorporated herein by reference.

Of significant use is the ability of well managers to communicate with a central host computer for supervisory control and data acquisition (SCADA). For example, a well manager unit receives surface rod and load information (or equivalent measurements), measures a surface card, computes a downhole card, and locally displays a graphical representation of the surface card and/or the downhole card for the operators' ease and benefit. However, the benefit of the

well manager features is diminished when the operator must be present at the well site to see and analyze the well data. A well manager with SCADA capability, on the other hand, can automatically transfer well data to a distantly located control station. SCADA allows information about the subsurface pump, including well and pump performance data, inferred fluid production over time, and surface and downhole cards, to be both displayed locally for manual recording and automatically sent to a distant central location. Furthermore, the SCADA system may be configured to send alarms, allowing problems to be timely announced. Control signals may also be sent from the central control station to the well manager. SCADA capability reduces or eliminates the need for an individual to visit the well site to determine the status at the controller and results in several advantages, including reducing delays in notifying the operator of alert or alarm conditions, increasing the accuracy of the disseminated well manager data, lowering costs of managing oil fields, and minimizing the need for the operator to visit potentially hazardous well sites. Thus, most sophisticated well managers have a built-in SCADA capability to communicate data by radio, hardwire, or telephone. This telemetry capability makes it possible for one or more computers to retrieve data from a controller, obtain status of operations, issue control instructions, monitor for alarms, and develop reports.

Although current SCADA systems provide some remote connectivity between a remote site and a number of well managers in an oil field, they generally employ expensive proprietary hardware and short-range RF radios of low bandwidth. Typical SCADA systems are polling systems that can only interrogate each well a few times each day to retrieve dynamometer and other performance data. Therefore downhole pump cards can on average be reviewed at the central location via SCADA only a few times each day.

Therefore, it is desirable to provide higher data throughput and continuous connectivity to a well manager by exploiting current internet technology. Such technology integrated with today's sophisticated well controllers would allow more well data to be collected at a central location at a lower cost. Several patents address connecting an oilfield to the internet. For example, U.S. Patent No. 6,857,474 issued to Bramlett et al. on February 22, 2005 shows a rod pump well manager with the capability to display a graphical pump card at a remote output display via an internet link 131 and is incorporated herein by reference. However, Bramlett's teaching is limited to using the internet to remotely display graphical surface and downhole cards; Bramlett does not disclose sending well production reports, statistics, pump diagnostics, alarms, alerts or other data from the well manager to remote users via the internet or receiving control data at the well manager from remote users over the internet.

The method according to U.S. Patent No. 7,096,092 issued to Ramakrishnan et al. on August 22, 2006 is illustrated in Figure 1. Ramakrishnan shows a method of managing oil fields including installing oil field sensors (50) on oil wells (60, 61, 62) , connecting the sensors (50) to computer controllers (52) disposed at the wells (60, 61, 62) for data collection and data analysis, and connecting a number of local oil field controllers (52) to a central web server (54). Access to oil field data in real time is provided to a remote computer (56) via the internet (1000). Raw data, partially analyzed data, or fully analyzed data is available remotely. The local controllers (52) are programmed with parameters for analyzing the data and automatically determining the presence of anomalies. Upon detecting the occurrence of an anomaly, the local controllers (52) are programmed to notify, via the central web server (54), an operator by email, pager, telephone, et cetera. If no response to the notification is received within a programmed period of time, the local controllers (52) automatically take pre-programmed corrective action.

Ramakrishnan does not disclose that the controllers are adapted to control rod pumps or that the controllers calculate downhole and surface cards or infer production.

U.S. Patent No. 6,967,589 issued to Peters on November 22, 2005 and illustrated in Figure 2 shows a system for monitoring gas/oil wells with a local monitoring unit (58) located at each well (61, 62), a central field-located relay unit (64) in wireless short range RF communication with a number of monitoring units (58), and a host interface linked (66) with the relay unit (64) via the internet (1000). The monitoring units (58) collect data regarding the status of the gas/oil wells (61, 62) and wirelessly transmit that data to the relay unit (64). The relay unit (64), in turn, connects to a host interface (66) over the internet (1000) and transmits the data. That is, a central field-wide web-enabled relay unit (64) is used for numerous well monitoring units (58). Each monitoring unit (58) can transmit information on demand or after an alarm condition is sensed. The relay unit (64) can request information from a monitoring unit (58) or respond to a wake up transmission sent to it from either the host interface (66) or a monitoring unit (58). The host interface (66) receives data from the relay unit (58) for providing data to an operator. Peters does not disclose that the well monitors (58) are adapted to control rod pumps or that they calculate downhole and surface cards or infer production.

Also illustrated by Figure 2, U.S. Patent No. 6,898,149 issued to Hill et al. on May 24, 2005 shows a data communications system for use with an oil or gas well (60) including downhole well sensors (67) that communicate via a conventional wireless SCADA interface (68) to a local internet server (64) located in the oil field. In other words, a field-wide web server (64) is used for servicing numerous wells. The internet server (64) acts to transmit data logging at remote points for display. Hill does not disclose controllers adapted to control rod pumps or to calculate downhole and surface cards.

Referring to Figure 3, U.S. Patent No. 6,873,267 issued to Tubel et al. on March 29, 2005 shows a system for monitoring and controlling hydrocarbon production wells (63, 65) from a first remote location (70) including a surface control and data acquisition systems (72, 74) each with one or more sensors or downhole flow control devices (76, 78). The surface control and data acquisition systems (72, 74) are in satellite communication with a remote controller (80) disposed at a second remote location (82). The remote controller includes an internet web site server for providing access to end users at the first remote location (70) over the internet (1000). The internet server (80) is disposed at a remote location, not locally at each well (63, 65) or at the surface control and data acquisition systems (72, 74). Tubel does not disclose that the system is adapted to control rod pumps or to calculate downhole and surface cards.

Finally, U.S. Patent No. 6,498,988 issued to Robert et al. on December 24, 2002 shows a technique for centralized processing for design and analysis on a server computer of oilfield engineering data transmitted over the internet from client computers at distributed locations. The data is processed at the remote server computing device and the results are communicated over the internet to the client computing device. Although each remote client computer has internet connectivity, they do not function as internet servers, and the data is not processed locally.

3. **Identification of Features Provided by Some Embodiments of the Invention**

A primary object of the invention is to provide a well manager for controlling a rod pump with constant and direct internet connectivity and the capability to act as a web server so that the well manager can host a remote user directly via the internet at any time from anywhere in the world to provide the remote operator unlimited access to critical operating data.

Another object of the invention is to provide a well manager that processes well data at the well site and requires little or no post-processing of collected data.

Another object of the invention is to eliminate the need for specialized and proprietary SCADA protocols and hardware connection methods such as direct serial communication, or other polling-style communication methods to provide data to a distant central location.

Another object of the invention is to provide a well manager unit that requires only standard commercial off-the-shelf computer technology.

Another object of the invention is to provide a well manager having a computer with standard network, administration and security features that require no specialized knowledge or training beyond that generally possessed by corporate information technology (IT) personnel to allow the well manager to be easily integrated into existing corporate IT systems.

Another object of the invention is to provide a well manager that runs totally independently of all other managing systems.

Another object of the invention is to provide a well manager that locally generates on-the-fly data processing and reports and displays them on an output display at the well or remotely via the internet.

Another object of the invention is to provide a well manager that communicates with a remote user using standard email alerts, SMS text messages, or other common internet messaging vehicles to provide the remote user with real-time alerts and reports generated directly by the well manager unit, thus eliminating the need for constant well monitoring by personnel and expensive hardware systems.

Another object of the invention is to provide a well manager where all data and settings are accessible via a web interface to reduce support costs by eliminating the requirement for physical presence to troubleshoot or reconfigure the well manager.

Another object of the invention is to provide a well manager that retrieves, stores, organizes, and processes data onsite in real time, providing reports compatible with off-the-shelf software products such as Excel,® Word,® Access,® et cetera.

Another object of the invention is to provide a well manager that runs proprietary software, such as SROD and DIAG, on specific data to determine opportunities for operating improvements and increased efficiencies.

Another object of the invention is to provide a well manager with backwards-compatible SCADA interoperatively.

## SUMMARY OF THE INVENTION

The objects identified above, as well as other features of the invention are incorporated in an apparatus and system for control of rod pumped wells including a well manager pump controller that has a computer system with data acquisition and control circuitry for collecting data from and controlling the rod pump. Preferably, the well manager calculates downhole or surface pump cards for pump off control. The computer system provides on-site well data processing and generates a full suite of well and reservoir operational management reports in user-friendly formats from the collected rod pump data to provide analysis, diagnostics and recommendations for optimizing well performance. The computer system also includes a high capacity web server for selectively and securely allowing a remote computer client to access the well manager over the internet to query well data, download processed reports, control the well, and configure the well manager. The well manager can also push reports, alerts, and alarms to a remote operator via email, text messaging or internet instant messaging, for example, during rod pump fault conditions.

In an oil field of multiple wells, each rod pump has an individual and dedicated well manager with an integral web server that is independent of all others. This system eliminates the need for traditional SCADA systems.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail hereinafter on the basis of the embodiments represented in the accompanying figures, in which:

Figure 1 is a schematic diagram illustrating an arrangement of prior art wherein well sensors are coupled to circuitry disposed locally at the well, with well circuitry for a number of wells in an oil field coupled to a central internet server;

Figure 2 is a schematic diagram illustrating an arrangement of prior art wherein well sensors are coupled to circuitry locally disposed at the well which transfer data in via wireless RF or SCADA links to a central internet server that serves a multi-well oil field;

Figure 3 is a schematic diagram illustrating an arrangement of prior art wherein downhole well sensors communicate with surface control systems, which in turn transmit data via satellite to a remote internet server;

Figure 4 is a schematic diagram according to a preferred embodiment of the invention illustrating a plurality of rod pumps each with a well manager having an integral web server therein that communicates with a remote client via the internet;

Figure 5 is a schematic diagram according to a preferred embodiment of the invention illustrating a local well manager adapted for controlling a rod pump and disposed in the vicinity of the well, including an internet server incorporated therein;

Figure 6 is a perspective view of a well controller according to an embodiment of the invention showing a computer display screen and input keypad housed in a weathertight enclosure;

Figure 7 is a functional schematic diagram of the computer architecture of the well manager according to an embodiment of the invention;

Figure 8 is a functional schematic diagram of the software of the well manager according to an embodiment of the invention; and

Figure 9 is a flow chart diagram depicting typical communication between the well manager of Figures 5-8 and a remote client computer.

## DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Figure 4 illustrates a number of rod pumps according to a preferred embodiment of the invention. Rod pumps 10A, 10B, 10C, 10D and 10E are each equipped with a well manager 100A, 100B, 100C, 100D, 100E, respectively. Each well manager 100A, 100B, 100C, 100D, 100E is independent of the others. Well managers 100A, 100B, 100C, 100D, 100E preferably provide pump off control and control the speed of operation of rod pumps 10A, 10B, 10C, 10D, 10E, respectively, to match production rate with well fill rate.

Unlike the prior art arrangements of Figures 1-3, each well manager 100A, 100B, 100C, 100D, 100E includes an integrated web server that intelligently handles request from a remote client for well data formatted in Hypertext markup language (HTML) or other user-friendly report formats.

Figures 5-7 illustrate a preferred embodiment of the invention. Figure 5 shows a typical rod pumping system, generally indicated by reference number 10, including a prime mover 12, typically an electric motor. The power output from the prime mover 12 is transmitted by a belt 14 to a gear box 16. The gear box 16 reduces the rotational speed generated by prime mover 12 and imparts a rotary motion to a pumping unit counterbalance, a counterweight 18 and a crank arm 20 that are journaled to a crank shaft end 22 of gear box 16. The rotary motion of crank arm

20 is converted to reciprocating motion by means of a walking beam 24. Crank arm 20 is connected to walking beam 24 by means of a Pitman 26. A walking horsehead 28 and a cable 30 hang a polished rod 32 which extends through a stuffing box 34.

A rod string 36 of sucker rods hangs from polished rod 32 within a tubing 38 located in a casing 40. Tubing 38 can be held stationary to casing 40 by anchor 37. The rod string 36 is connected to a plunger 42 of a subsurface pump 44. Pump 44 includes a traveling valve 46, a standing valve 48 and a pump barrel 50. In a reciprocation cycle of the structure, including the walking beam 24, polished rod 32, rod string 36 and pump plunger 42, fluids are lifted on the upstroke. When pump fillage occurs on the upstroke between the traveling valve 46 and the standing valve 48, the fluid is trapped above the standing valve 48. A portion of this fluid is displaced above the traveling valve 46 when the traveling valve moves down. Then, this fluid is lifted toward the surface on the upstroke.

The prime mover 12 of pumping system 10 is operatively controlled by a locally-disposed well manager 100. Well manager 100 may employ any of a number of pump control methodologies, including control of the prime mover 12 based on surface cards, downhole cards, or motor power. U.S. Patent No. 3,951,209 issued to Gibbs, which describes pump control by surface cards, and U.S. Patent No. 5,252,031 issued to Gibbs, which describes pump control by downhole cards, are incorporated herein by reference.

Well manager 100 includes a computer system 102 (Figure 7). Computer system 102 collects data from and sends control signals to rod pump 10. Computer system 102 also provides on-site well data processing, generating a full suite of well and reservoir operational management reports from the collected rod pump data. Furthermore, computer system 102 functions as a high-capacity web server that hosts a server software application for selectively and securely

allowing a remote client computer 91 access to the server over the internet 1000 for transfer of well data and reports. The computer system 102 preferably has the memory capacity and functional capabilities of at least a powerful desktop computer to support a large number of input and control channels, handle data-intensive mathematical computations, and maintain high-throughput internet communications.

Referring to Figure 6, well manager 100 is ideally equipped with a local display monitor 120 and input keyboard, keypad, and/or input pointing device 122 that are operatively coupled to the computer system 102 for interfacing with a local operator. Well manager 100 is typically incorporated into a single chassis of electronics housed in a weathertight enclosure 101. Well manager may also include a wireless local interface to improve the field operator's efficiency. For example, Bluetooth communication

Figure 7 is a block diagram that illustrates the architecture of a preferred embodiment of the computer system 102, although other architectures may be used as appropriate. Computer system 102 includes a central processing unit (CPU) 104 that is coupled to various buses by a northbridge 150 and a southbridge 152 chipset. CPU 104 is operatively coupled to volatile memory 106 by a high speed memory bus 107 and to a video display 120 by a graphics bus 121 such as an Accelerated Graphics Port (AGP) or a Peripheral Component Interconnect (PCI) Express bus. The memory bus 107 and the graphics bus 121 are directly coupled to the northbridge 150. In other words, they are located on the high-speed front side bus (FSB).

CPU 104 is operatively coupled to a number of other devices or buses on the slower back side bus (BSB), i.e., through the southbridge 152. For instance, keypad 122, non-volatile memory 108, and a network interface 105 are directly tied to southbridge 152. Network interface 105 is preferably an industry standard Transmission Control Protocol over Internet

Protocol (TCP/IP)-capable interface that is accessible by hardwire or wireless network communication methods. An optional Universal Serial Bus (USB) 154 connects USB ports 156 to southbridge 152, and an optional hard disk drive or compact disc (CD) 158 is tied to the BSB by an Integrated Drive Electronics (IDE) (also known as Advanced Technology Attachment (ATA)) bus 160. Input and output data acquisition and control circuits 110, 112 are preferably coupled to southbridge 152 by a PCI bus 162. Although not illustrated, computer system 102 includes a power supply with power conditioning circuitry that typically receives line power and supplies low voltage direct current power to the other components of computer system 102.

CPU 104 is preferably a microprocessor or microcontroller, although special-purpose electronic logic circuits may be used. As is well known in the computer field, processor 104 executes software code instructions retrieved from a memory device 106, 108, 158 to interact with a user, control the reception of input data, and access, manipulate, store, transfer and display data on output devices. CPU word size may range from 8 to 64 bits, but computer system 102 is preferably capable of processing words of sufficient size at a sufficient speed so as to accurately and concurrently control the rod pump 10 (Figure 5), process well data, and perform web server services all in real time.

Memory 106, 108, 158 is used for storing input data, processed data, and software in the form of instructions for the processor. Computer system 102 ideally includes both volatile memory 106 such as random access memory (RAM), which due to its high speed and ease of programming is primarily used to store input data and frequently changing digital control logic software, and non-volatile memory 108 such as battery-backed-up complimentary metal oxide semiconductor (CMOS) memory or electronically erasable programmable read-only memory (EEPROM), which retain memory without power from the computer power supply. CMOS

memory and EEPROMs are preferable to store data or software code that is expected to be infrequently changed. Computer system 102 may also include non-volatile read-only memory (ROM). ROM chips, which cannot be reprogrammed, are preferred to store low-level interface software programs, often referred to as firmware, that contain specific instructions to allow higher-level digital control logic software to access and control a specific piece of equipment. For example, a basic input/output system (BIOS) chip 115 used to provide low-level boot instructions to CPU 104 is occasionally provided on a ROM chip. Other memory devices, such as magnetic or optical mass storage devices 158 are optionally included in computer system 102 to store software code and data. Network memory devices, accessed via network interface 105, may also be used. Software code and data originating from non-volatile memory 108, hard disk drive or CD 158, or via network interface 105 are usually transferred to RAM 106 for faster operation of computer system 102. As computer systems are well known in the art, they are not discussed further herein.

During control of rod pump 10 by well manager 100 (Figure 5), CPU 104 continuously scans the status of all input devices connected to input data acquisition circuitry 110, correlates the received input with control logic in memory 106, and produces the appropriate output responses needed to control pump 10 via the output control circuitry 112. As shown in Figures 5 and 7, typical inputs include a load cell 93 on the polished rod 32 and an inclinometer 94 on the walking beam 24, although other inputs may be used. The input circuitry 110 preferably includes one or more analog-to-digital converters (ADC) 111 to provide capability for monitoring analog electronic signals and a number of digital logic input gates 109 for receiving digital signals, thus allowing input from almost any sensor, monitor, gauge, or transducer. Sensor input to well manager 100 may be in either discrete or continuous form, or a combination

of both. Discrete inputs may come from push buttons, micro switches, limit switches, photocells, proximity switches, shaft encoders, optional scales, or pressure switches, for instance. Continuous inputs may come from sources such as strain gauges, resolvers, thermocouples, transducers, resistance bridges, potentiometers, or voltmeters.

Well manager 100 examines the status of a set of inputs and, based on this status and instructions coded in digital control logic software 200, actuates or regulates a set of outputs for actuating hardware such as solenoids and variable speed motor drive circuitry. The output control circuitry 112 preferably includes one or more digital-to-analog converters (DAC) 113 for generating analog output signals and a number of digital logic output gates 114 for outputting digital signals so that well manager 100 can be connected to almost any analog or digital device in the field for control purposes. An output control line 92 for providing a control signal to regulate the speed of variable speed motor 12 is shown in Figures 5 and 7.

Well manager 100 may provide open-loop control, closed-loop control, or a combination of both. In open-loop control, well manager 100 issues commands to the rod pump components but has no means of assessing the results of these commands; no provision is made for feedback of information concerning movement of a controlled element, for example. In closed-loop control, also referred to as feedback control, well manager 100 outputs a command signal to a rod pump element and then compares the expected result of the command signal to the actual measured movement or location of the driven component. The difference constitutes an error signal, which is fed back to well manager 100 to adjust the command signal until no error exists. Closed loop control is generally required for use of a servomotor. The feedback devices normally used for measuring movement or location of the component are called resolvers, encoders, Inductosyn® transducers, or optical scales, and any of these, other suitable devices, or a

combination thereof are used with well manager 100 as appropriate. As control systems in general, and computer-aided data acquisition and control in particular, are well known in the art, specific details are not addressed herein.

Well manager 100 includes computer software 200 as an integral part of the system. Figure 5 illustrates the well manager 100. Figure 7 is a functional block diagram of a preferred embodiment of computer system 102, and Figure 8 is a functional block diagram of a preferred embodiment of software 200. Referring to Figures 5, 7 and 8 collectively, the software code 200 resides in RAM 106, non-volatile memory 108, hard disk drive, CD, or other mass storage medium 158. Additionally, the software 200 may be stored at a separate computer and accessed over the internet 1000 via network interface 105. Computer software 200 serves several purposes, including retrieving well data from the input circuitry, transforming and displaying data on computer monitors, generating reports, issuing control instructions for the rod pump, and transmitting data to a remote user over the internet. Computer software 200 includes an operating system (OS) 210, a well manager application 220, a web server application 230, an optional web browser application 240, and an optional network firewall application 250.

Operating system 210 controls computer resources, peripherals, and the execution of software applications for computer system 102. Operating system 210 is preferably an industry-standard OS such as a Linux,® Unix,® Windows,® or Macintosh® Operating System. As OS technology is commonplace and well understood in the art, operating system 210 is not discussed further herein.

Software 200 running on computer system 102 generates a local user interface 180, 180' that is displayed on monitor 120 (Figure 6) at the well site. In a preferred embodiment, local user interface 180 is a graphical user interface (GUI) constructed of standard windows-type

display and control mechanisms including windows, client windows, frames, icons, buttons, check boxes, radio buttons, scroll bars, drop-down menus, pull-down menus, folder tabs, bar graphs, panes, panels, forms, slide bars, selection boxes, dialog boxes, text boxes, list boxes, menu bars, bar graphs, wizards, et cetera. The graphical user interface is preferably constructed using an object-oriented programming language such as C++ for a Microsoft® Windows,® Linux® or Unix® OS. The graphical user interface 180 may be generated by a standard web browser application 240 such as Internet Explorer® or Netscape® running on computer system 102 that displays as a web page HyperText mark-up language (HTML) code generated concurrently by well manager application 220 and web server application 230, or alternatively, the graphical user interface 180' may be generated directly by well manager application 220 (using OS 210 resources as appropriate). In another embodiment (not illustrated), the local user interface may consist entirely of a legacy-style character and graphics display with keypad control rather than a windows-style interface. In this case, local user interface is without the use of browser application 240. As user interface and object-oriented programming are well known in the field, the details of constructing the user interfaces are not discussed further herein.

Well manager software application 220 is preferably a suite of custom software programs and files that control rod pump 10 (Figure 5), generate a local user display 180, 180', analyze well data, provide user reports over the internet to remote users, send alarms and alerts to remote users, and accept control commands over the internet from remote users for control of the rod pump. Well manager software application 220 preferably includes a well control module 221, a family of hyperlinked HTML form files 223 disposed in a web page directory accessed by web server application 230, and a series of Common Gateway Interface (CGI) shell scripts or compiled programs 227, disposed in a cgi-bin directory, that are selectively executed in order to

transform the otherwise static HTML form files 223 into a dynamic user interface when displayed in a web browser.

Well control module 221 is a custom software program that preferably provides pump-off control and production optimization capabilities such as lift optimization, automatic well testing, compressor monitoring-control, trend analysis, and pump system analysis. In rod-pumping applications, for example, proprietary optimization software, such as SROD and DIAG, is executed following each stroke of the pumping unit to determine optimum pumping speed, whether the unit should be turned off or remain running, the amount of production through the pump, the pump intake pressure, mechanical efficiencies, and opportunities for operating improvements and increased efficiencies. For example, a well manager application is described in U.S. Patent Application No. 10/940,273 filed on January 5, 2005 by Gibbs et al., entitled "Inferred Production Rates of a Rod Pumped Well from Surface and Pump Card Information," which is incorporated herein by reference.

Well manager 100 collects tremendous amounts of rod pump data at input circuitry 110 for analysis by well manager software application 220. Well manager application 220 retrieves, stores, organizes, and processes data onsite in real time, providing reports compatible with off-the-shelf software products such as Excel,® Word,® Access,® etc. Well manager application 220 generates and makes available locally a myriad of reports from the collected data, allowing a user to query and format well data and graphically display trends with tremendous flexibility. An optional relational database application 225, such as MySQL,® may be integrated with well manager application 220 in order to simplify the handling of the large amount of collected well data. As relational databases are well known in the art, database 225 is not discussed further herein.

Software 200 includes a web sever application 230 that enables users at remote computer 91 (Figure 5) to access well manager 100 to upload control instructions and download well data and reports. Apache is a popular open source HyperText transport protocol (HTTP) web server application that is used with Linux, Windows and other operating systems. Utilizing standard ethernet and TCP/IP networking protocols, well manager 100 is connected to the internet 1000 and assigned a static internet protocol (IP) address enabling direct inbound communication with the unit at the well site. This addressing schema eliminates the need for specialized and proprietary SCADA protocols and hardware connection methods such as direct serial communication, analog radio communication, or other polling-style communication methods. With communications managed by web server application 230, well manager 100 is accessible via the static IP address from anywhere in the world having internet access. As web server applications are commonplace and well known in the art, web server application 230 is not discussed further herein.

Well manager 100 may include a network firewall to protect it from unauthorized intrusion and computer hacking efforts. The firewall may be a firewall software application 250 executed by computer system 102, or it may be a discrete and independent hardware firewall 190 operatively coupled between network interface 105 of computer system 102 and the internet 1000. Regardless of the type of firewall installed, the firewall is preferably commercial off-the-shelf and provides controlled access to well manager 100 using multiple recognized network security methods such as user and password challenges, VPN access, filtered IP address access, et cetera. In other words, well manager 100 is secured to eliminate unauthorized access the same way that an ordinary computer is protected using existing or future common network security

products. As network firewalls are well known in the art, firewall 190, 250 is not discussed further herein.

Figure 9 is a flow chart diagram illustrating an example communication sequence between a remote user at computer 91 and well manager 100 according to one embodiment of the invention. Referring to Figures 8 and 9, web server application 230 and well manager application 220 cooperate to provide secure remote internet access to well manager 100. Web server 230 provides initial login access to a remote client computer 91. Once the remote client 91 is authenticated, an initial or default HTML file 224 is transmitted by web server 230 to the remote client computer. The initial HTML file 224 may include current well data and status provided by well manager application 220. In other words, the default HTML file 224 is not necessarily a static or unchanging file. The initial HTML file 224, displayed as a web page in a web browser application 241 running on remote client computer 91, forms a remote user interface 181. Web server 230 fields requests from remote users via one or more HTML web pages 223. Well manager 220 interprets each request using CGI scripts or programs 227 and selects, analyzes, sorts and codes well data in HTML format in response to the request. Web server 230 transmits the generated HTML code over the internet 1000 to remote computer 91 for display in a web browser application 241 running thereon. Thus, the remote user interface 181 display consists entirely of HTML code displayed in a browser software application running on the remote computer system 91. Additionally, due to the tremendous onboard processing power provided by computer 102, well manager 100 is capable of generating on-the-fly data processing and reports locally rather than relying on post processing of well data by a distant computer facility. These data reports, generated by well manager application in Word® or Excel® format for example, may be downloaded by remote computer 91 via web server 230 and internet 1000.

Remote computer 91 may be a personal computer, desktop computer, laptop computer, mini computer, or mainframe computer, for example, but remote computer 91 may also be a wireless personal digital assistant (PDA) such as a BlackBerry® or Palm® handheld device or cell phone that communicates with well manager 100 via a wireless internet or email connection.

Well manager 100 may additionally be programmed to "push" data to a remote user, rather than responding to a user request that "pulls" data. For instance, reports can automatically and routinely be generated and emailed to a remote user. Also, situations requiring critical decisions, alerts, and alarms may be immediately communicated in real-time to on-call operators via email, SMS text messaging, or any other standard type of internet messaging platform, eliminating the need for expensive hardware systems and constant monitoring by personnel at a SCADA control station. As internet application programming is well known in the art, details are not provided herein.

Management and access to well manager 100 for system administration is provided by the web interface built into well manager 100 and accessible via TCP/IP through a computer web browser. Well manager 100 is simply another computer node in a corporate network requiring few, if any, changes in security policies and protection methods. Administration of the network features and security of the well manager unit are thus easily managed by ordinary corporate information technology personnel as no additional protocol training or specialized knowledge is necessary to ensure successful network integration of well manager unit 100. All configuration, management and reports generated are ideally accessible directly from the web interface. Furthermore, well manager 100 is easily upgraded by uploading new software 200 or firmware 108 over the internet 1000.

As shown in Figure 4, well manager 100 runs totally independently of managing systems or other well controllers. With direct internet access available to well manager unit 100, the need for traditional management systems and specialized hardware or software systems is eliminated That is, SCADA systems using polling-style data collection are no longer necessary. However, well manager 100 is preferably backwards compatible to allow it to work with existing legacy SCADA devices until obsolete SCADA systems are completely phased out.

Although the invention is described herein with reference to control of rod pumps, the invention is not limited as such. Rather, the invention includes an entire spectrum of artificial lift controllers having integral internet web servers such as for controlling rod pumps, progressing cavity pumps, injection wells, ESP, variable speed drives, et cetera. Nor is the invention limited to the production of hydrocarbons; the invention includes controllers with integral internet web servers for producing water, for dewatering, for gas measurement, et cetera. Finally, the invention is not limited to a stand alone controller, but includes portable diagnostic equipment with integral internet web servers and controllers with integral internet web servers that are also combined with other systems, for example.

Although the embodiments of well manager 100 described herein employ HTML and TCP/IP formats, the invention is not limited to using these formats. New communication formats and protocols may be developed over time which may replace existing formats, and well manager 100 preferably employs technologies consistent with the internet standards in use at any given time.

In summary, by providing well manager 100 with real-time, constant onsite internet communication, remote operators have access to operating data at all times. All of the well data reporting functionality of well manager 100 that is available locally is exportable over the

internet to remote users. For example, reservoir engineers can monitor flood response on a minute-to-minute basis, lease operators can have periodic custom reports of the status of each well produced automatically, and technicians can determine the discharge pressure of a compressor station in a small remote field. Support costs and requirements are reduced, because no physical presence at the well is required for troubleshooting or reconfiguration of the well manager units by the operator; remote troubleshooting of the well, the pump 10, or the well manager 100 is possible over the internet 1000. The need for corrective actions can be identified sooner to minimize expensive repairs, losses in production, or pollution to the environment.

The Abstract of the disclosure is written solely for providing the United States Patent and Trademark Office and the public at large with a way by which to determine quickly from a cursory reading the nature and gist of the technical disclosure, and it represents solely a preferred embodiment and is not indicative of the nature of the invention as a whole.

While some embodiments of the invention have been illustrated in detail, the invention is not limited to the embodiments shown; modifications and adaptations of the above embodiment may occur to those skilled in the art. Such modifications and adaptations are in the spirit and scope of the invention as set forth herein:

**WHAT IS CLAIMED IS:**

1. An apparatus for controlling a rod pump (10), said rod pump characterized by having a rod (32) that is reciprocated by a prime mover (12), the apparatus comprising:

a pump controller (100) coupled to and disposed near said rod pump, said controller arranged and designed to control the speed of said prime mover, to receive and record measurements of a plurality of parameters of said rod pump, and to generate an operational report therefrom; and

a web server (102, 210, 230) integrated with said well controller and operatively connected to an internet (1000), said web server arranged and designed to handle a request from and transmit said operational report to a remote client computer (91) via said internet.

2. The apparatus of claim 1 wherein said controller comprises:

a computer system (102);

data acquisition input circuitry (110) operatively coupled said computer system and a sensor (93, 94) and arranged to measure a parameter of said rod pump;

a well manager software application (220) structured for execution by and residing on said computer system and designed and arranged to calculate a desired speed of said prime mover as a function of a measurement of said parameter; and

control output circuitry (112) operatively coupled between said computer system and said prime mover and arranged and designed to cause said prime mover to move at said desired speed.

3. The apparatus of claim 2 wherein said controller further comprises:

first and second sensors (93, 94) and arranged to measure a stroke position of said rod (32) and a load acting on said rod pump (10), respectively;

said well manager software application (220) arranged to generate a downhole pump card from measurements of said first and second sensors (93, 94) and to calculate a desired speed of said prime mover (12) as a function of said downhole pump card.

4. The apparatus of claim 2 wherein said web server comprises:

a web server software application (230) structured for execution by and residing on said computer system (102).

5. In a well produced by a pump (10) having a pump controller (100) operatively coupled to said pump for controlling the speed of said pump, the improvement comprising:

a web server (102, 210, 230) integrated with said pump controller (100), said web server coupled to an internet (1000) and arranged and designed to allow communications between said pump controller and a remote client computer (91) via said internet.

6. A method for controlling a pump (10)having a prime mover (12), the method comprising the steps of:

integrating a web server (102, 210, 230) with a controller (100) that is arranged and designed to control the speed of said prime mover;

disposing said controller (100) and said web server integrated therewith near said pump (10);

operatively coupling said web server to an internet (1000);

measuring a parameter of said pump by said controller;

calculating by said controller (100) a desired speed of said prime mover (12) as a function of a measurement of said parameter;

storing in said controller said measurement as data;

controlling the speed of said prime mover at said desired speed by said controller;

receiving a request for a report from a remote client (91) via said internet (1000) by said controller (100); and

transmitting said report by said controller to said remote client via said internet.

7. The method of claim 6 further comprising the step of:

generating said report by said controller from said data.

8. The method of claim 7 further comprising the steps of:

formatting said report by said controller in a hypertext markup language; and

displaying said report by said remote client as a web page (181).

9. The method of claim 6 further comprising the step of:

authenticating said remote client (91) by said controller (100).

10. The method of claim 6 wherein said pump (10) is a rod pump characterized by having a rod (32) that is reciprocated by said prime mover (12), the method further comprising the steps of:

measuring a load of said rod pump (10) and a position of said rod (32) by said controller (100);

generating a downhole pump card from load and position measurements by said controller;

storing in said controller said load and position measurements as said data; and

controlling the speed of said rod pump by said controller as a function of said downhole pump card.

11. The method of claim 6 further comprising the step of:

pushing a notification of a condition of said pump to a remote user (91) over said internet (1000) by said controller (100).

12. The method of claim 6 further comprising the step of:

configuring said controller (100) by a remote user (91) over said internet (1000).

13. A method for managing production of an oil reservoir produced by first and second wells having first and second pumps (10A, 10B), respectively, the method comprising the steps of:

disposing first and second pump controllers (100A, 100B) at said first and second pumps, respectively, said first controller operatively coupled to said first pump so as to control the speed thereof, and said second controller operatively coupled to said second pump so as to control the speed thereof;

integrating a first web server with said first controller (100A), said first web server arranged and designed for receiving a first request from a remote client (91) and transmitting a first response to said remote client via an internet (1000);

coupling said first web server to said internet;

integrating a second web server with said second controller (100B), said second web server arranged and designed for receiving a second request from said remote client (91) and transmitting a second response to said remote client via said internet (1000), said second controller independent of said first controller; and

coupling said second web server to said internet.

14. The method of claim 13 further comprising the steps of:

generating said first response by said first controller (100A) from data of said first pump (10A); and

generating said second response by said second controller (100B) from data of said second pump (10B).

15. The method of claim 14 further comprising the steps of:

formatting said first response by said first controller (100A) in a hypertext markup language;

displaying said first response by said remote client (91) as a first web page (181);

formatting said second response by said second controller (100B) in a hypertext markup language; and

displaying said second response by said remote client (91) as a second web page.

16. The method of claim 13 further comprising the steps of:

authenticating said remote client (91) by said first controller (100A); and

authenticating said remote client (91) by said second controller (100B).

17. The method of claim 14 wherein said first and second pumps (10A, 10B) are first and second rod pumps, respectively, the method further comprising the steps of:

measuring a first load of said first rod pump (10A) and a first position of a rod of said first rod pump by said first controller;

generating a first downhole pump card from first load and position measurements by said first controller (100A);

storing in said first controller said first load and position measurements as said first data;

controlling the speed of said first rod pump (10A) by said first controller (100A) as a function of said first downhole pump card;

measuring a second load of said second rod pump (10B) and a second position of a rod of said second rod pump by said second controller;

generating a second downhole pump card from second load and position measurements by said second controller (100B);

storing in said second controller said second load and position measurements as said second data; and

controlling the speed of said second rod pump (10B) by said second controller (100B) as a function of said second downhole pump card.

18. The method of claim 13 further comprising the steps of:

pushing a first notification of a first condition of said first pump (10A) to a remote user (91) over said internet (1000) by said first controller (100A); and

pushing a second notification of a second condition of said second pump (10B) to said remote user (91) over said internet (1000) by said second controller (100B).

19. The method of claim 13 further comprising the steps of:

configuring said first controller (100A) by a remote user (91) over said internet (1000); and

configuring said second controller (100B) by said remote user (91) over said internet (1000).

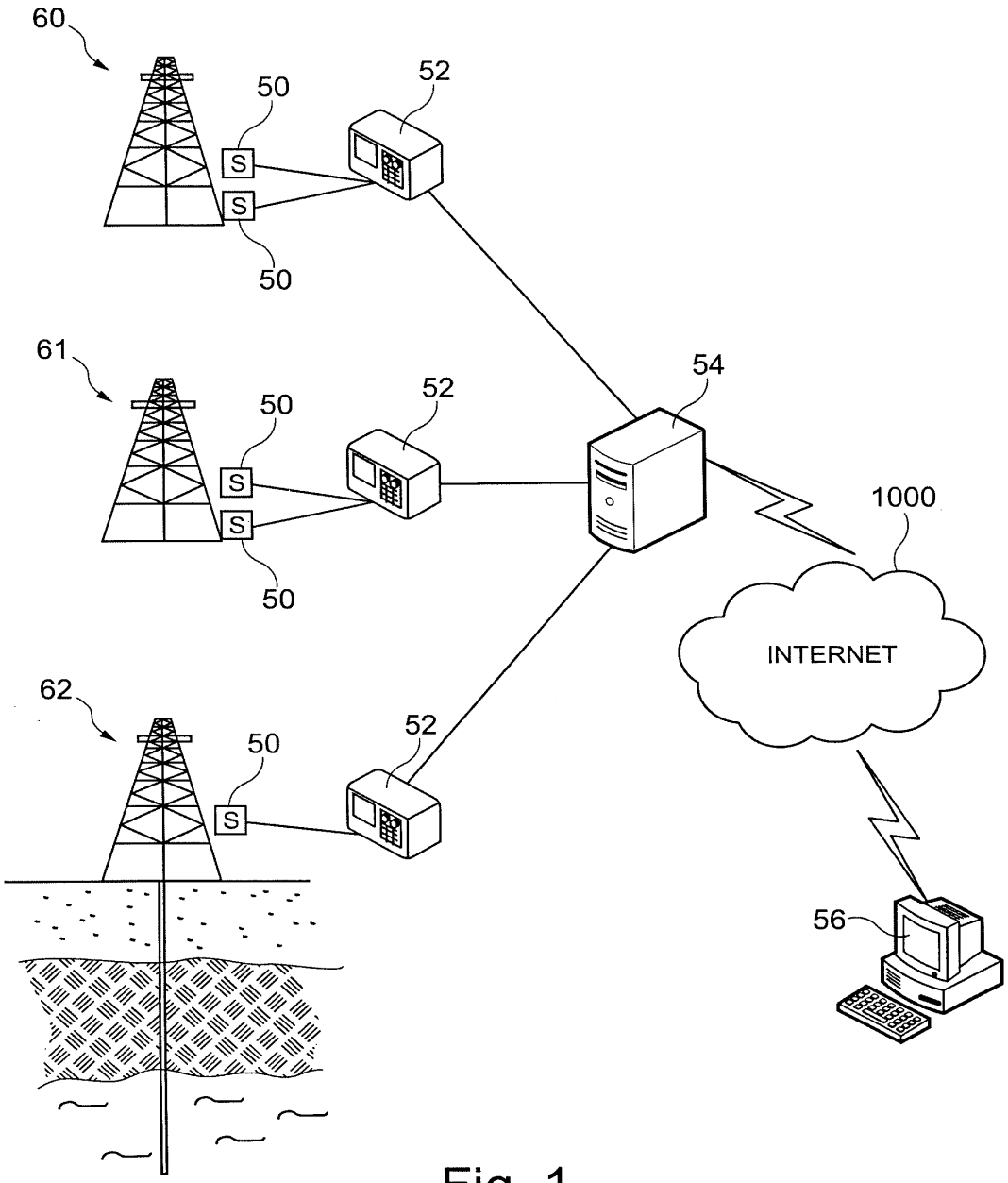



Fig. 1
(PRIOR ART)

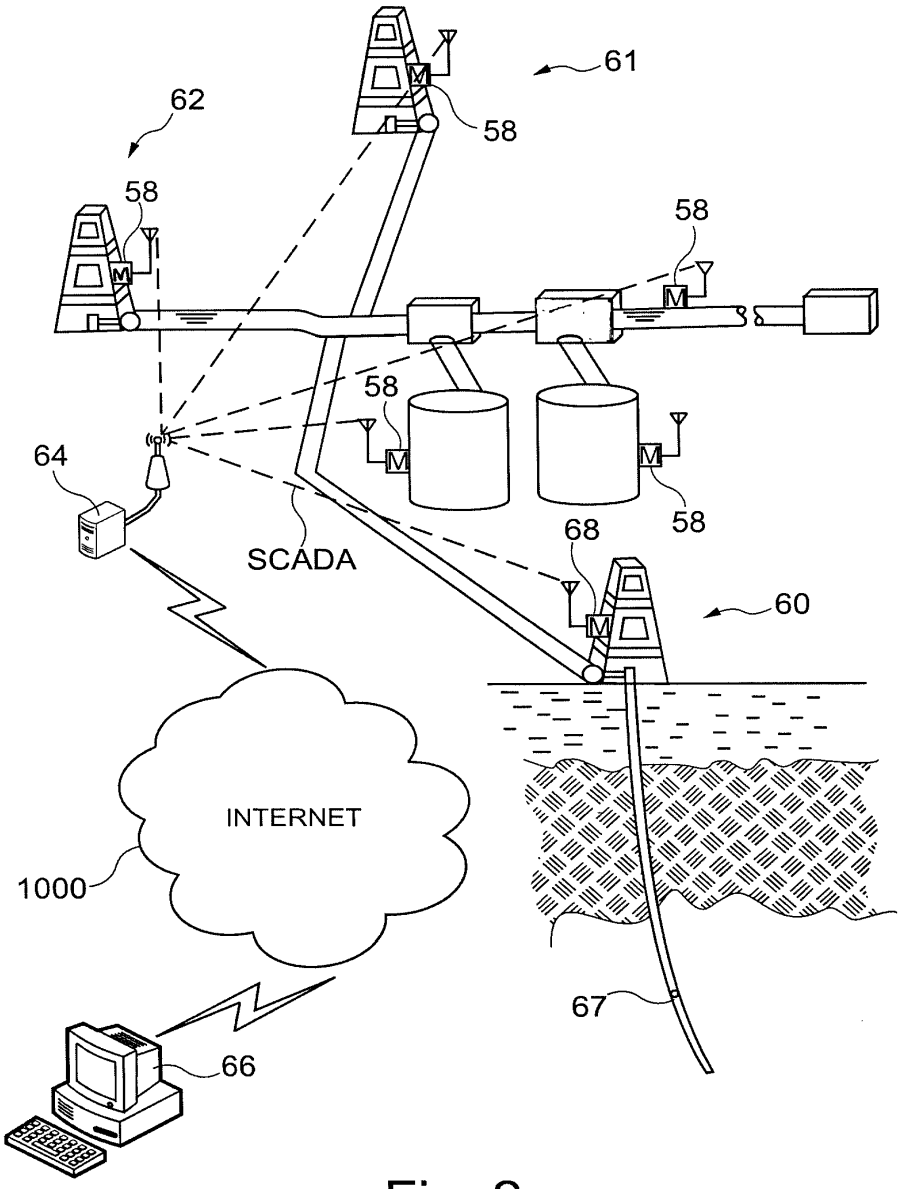



Fig. 2
(PRIOR ART)

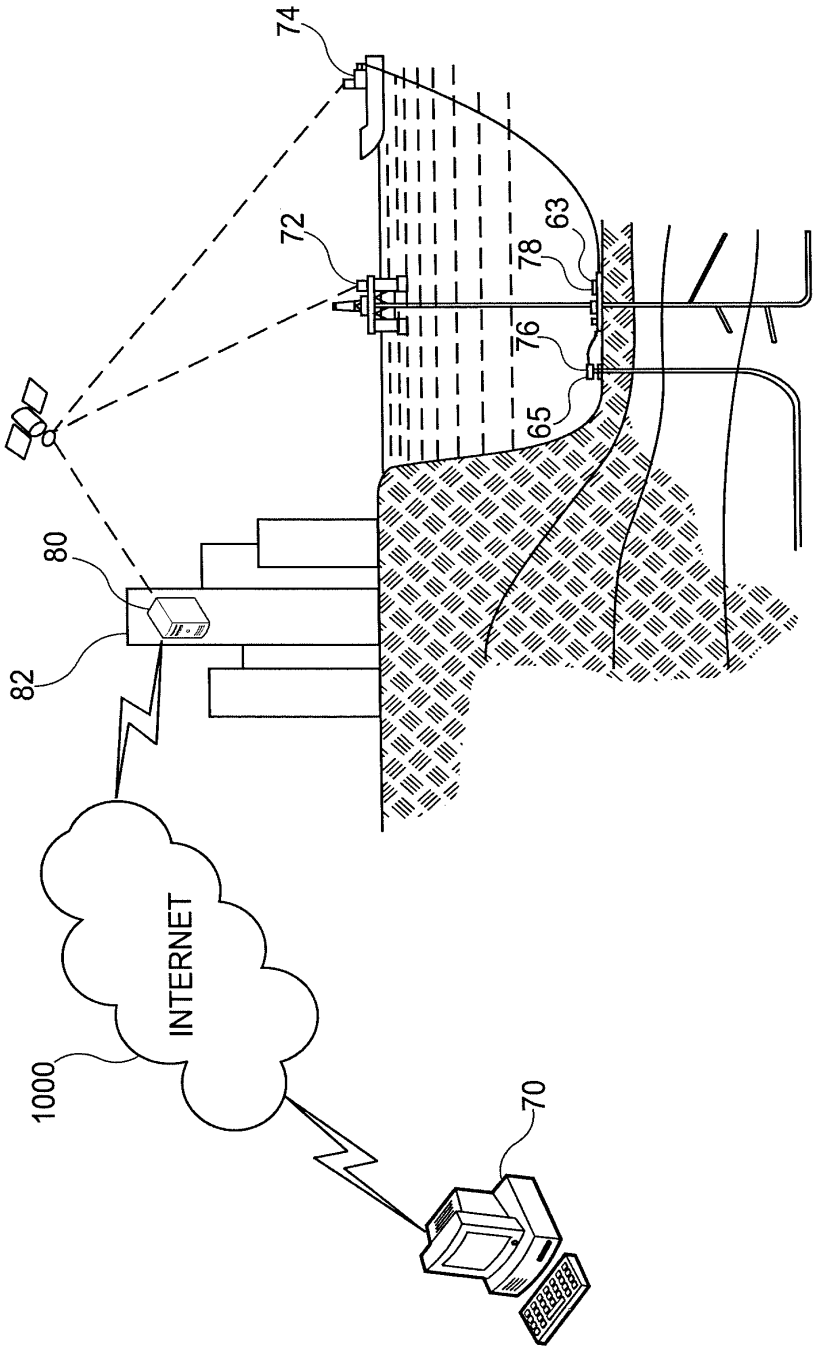



Fig. 3
(PRIOR ART)

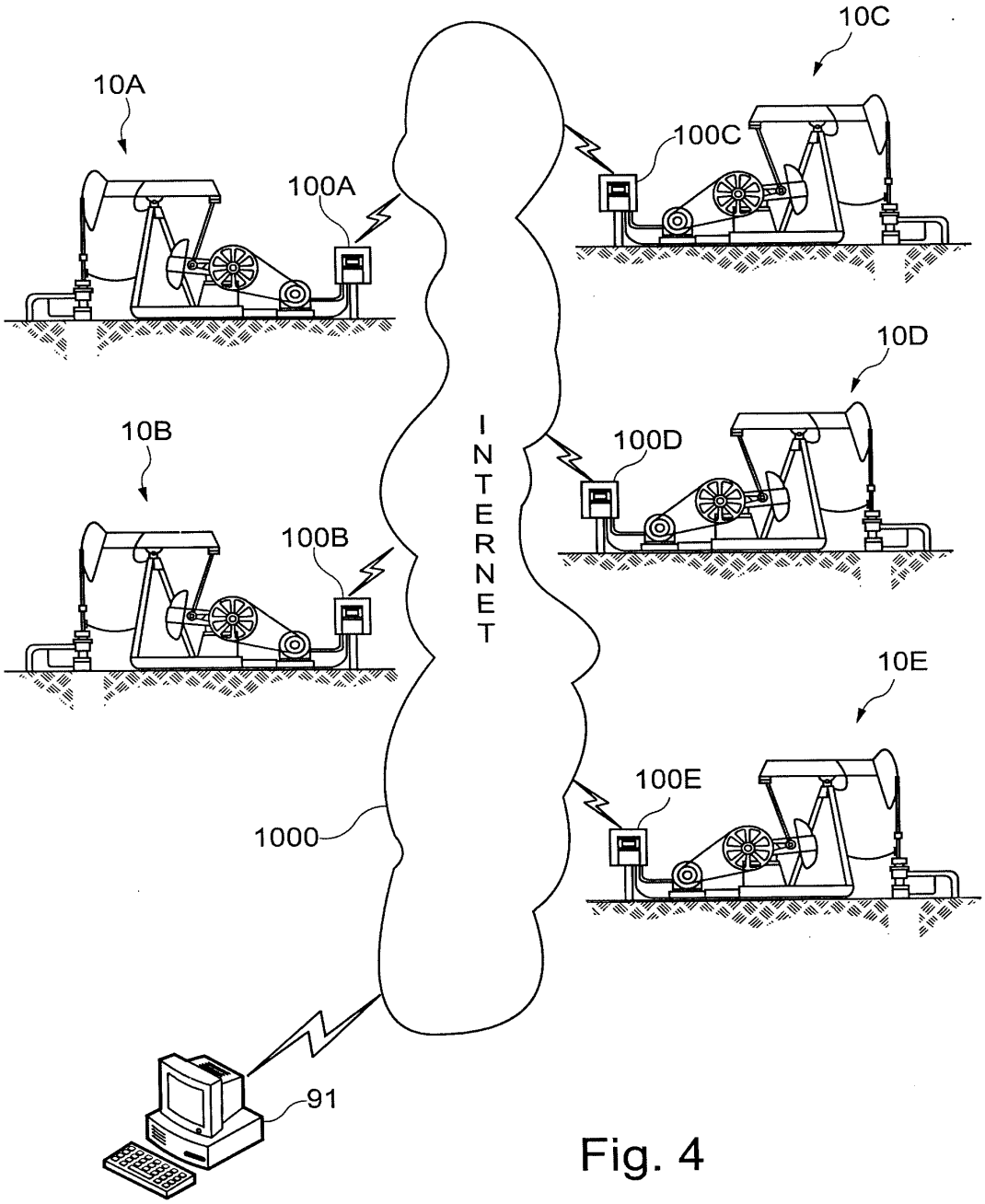



Fig. 4

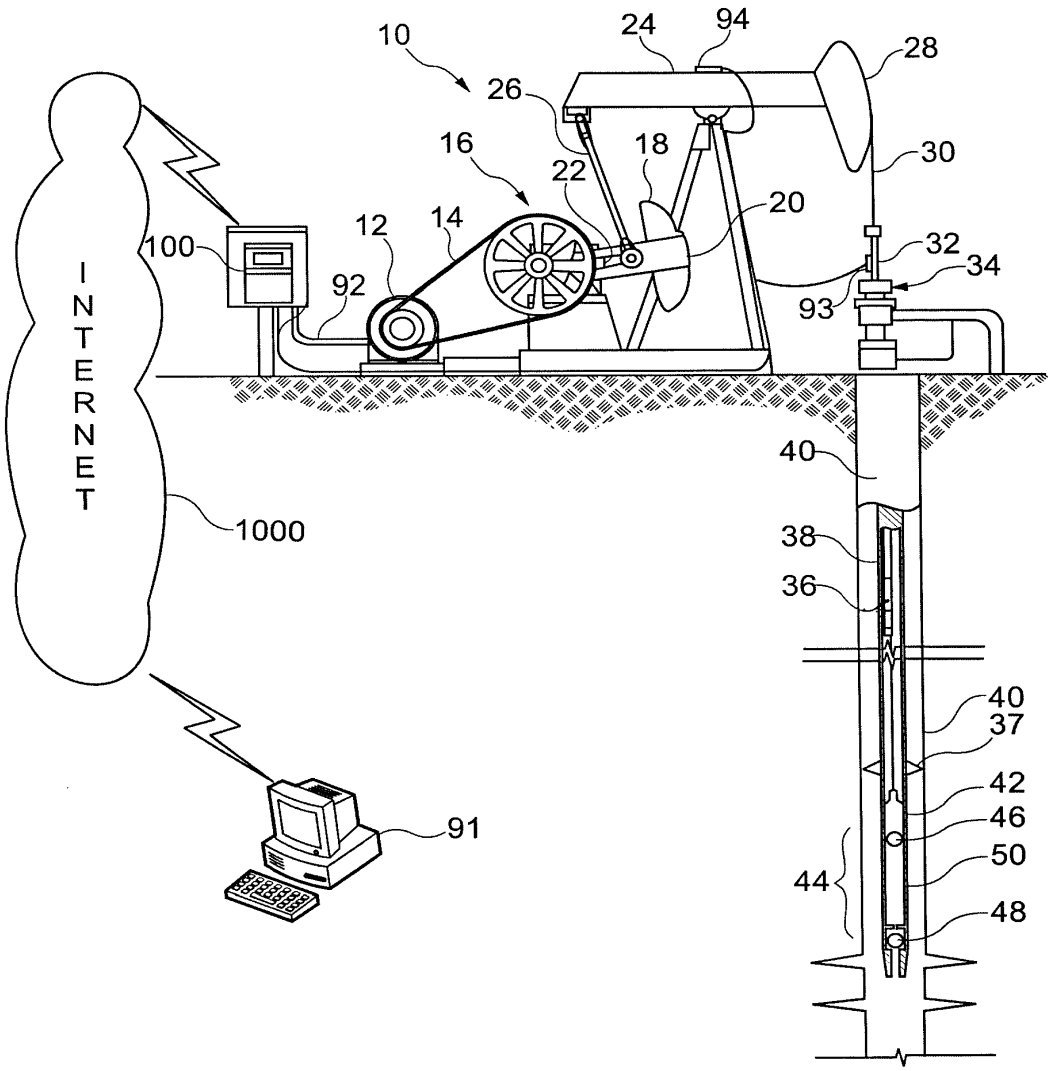

10
24
94
28
26
16
18
30
22
20
12
14
32
34
100
92
93
INTERNET
40
1000
38
36
40
37
42
46
50
91
44
48

Fig. 5

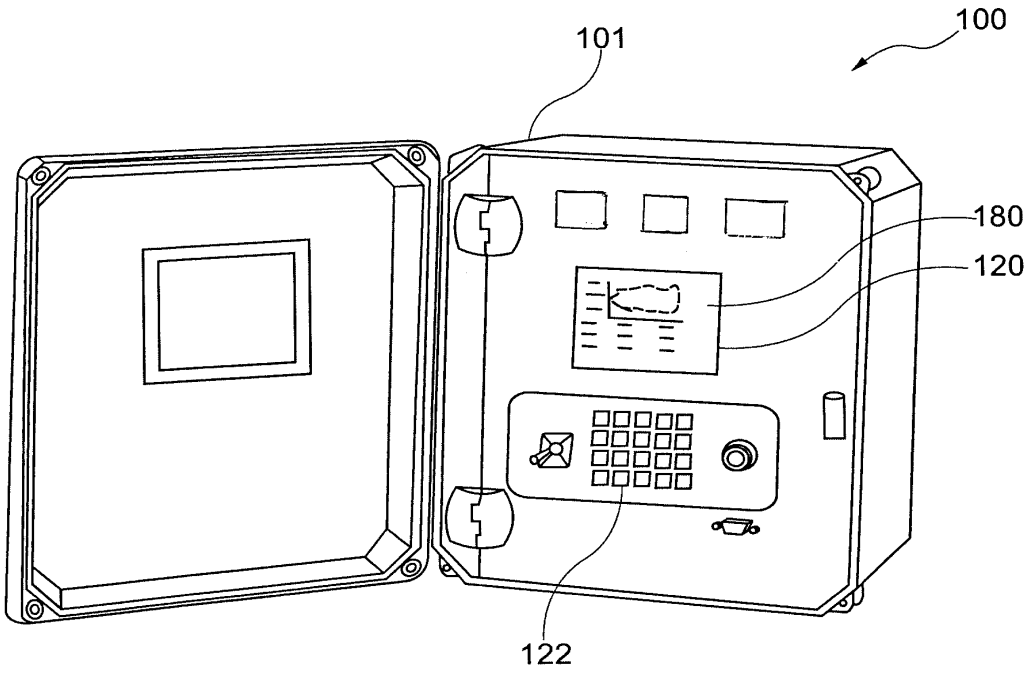



Fig. 6

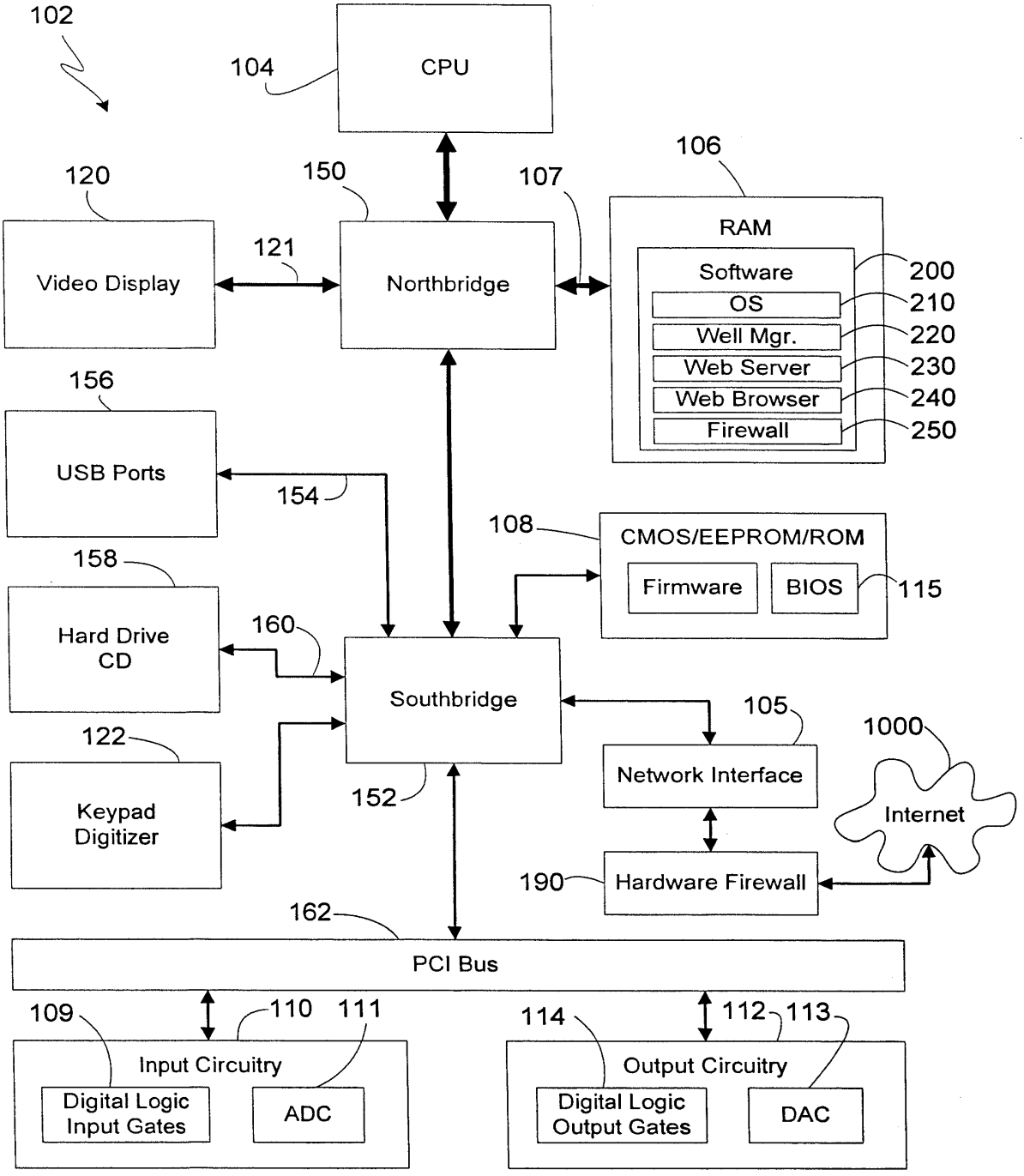

102
104
CPU
106
120
150
107
RAM
121
Video Display
Northbridge
Software
200
OS
210
Well Mgr.
220
Web Server
230
Web Browser
240
Firewall
250
156
USB Ports
154
108
CMOS/EEPROM/ROM
158
Firmware
BIOS
115
Hard Drive
CD
160
Southbridge
105
1000
122
Network Interface
Internet
Keypad
Digitizer
152
190
Hardware Firewall
162
PCI Bus
109
110
111
114
112
113
Input Circuitry
Output Circuitry
Digital Logic
Input Gates
ADC
Digital Logic
Output Gates
DAC

Fig. 7

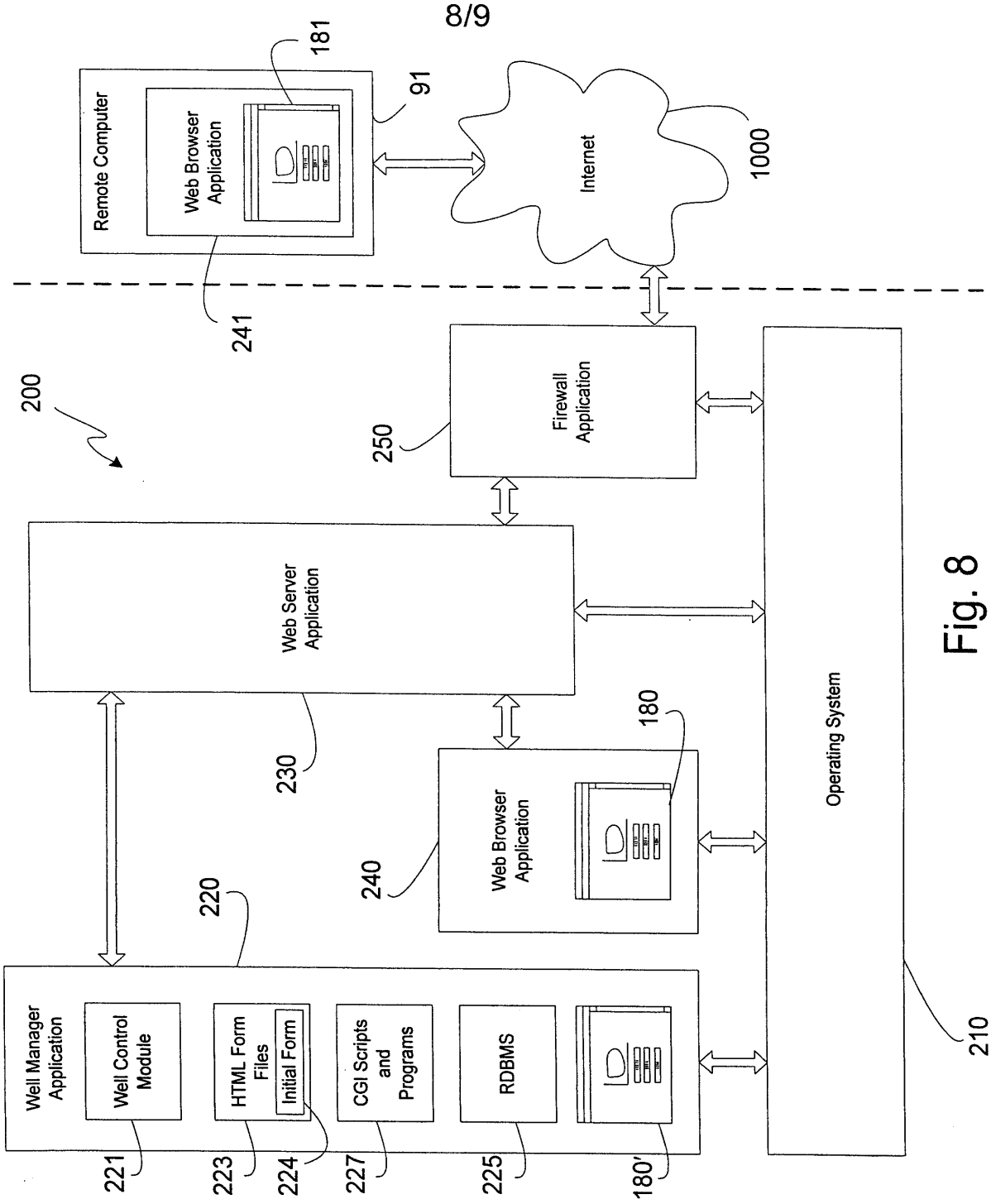

Remote Computer
Web Browser Application
181
91
Internet
1000
241
200
250
Firewall Application
Web Server Application
230
180
Web Browser Application
240
220
Operating System
Well Manager Application
Well Control Module
HTML Form Files
Initial Form
CGI Scripts and Programs
RDBMS
221
223
224
227
225
180'
210

Fig. 8

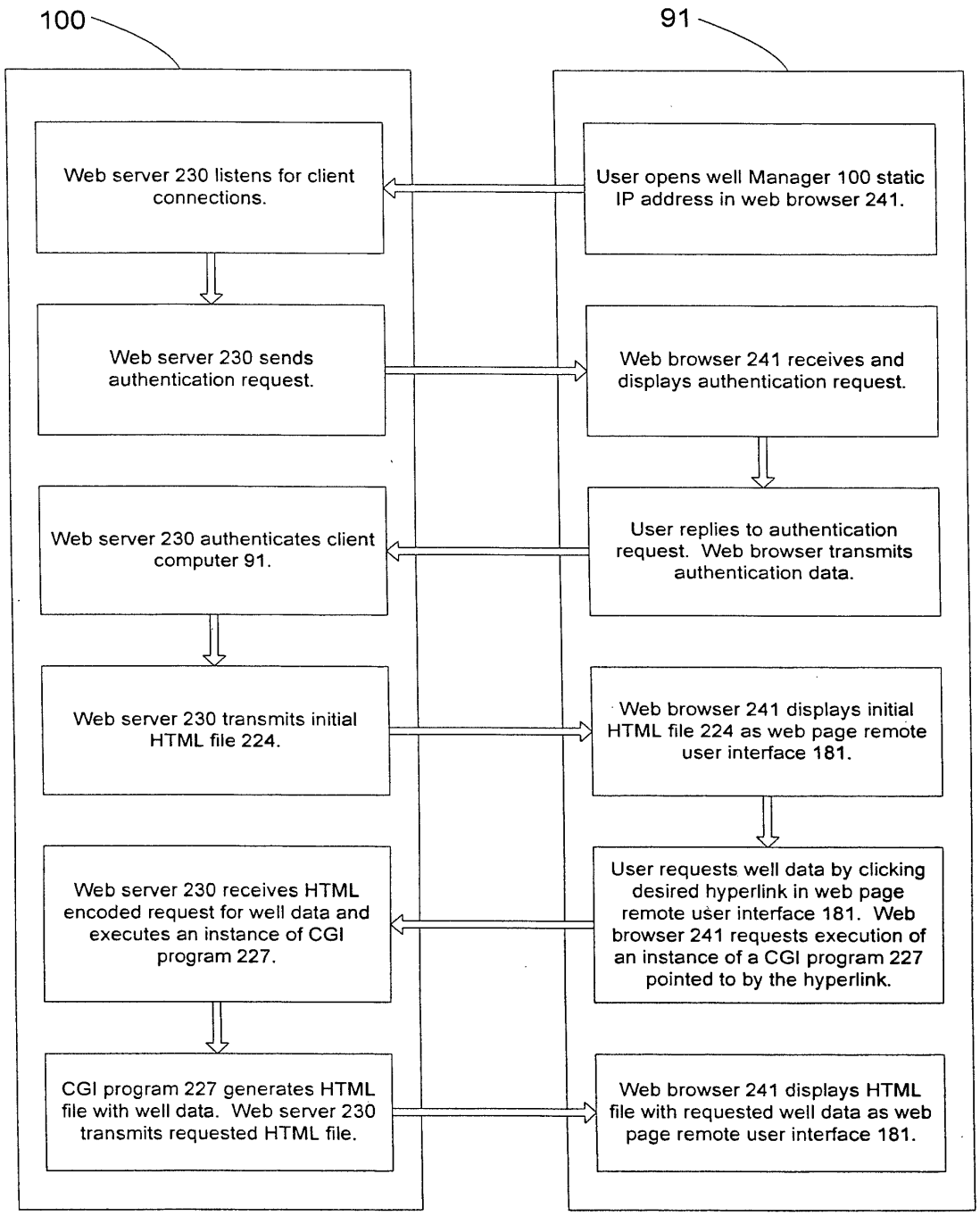

100
91
Web server 230 listens for client connections.
User opens well Manager 100 static IP address in web browser 241.
Web server 230 sends authentication request.
Web browser 241 receives and displays authentication request.
Web server 230 authenticates client computer 91.
User replies to authentication request. Web browser transmits authentication data.
Web server 230 transmits initial HTML file 224.
Web browser 241 displays initial HTML file 224 as web page remote user interface 181.
Web server 230 receives HTML encoded request for well data and executes an instance of CGI program 227.
User requests well data by clicking desired hyperlink in web page remote user interface 181. Web browser 241 requests execution of an instance of a CGI program 227 pointed to by the hyperlink.
CGI program 227 generates HTML file with well data. Web server 230 transmits requested HTML file.
Web browser 241 displays HTML file with requested well data as web page remote user interface 181.

Fig. 9

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/59749

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06F 11/00 (2008.04)
USPC - 702/188
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)
USPC: 702/188

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 702/6, 702/127, 702/188; search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Delphion [German (Applications - Full text), German (Granted - Full text), European (Applications - Full text), European (Granted - Full text), INPADOC, Abstracts of Japan, US (Granted - Full text), WIPO PCT Publications (Full text), US (Applications - Full text)]; Google Scholar; pump control, hydrocarbon, gas, oil, downhole

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 2006/0149476 A1 (GIBBS et al.) 06 July 2006 (06.07.2006), abstract, para [0001], [0021], [0032], [0041], [0073]. | 1-19 |
| Y | US 2006/0271299 A1 (WARD et al.) 30 November 2006 (30.11.2006), abstract, fig 7, para [0018], [0028]-[0029], [0050], [0052], [0084]. | 1-19 |
| A | US 2003/0065447 A1 (BRAMLETT et al.) 03 April 2003 (03.04.2003), abstract, fig 1-6. | 1-19 |
| A | US 4,594,665 A (CHANDRA et al.) 10 June 1986 (10.06.1986), abstract, fig 1A-23. | 1-19 |

☐ Further documents are listed in the continuation of Box C. ☐

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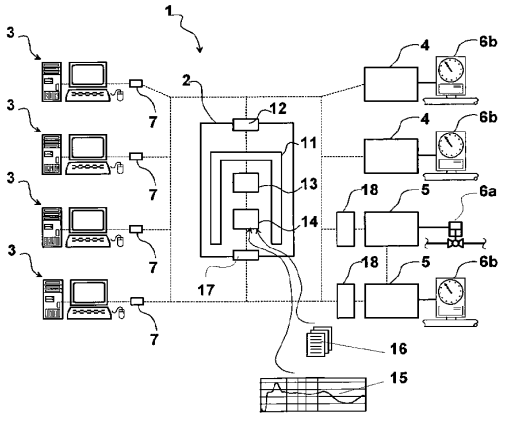
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## (54) Control method for remote installations

(57) A control method for remote installations through data processing networks, in particular, through a data processing network (1) with TCP/IP protocol, said installations comprising equipment (6a, 6b) such as measuring instruments of process variables and actuators of mechanical and electric devices of various type, such as valves, motors, pumps and other machines in civil or industrial installations. The method provides prearranging a server (2) wherein a gateway (11) resides on a first port (12) of the server having a public static IP address visible in the network. A terminal of the network, which can be a user (3) for controlling the plant or a peripheral device (4,5) associated with an equipment (6a, 6b) of the plant, requires and obtains a dynamic IP address (10) and a grant to access said terminal. Then, a request is carried out of a connection to the gateway by said terminals through said first port. The connection is accepted and said dynamic IP address is recorded through the gateway. The gateway then asks and obtains from the terminal a identification code proper of the terminals, which code is recorded in a table (16) of correspondence among dynamic IP addresses and identification codes of the terminals. This table is used for all the operations of communication with the terminal.

**Fig. 1**




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## Description

### Field of the invention

**[0001]** The present invention relates to a control method for remote installations through data processing networks, said installations comprising equipment such as measuring instruments of process variables and actuators of mechanical and electric devices of various type, such as valves, motors, pumps and other machines.

**[0002]** The term control method embraces the use of functions of data acquisition for displaying and/or changing the data in a user interface, functions for generating alarms, blocks, tuning operations, as well as functions of adjustments.

**[0003]** The method according to the invention can be used for example for remote controlling process installations, such as plants for chemicals and the like, for the food industry, for making energy, purification plants, hydraulic, mechanical, electric plants, etc.

### Background of the invention

**[0004]** All the known methods for controlling remote installations provide a communication step between peripheral devices associated with operating equipment and at least one point, called supervision unit, said supervision unit, for example being arranged at a user's remote control station. Said peripheral device and supervision unit are called terminals.

**[0005]** The remote control system according to said methods require communication means or connections between terminals, such connections forming a local network (LAN) or extended network (WAN), according to whether the object of the control are a single installation or several installations, distributed in a more or less wide territory. For example, systems that perform said methods are called respectively SCADA (Supervisory Control And data acquisition) or DCS (Distribued Control System).

**[0006]** In particular, said communication means can be:

- cables, for example telephone twin cables, associated with a modem;
- electromagnetic waves, normally set in the frequency bands known as UHF and VHF, said electromagnetic signals coupling to proprietary networks comprising one or more radio links and GSM that uses public networks.

**[0007]** In the last decades as means of communication between terminals the Internet and Intranet connections have developed. Said terminals gain access to the network transmitting the data on public networks, always by means of cables, modem and/or electromagnetic waves. PSTN or ADSL connections respectively are also cable connections with analog or digital modem whereas for radiofrequency connections GPRS and UMTS systems are used.

**[0008]** The known methods of remote control system provide, furthermore, a step of identification of the terminals. Means for identification can be, for example, telephone numbers, radio addresses, IP addresses.

**[0009]** In particular, an IP address, being a succession of numbers, normally four, and in such a case it is called IPv4, each set between 0 and 255 and separated by dots, thus allowing to generate a very high number of addresses. However, the system of IP addresses is becoming less appropriate due to a very diffused use of Internet and of data processing networks generally for transmitting data.

in order to overcome this problem various solutions have been proposed. A first solution consists of using a TCP/IP protocol that provides sequences of six numbers instead of four, this version being called IPv6. A generalized use of IPv6 requires however a long time and very high costs.

**[0010]** A second solution a method called NET/Gateway, still based on the use of IP addresses under IPv4. Said method provides distinguishing static IP addresses and dynamic IP addresses. Whereas the former are invariably associated with a determined subject, which is identified always with the same address whenever it is connected to the network, the latter, instead, are allocated to a subject at the beginning of a connection and have validity for the only duration of the connection same. actually, said dynamic IP addresses identify a connection and not a connected subject.

**[0011]** Such NET/Gateway method is already largely used for normal Internet utilizations and in mobile phone systems: for example, the common GPRS/UMTS and PSTN connections, as well as private ADSL, use dynamic IP addresses.

**[0012]** In case of controlling remote installations, the use of dynamic IP addresses is known in many successive connections for identifying even different terminals, provided said terminals are not always connected to the data processing network. A same group of terminals requires then a number of IP addresses smaller than a group consisting of only static IP addresses.

**[0013]** However, in case of the systems of controlling remote installations, the use of dynamic IP addresses has some difficulties.

**[0014]** In particular, the data packets sent by a same peripheral device in successive connections, and sent to a user of the control, or to a control device, must provide coherent sets, i.e. it shoulkd be able to identify univocally the peripheral device that has sent them.

**[0015]** For example, a user of a remote control system of a plant must be adapted to assign univocally to a determined peripheral device, typically a determined measuring instrument, the data displayed in an assigned area of the interface associated with said user. Similarly, the writing a coherent registration, or trend, of historical values of a process variable, by adjoining data packets obtained in successive connections of the associated pe-



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ripheral devices with an instrument that detects this variable, requires a univocal identification of the instrument at any updating of the registration.

**[0016]** An univocal identification of the terminals is clearly impossible by using only dynamic IP addresses. A dynamic IP address allows a connection to the network but not the visibility of a terminal, nor a communication with other peripheral devices, said IP address being unknown to said other terminal.

**[0017]** Presently, the various solutions proposed in order to solve this problem have given not much satisfactory results. On the other hand, the use of static IP addresses, as above described, is scarcely practicable for controlling remote installations.

Summary of the invention

**[0018]** It is then a feature of the present invention to provide a control method for remote installations through data processing networks with dynamic IP addresses that allows an univocal identification of terminals, said terminals being peripheral devices associated with operating equipment of the installations or supervision units associated with users of the control.

**[0019]** It is another feature of the present invention to provide a control method for remote installations that avoids the use of additional data repeating apparatus sent from peripheral devices to equipment of the installation.

**[0020]** These and other objects are achieved through a remote control method of an equipment of a plant by a user through a data processing network with TCP/IP protocol, said data processing network comprising:

- prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public static IP address visible in said data processing network,
- requesting an access to the data processing network by a terminal selected from the group comprised of:

- a supervision unit associated with said user,
- a peripheral device associated with said equipment,
- assigning a dynamic IP address and granting access to said terminal,

the main feature of the method being to provide, furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**[0021]** Actually, each time that a terminal is connected, the gateway updates said table of correspondence among dynamic IP addresses and terminal identification codes. This way, the terminal can communicate without possessing static addresses, being it enough that they reach through the data processing network the gateway accessible through said first port of the server.

**[0022]** In particular, the connection of the peripheral device to the data processing network can be carried out in a known way, according to a technique chosen for example among:

- Ethernet,
- GPRS, wherein the dynamic IP address is granted by a network service provider or IAP,
- radio waves of wavelength preferably comprised within known bands such as UHF or VHF, wherein the method comprises a step of radio conversion towards Ethernet or towards GPRS through the above described steps.

**[0023]** In particular, the connection of the supervision unit to the data processing network can be carried out in a known way, by a technique chosen for example among:

- Ethernet,
- GPRS,
- ADSL,
- PSTN,

**[0024]** In the last three cases an operation of a IAP being provided for assigning the IP address.

**[0025]** In particular, a user can obtain data relative to an equipment of the installation through a specific query. To this end, the method can comprise the steps of:

- requesting data relative to a peripheral device, said requesting step being formulated to the gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. the connection bound by the peripheral device by the table of correspondence through the gateway,
- sending the request to said peripheral device on said connection through the gateway.

**[0026]** Not exclusively, to this end, the method can comprise a step of request for data transmission to a control unit, this request being formulated to the gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**[0027]** Always not exclusively, to this end, the method

can comprise, furthermore, the steps of:

- searching the current control unit IP address, i.e. of the connection associated to said control unit by the table of correspondence through the gateway,
- sending the data to said control unit on said connection by said gateway.

Said steps of transmitting requests and data are allowed associating requests and data to a header that contains an univocal identification of the addressee and an univocal identification of the sender, and associating said identifications in a TCP/IP packet. This packet is sent to the server on the previously open connection.

Preferably, said server can comprise furthermore

- program means called master,
- a a data registration zone called database, this database being associated with a seconda port of the server, said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**[0028]** Furthermore, the method can provide a step of data transmission from the database to a supervision unit through said second port of the server.

**[0029]** Alternatively, data relative to an equipment of the installation can be obtained by a user of the control or from the database according to a program, said program comprising temporal limits and/or alarm conditions.

**[0030]** To this purpose and in a first aspect, the method can comprise a step of assigning temporal limits by a user preferably through a supervision unit, such temporal limits cause data to be sent from a peripheral device to the gateway and from the gateway to a supervision unit for being notified to a user, or from the gateway to the master for registration in the database.

**[0031]** Preferably, such temporal limits are recorded in a peripheral device associated with said equipment of the installation.

**[0032]** In particular, such temporal limits can be defined by equal time intervals, said intervals forming a frequency of data transmission from said peripheral device.

**[0033]** In a second aspect of the invention. and for the same objects, the method can provide a step of defining conditions of alarm by a user, preferably through a supervision unit associated with said user, such conditions being for example:

- exceeding an assigned threshold value by a process variable,
- missing confirmation of execution of a command to a peripheral device associated with an actuator, advantageously after a determined number of iterations of said command,
- missing receipt of commands from a peripheral device for a determined time interval,

Such conditions of alarm causing a data transmission from said peripheral device to the gateway and from the gateway to a supervision unit for being notified to a user, or from the gateway to the master for registration in the database, in particular, for compilation of historical alarm data.

**[0034]** Preferably, such conditions are recorded in said peripheral device.

**[0035]** Some peripheral devices, normally associated with measuring instruments, which can be in series or in parallel to each other, can carry out, further to the described functions of transmission of data, also automatic actuating functions of other peripheral devices, normally associated with actuators.

**[0036]** In this case the data, alarms and controls, are preferably exchanged directly between peripheral devices, for example by radio. The server, can, in any case, carry out contemporaneous functions of notifying an alarm to a supervision unit through the gateway, according to the steps of search and sending above described, or of registration of alarms and events in the database through the gateway and the master.

**[0037]** A step can be provided of defining alarm conditions, by a user, such that at said conditions of alarm the steps are repeated according to a determined time interval, until the condition of alarm that the has caused it is present. Such conditions of alarm can be recorded in a peripheral device.

**[0038]** To this purpose, a condition of alarm can cause the generation of a command, this command being a signal sent from a first peripheral device, called master peripheral device, to a second peripheral device, called slave peripheral device. This chain of generation, transmission and running controls is called automatism, in this case said method providing at least two peripheral devices associated with operating equipment of the installation, of which one is an instrument and the other is an actuator.

**[0039]** Preferably, the step of sending said command is repeated according to a determined time interval, until the condition of alarm that has generated it remains.

**[0040]** The method can comprise furthermore, a step of disconnecting an automatism.

**[0041]** Preferably, communication between a master peripheral device and a slave peripheral device is made through radio waves, for example of wavelength comprised within known bands such as VHF and UHF.

**[0042]** Furthermore, the method can comprise the steps of:

- generating a command by a user of the control through a control unit, said command being for a slave peripheral device,
- requesting a transmission of said command to said

slave peripheral device, said requesting step being formulated to the gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. the connection associated to said slave peripheral device by the table of correspondence through the gateway,
- sending said command to said slave peripheral device on said connection by said gateway.

**[0043]** This way, a user of the control can operate an actuator for changing a status of an equipment, for example running or stopping a motor, or opening a valve, by receiving an alarm or in any case at the user's choice.

Brief description of the drawings

**[0044]** The invention will be made clearer with the following description of an exemplary embodiment thereof, exemplifying but not limitative, with reference to the attached drawings wherein:

- Figure 1 is a diagrammatic view of a data processing network for remote controlling of a plant, according to the invention;
- Figure 2 is a diagrammatic view of exchange of data in a procedure of request and grant of an access of a terminal GPRS to the data processing network;
- Figures 3a and 3b show a diagrammatic view of exchange of data in phases of univocal identification of a terminal connected to the data processing network;
- Figure 4 is a diagrammatic view of exchange of data in a procedure of transmission of a requesting data or of a command formulated by a control unit and directed to a peripheral device;
- Figure 5 is a diagrammatic view of exchange of data in a procedure of updating data relative to a peripheral device.

Description of preferred exemplary embodiments

**[0045]** With reference to figure 1, an implementation is presented of the method according to the invention. For remote controlling a remote plant a data processing network 1 is available with TCP/IP protocol. It comprises a server 2, whose ports 12 and 17 are identified and shown in the network through TCP/IP public and static address.

**[0046]** The network comprises then a variable number of control unit 3, forming the interface with the users of the control, not shown in the figures, a variable number of peripheral devices 4 or 5, associated with operating equipment of a plant, such as measuring instruments 6b or actuators 6a, for example a valve. In the instantaneous status of the system shown in figure 1 four users are connected to the network through respective control units 3, and four peripheral devices 4 or 5.

**[0047]** In the example shown in figure 1, the control units 3 are connected to the network 1 by means of ADSL modem 7. Concerning the peripheral device 4 they are connected to the network 1 by means of integrated GPRS devices, whereas the peripheral device 5 have a radio connection and require further peripheral devices 18 with double radio/GPRS interface for connection to the network 1.

**[0048]** The mode of connection chosen for the control unit and the peripheral devices, respectively ADSL and GPRS, require the operation of a network services provider, diagrammaticlly shown with the symbol 9 (figure 2) for assigning to the terminal of a TCP/IP address 10, in this case of dynamic type, i.e. representstivo of a peripheral device during the sole current session.

**[0049]** Always with reference to the example of figure 1, in the server a gateway 11 is resodent, which dialog with each other components of the network through the port 12 of the server, available owing to a public static IP address visible in all the data processing network; nel server is furthermore, residing a master 13, which recepisce and selects the data from the gateway 11, and is furthermore, residing a database 14, on which the master 13 records data selected, in the shape of trend of process variables 15 and of storici 16 of alarms and events. this database is accessible by a port dedicated 17, which are also available from each point of the data processing network owing to an IP address public and static.

**[0050]** Are now described the mode of operation of a control system that applies the method according to the invention.

**[0051]** A first procedure, common to all the mode of operation since preliminary an each exchange of data between components of the data processing network, is the request preparing for entering the data processing network 1 by the terminal. Figure 2 represents this process with reference to a peripheral device 4, but is valid also for peripheral devices 18 and the control unit 3, after change of these numbers to number 4, as indicated between brackets. This consideration is also valid for processes described hereinafter.

**[0052]** Firstly, the peripheral device 4 has a request 21 for entering the data processing network 1 to the network service provider 9. Then, the provider 9 inoltra a nulla-osta 22 to the connection and assegna to this connection an dynamic IP address 10.

**[0053]** A second procedure causes an univocal identification of the terminal linked, cause to be possible the exchange of data between such terminal. Figures 3A and 3B show this process with reference to a peripheral device 4.

**[0054]** Firstly (figure 3A), the peripheral device 4 has a request 31 of connection to the server 2, more precisely to the gateway 11 through the port 12 (figure 1), visible owing to an IP address static known to the peripheral device 4. Then, the gateway 11 inoltra a nulla-osta 32 to



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the connection and annota the data relative to the new linking, i.e. the dynamic IP address 10 associated with the linking. At this point (figure 3B) the gateway 11 inoltra a request 33 an identification code proper to the peripheral device 4, which delivers a response 34 containing the identification code required 35. The gateway 11 stores the identification code 35 at the dynamic IP address 10, in a table 36 of correspondsnze between dynamic IP addresses of connection and identifiedvi of peripheral devices.

**[0055]** A third procedure, described with reference to figure 4, consists of sending a message to the server 2 by a control unit 3, said message being for an assegned peripheral devices 4. this message can be a request for updating data relative to a peripheral device associated with an instrument measuring 6b (figure 1), or a command for a peripheral device associated with an actuator 6a.

**[0056]** In the former case, the control unit 3 delivers to the gateway 11 a request 41 of updating the data of an assegned peripheral devices 4, connection to the request the identification code proper of the peripheral device same. The gateway 11 esegue a search 42 of the IP address 10 relative to the connection of the peripheral device 4 destinataria of the request for updating data, using for this search the table 36 of correspondence among dynamic IP addresses and identification codes of peripheral devices connected. once recovered the IP address 10, the gateway proceeds to the step of sending 43 of the request for updating data to the peripheral device 4.

**[0057]** In the latter case, val still the description now carried out replacing simply "request for updating dati" with "comando".

**[0058]** A fourth procedure, described with reference to figure 5, consists of data transmission to the server 2 by a peripheral device 4, such data being set to an assegned control unit 3. This procedure can be activated in response to a request for updating data, above described, or can be activated according to a program of time or a logic based on alarm conditions, this logic and this program being recorded in the peripheral device and/or nel server. The peripheral device 4 esegue then the step of sending 51 of a packet of data, corredato delil identification code 52 proper of the addressee, which in this case is the control unit 3.

**[0059]** If this procedure both activated in response to a request for the control unit, the dynamic IP address of the control unit destinataria of the data is known, since is weftngiven by the packet data that conteneva the demand, therefore the gateway 11 esegue the step of sending 55 of the data to the peripheral device 3.

**[0060]** In the other cases, it is known only the identification code proper of the addressee, therefore the gateway 11 must execute a search 53 of the IP address 54 relative to the connection of the or the control unit 3 destinatarie of the data, using for this search the table 36 of correspondence among dynamic IP addresses and identification codes of peripheral devices connected. once recovered the IP address 54, the gateway proceeds to the step of sending 55 of the request for updating data to the control unit 3.

**[0061]** Other sequences of transmission of data are, typically:

a) storing of a program in a peripheral device, which is similar to the first procedure;
b) registration of data nel database, which is similar to the fourth procedure;
c) running an automatism, in particular, in the shape of dialogo between peripheral devices where the server is not involved unless for functions of registration of events and alarms, unless for making reference to the table of corispondences;
d) disconnecting an automatism, which is similar to the first procedure;
e) consultation of the database by a user, as function accessoria, in a way similar to the first procedure.

**[0062]** The description of which above an exemplary embodiment specific of the method is capable of show the invention from a viewpoint conceptual so that other, using the prior art, can be changing and/or adapting in various applications this exemplary embodiment specific without further ricerche and without moving away from each other by the concept inventive, and, then is intended that such adaptation and changes will be high as equivalent of an exemplary embodiment specific. The means and the material to provide the various functions described can be changes nature without for this come out from the field of invention. is intended that the expressions or the terminology used have object purely describedvo and for this not limitative.

## Claims

1. A control method for remote controlling an equipment of a plant by a user, in particular, through a data processing network with TCP/IP protocol, said data processing network comprising:

   - prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public static IP address visible in said data processing network,
   - requesting an access to the data processing network by a terminal selected from the group comprised of:
   - a supervision unit associated with said user,
   - a peripheral device associated with said equipment,
   - assigning a dynamic IP address and granting access to said terminal,



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**characterised in that it provides** furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**2.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves of wavelength comprised within known bands such as UHF or VHF.

**3.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves and a step is provided of radio conversion towards Ethernet or towards GPRS.

**4.** Method, according to claim 1, wherein the steps are provided of:

- requesting data relative to a peripheral device, said requesting step being formulated to said gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. of the connection associated to said peripheral device by said table of correspondence by said gateway,
- sending said requesting step to said peripheral device on said connection by said gateway.

**5.** Method, according to claim 1, wherein a step is provided of requesting data transmission to a control unit, said requesting step being formulated to said gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**6.** Method, according to claim 6, wherein the steps are provided of:

- searching the current control unit IP address, i.e. the connection associated to said control unit by said table of correspondence by said gateway,
- sending said data to said control unit on said connection by said gateway.

**7.** Method, according to claim 6, wherein said server can comprise furthermore

- program means called master,
- a data registration zone called database, this database being associated with a seconda port of the server,

said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**8.** Method, according to claim 5, wherein a step is provided of assignment of data from said database to a supervision unit by a second port of the server.

**9.** Method, according to claims 6 and 7, wherein a step is provided of assegning temporal limits by a user through a supervision unit,d said temporal limits being recorded in a peripheral device associated with an equipment of the installation.

**10.** Method, according to claim 1, wherein the steps are provided of:

- generating a command by a user of the control through a control unit, said command being directed to a peripheral device associated with an actuator,
- requesting a transmission of said command to said peripheral device, said requesting step being formulated to said gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the connection relative to said peripheral device by said table of correspondence by said gateway,
- sending said command to said peripheral device on said connection by said gateway.

**Amended claims in accordance with Rule 137(2) EPC.**

**1.** A control method for remotely controlling an equipment of a plant by a user, in particular, through a data processing network with TCP/IP protocol, said data processing network comprising:

- prearranging a computer, called server, said server comprising a program means, called gateway, said gateway being connected to a first port of said server, said first port having a public



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static IP address visible in said data processing network,
- requesting an access to the data processing network by a terminal selected from the group comprised of:

  - a supervision unit associated with said user,
  - a peripheral device associated with said equipment,

- assigning a dynamic IP address and granting access to said terminal,

**characterised in that** it provides furthermore, the steps of:

- requesting a connection to the gateway by said terminals through said first port,
- accepting the connection and storing said dynamic IP address by said gateway,
- requesting from the gateway to the terminal an identification code proper of the terminal,
- sending said identification code to the gateway by the terminal,
- storing from the gateway said identification code and said dynamic IP address in a table of correspondence among dynamic IP addresses and identification codes of the terminals.

**2.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves of wavelength comprised within known bands such as UHF or VHF.

**3.** Method, according to claim 1, wherein the connection of a terminal to said data processing network is made through radio waves and a step is provided of radio conversion towards Ethernet or towards GPRS.

**4.** Method, according to claim 1, wherein the steps are provided of:

- requesting data relative to a peripheral device, said requesting step being formulated to said gateway by a user through a control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the current IP address of said peripheral device, i.e. of the connection associated to said peripheral device by said table of correspondence by said gateway,
- sending said requesting step to said peripheral device on said connection by said gateway.

**5.** Method, according to claim 1, wherein a step is provided of requesting data transmission to a control unit, said requesting step being formulated to said gateway by a peripheral device, said requesting step declaring the identification code proper of said control unit.

**6.** Method, according to claim 6, wherein the steps are provided of:

- searching the current control unit IP address, i.e. the connection associated to said control unit by said table of correspondence by said gateway,
- sending said data to said control unit on said connection by said gateway.

**7.** Method, according to claim 6, wherein said server can comprise furthermore

- program means called master,
- a data registration zone called database, this database being associated with a seconda port of the server,

said method comprising, furthermore, the steps of:

- transferring data from the gateway to the master,
- analysing data and choosing relevant data by the master,
- registering relevant data in the database by the master.

**8.** Method, according to claim 5, wherein a step is provided of assignment of data from said database to a supervision unit by a second port of the server.

**9.** Method, according to claims 6 and 7, wherein a step is provided of assigning temporal limits by a user through a supervision unit, d said temporal limits being recorded in a peripheral device associated with an equipment of the installation.

**10.** Method, according to claim 1, wherein the steps are provided of:

- generating a command by a user of the control through a control unit, said command being directed to a peripheral device associated with an actuator,
- requesting a transmission of said command to said peripheral device, said requesting step being formulated to said gateway from said user through said control unit, said requesting step declaring the identification code proper of said peripheral device,
- searching the connection relative to said peripheral device by said table of correspondence by said gateway,



EX1004, Page 495

- sending said command to said peripheral device on said connection by said gateway.



EX1004, Page 496

**Fig. 1**

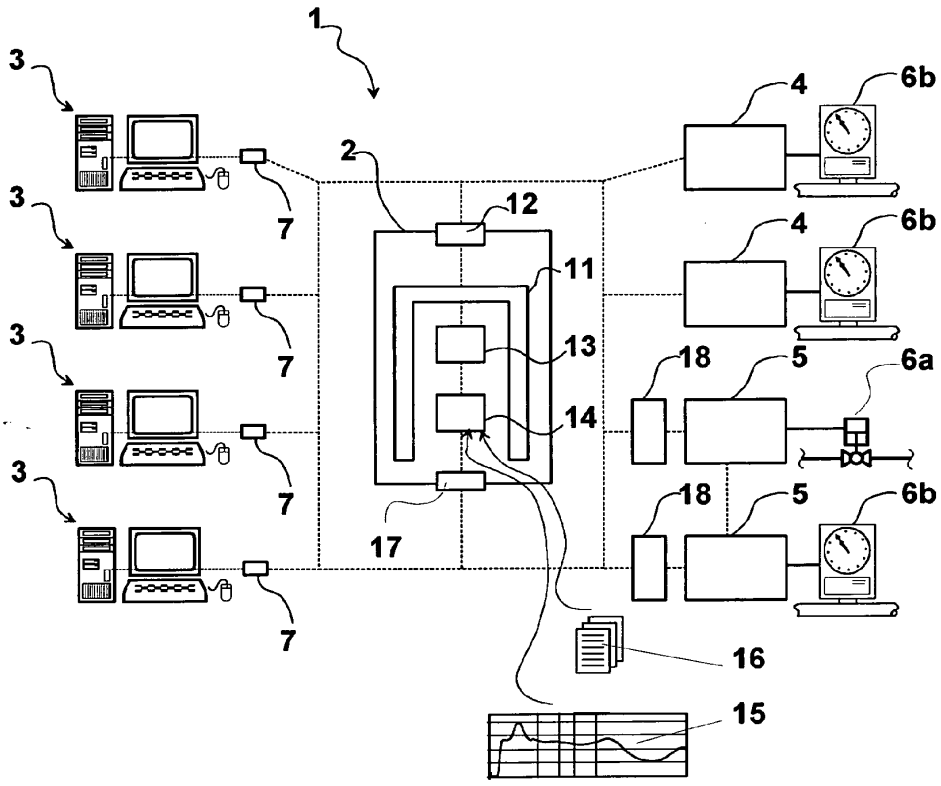


**Fig. 2**

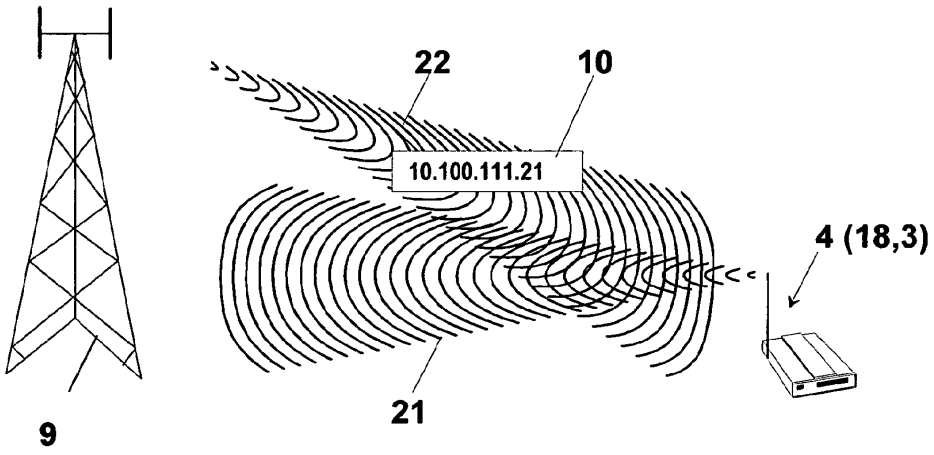


**Fig. 3A**

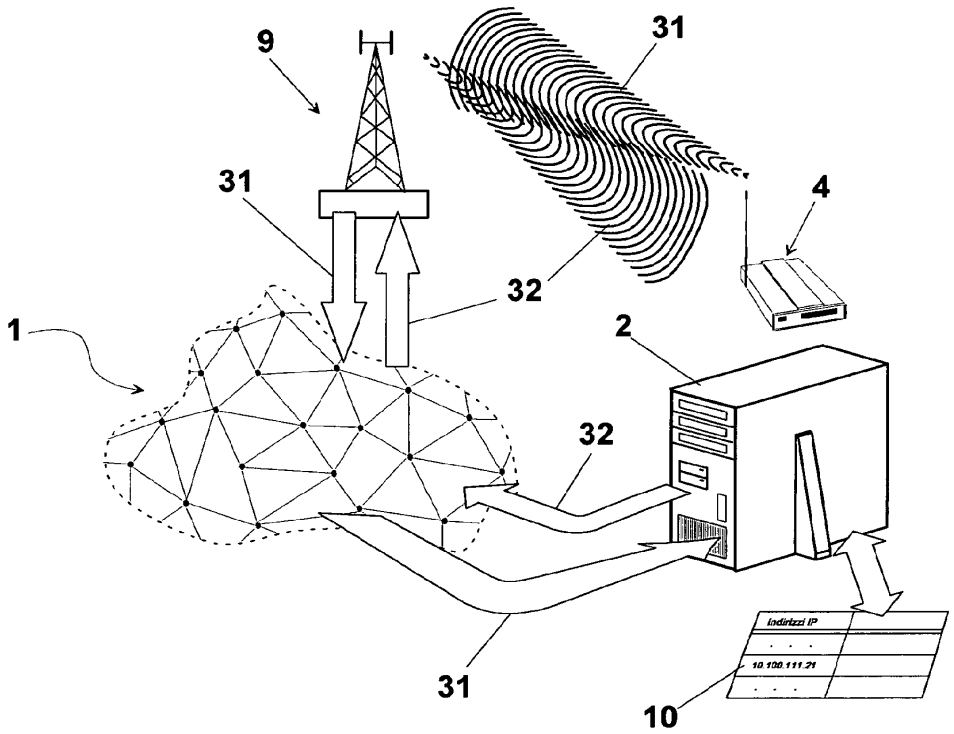


Fig. 3B

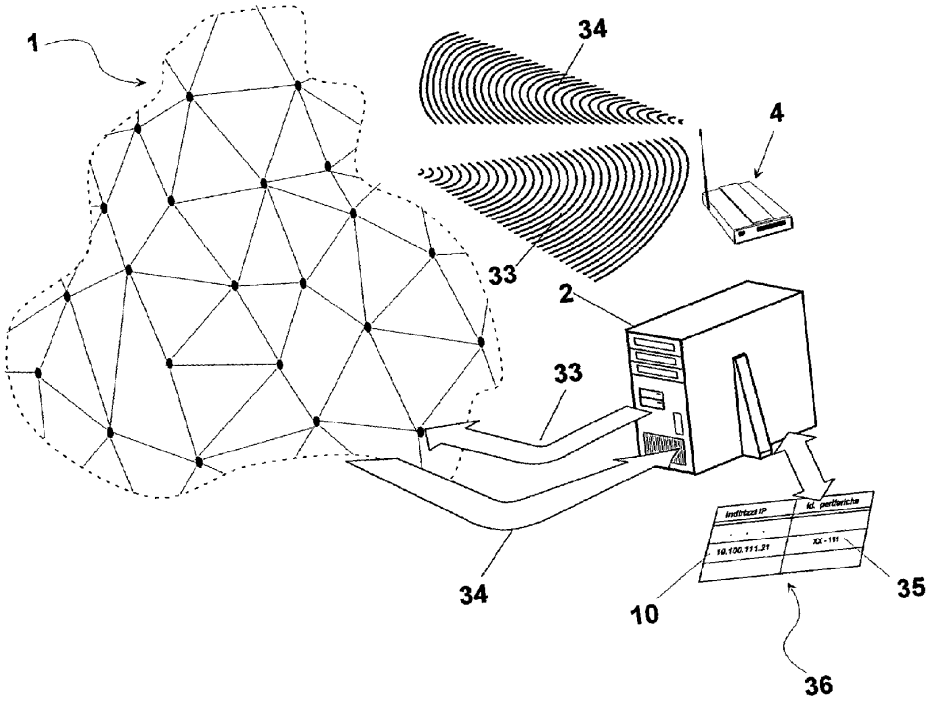


**Fig. 4**

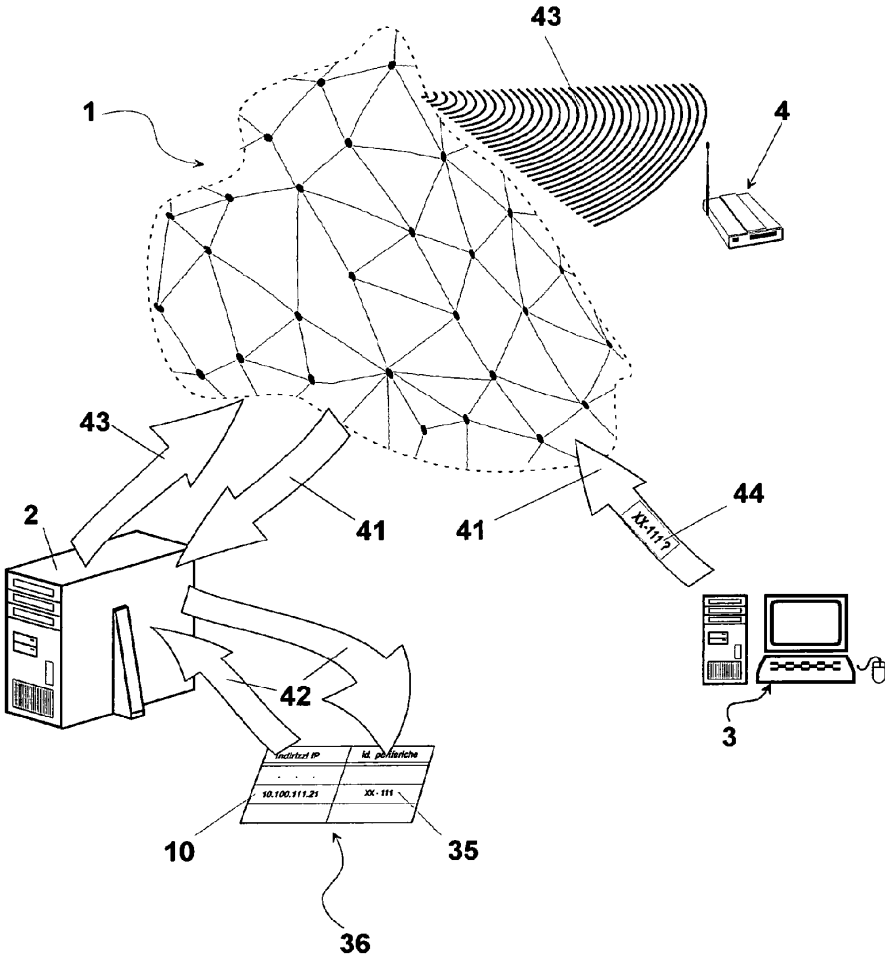
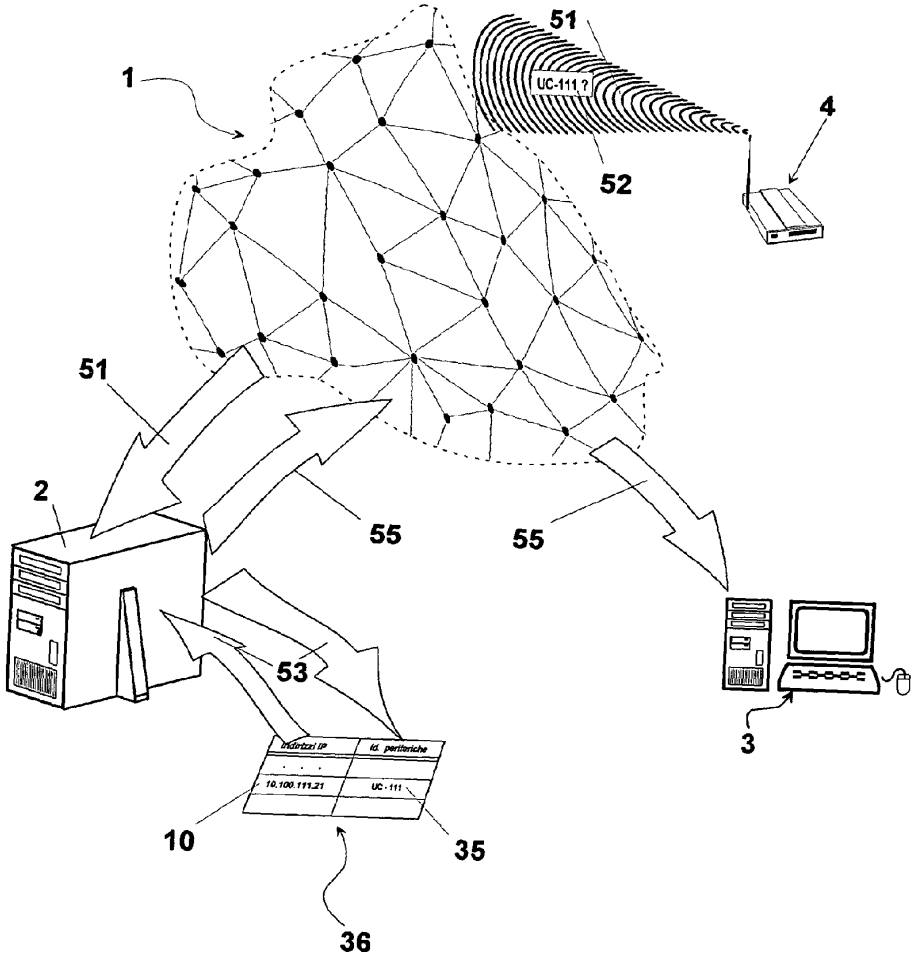

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**Fig. 5**


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Indirizzi IP
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# EUROPEAN SEARCH REPORT

Application Number
EP 08 00 2184

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | JP 2006 290523 A (MITSUBISHI ELEC BUILDING TECHN) 26 October 2006 (2006-10-26) * abstract * | 1-10 | INV. G05B19/042 H04L29/00 |
| A | US 2002/062365 A1 (NISHIKAWA YOUICHIRO [JP] ET AL) 23 May 2002 (2002-05-23) * paragraph [0011] - paragraph [0022]; figure 2 * | 1-10 | |
| A | US 2005/150950 A1 (ASAI ARITO [JP]) 14 July 2005 (2005-07-14) * paragraph [0060] - paragraph [0064] * | 1 | |
| A | US 6 499 054 B1 (HESSELINK LAMBERTUS [US] ET AL) 24 December 2002 (2002-12-24) * the whole document * | 1 | |
| A | US 2004/249491 A1 (HOTT BRANDT POWELL [US]) 9 December 2004 (2004-12-09) * the whole document * | 1 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) G05B H04L G06F |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 6 March 2009 | Kuntz, Jean-Marc |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 08 00 2184

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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06-03-2009

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| JP 2006290523 A | 26-10-2006 | NONE | |
| US 2002062365 A1 | 23-05-2002 | JP 2001359176 A | 26-12-2001 |
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| | | US 6732158 B1 | 04-05-2004 |
| US 2004249491 A1 | 09-12-2004 | NONE | |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 14589030 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 31-DEC-2012 |
| **Filing Date:** | |
| **Time Stamp:** | 15:10:49 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| Submitted with Payment | no |
|---|---|

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | Information Disclosure Statement (IDS) Form (SB08) | tuckIDS.pdf | 613489<br>741073d41981be50511839dd6d392c36185972eb | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |

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|---|---|---|---|---|---|
| 2 | Foreign Reference | tuck1.pdf | 2551462<br>edb397ddda92d5dd8268778200779e3fd626862c | no | 52 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Foreign Reference | tuck2.pdf | 1860270<br>12e456a6fa975628f9045e65b1fe76e4c59ad61f | no | 44 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Foreign Reference | tuck3.pdf | 784836<br>1b7b2965467d7868bdf9af75b82d1a0b0b7ebf4a | no | 17 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Non Patent Literature | tuck4.pdf | 479392<br>a549c5150afa722bbfdb43a454fe7433fb79e450 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Non Patent Literature | Tuck5.pdf | 102919<br>8840724495f119f71bf86762b35dfd45838b2522 | no | 4 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 7 | Non Patent Literature | tuck6.pdf | 1413873<br>05ca7f3cee5e47187c897f600982de5ceb955ccf | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 8 | Non Patent Literature | tuck7.pdf | 224035<br>63cbe9db4b087d54076db93eff5ebed1ee43d4be | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 9 | Non Patent Literature | tuck8.pdf | 1489733<br>6aad695f155858ab6a76fa526186a7c438ca5d37 | no | 17 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | | **Total Files Size (in bytes):** | 9520009 | |

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**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**
**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**

PTO/AIA/01 (06-12)
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U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| Title of Invention | Remote Control of Fluid-Handling Devices |
|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

- [■] The attached application, or
- [ ] United States application or PCT international application number _____ filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Aaron Phillips Date (Optional): 12/6/2012

Signature: Aaron Phillips

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**Doc Code: TRACK1.REQ**
**Document Description: TrackOne Request**

PTO/SB/424 (12-11)

## CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION UNDER 37 CFR 1.102(e) (Page 1 of 1)

| | | | |
|---|---|---|---|
| First Named Inventor: | Aaron Phillips | Nonprovisional Application Number (if known): | |
| Title of Invention: | Remote Control of Fluid-Handling Devices | | |

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i), the prioritized examination fee set forth in 37 CFR 1.17(c), and if not already paid, the publication fee set forth in 37 CFR 1.18(d) have been filed with the request. The basic filing fee, search fee, examination fee, and any required excess claims and application size fees are filed with the request or have been already been paid.

2. The application contains or is amended to contain no more than four independent claims and no more than thirty total claims, and no multiple dependent claims.

3. The applicable box is checked below:

**I. ☑ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.

---OR---

(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.

ii. An executed oath or declaration under 37 CFR 1.63 is filed with the application.

**II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

i. A request for continued examination has been filed with, or prior to, this form.
ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

| | |
|---|---|
| Signature /Joshua L. Tucker/ | Date 2012-12-07 |
| Name (Print/Typed) Joshua L. Tucker | Practitioner Registration Number 63809 |

***Note:*** *Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the form of the signature. If necessary, submit multiple forms for more than one signature, see below*.*

☑ *Total of 1 forms are submitted.

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The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 000314.000003 |
|---|---|---|
| | Application Number | |
| Title of Invention | Remote Control of Fluid-Handling Devices | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

## Inventor Information:

**Inventor 1** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Aaron | | Phillips | |

**Residence Information (Select One)** ◉ US Residency ○ Non US Residency ○ Active US Military Service

| City | Lubbock | State/Province | TX | Country of Residence i | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

| Address 1 | 2806 87th St. | | |
|---|---|---|---|
| Address 2 | | | |
| City | Lubbock | State/Province | TX |
| Postal Code | 79423 | Country i | US |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

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**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 35979 | | |
|---|---|---|---|
| Email Address | docketing@bgllp.com | Add Email | Remove Email |

## Application Information:

| Title of the Invention | Remote Control of Fluid-Handling Devices | | |
|---|---|---|---|
| Attorney Docket Number | 000314.000003 | Small Entity Status Claimed | ☒ |
| Application Type | Nonprovisional | | |
| Subject Matter | Utility | | |
| Suggested Class (if any) | | Sub Class (if any) | |
| Suggested Technology Center (if any) | | | |
| Total Number of Drawing Sheets (if any) | 3 | Suggested Figure for Publication (if any) | |

PTO/AIA/14 (08-12)
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 000314.000003 |
|---|---|---|
| | Application Number | |
| Title of Invention | Remote Control of Fluid-Handling Devices | |

## Publication Information:

| |
|---|
| ☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219) |
| ☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing. |

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| Prior Application Status | | | Remove |
|---|---|---|---|
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| Application Number | Country i | Filing Date (YYYY-MM-DD) | Priority Claimed |
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| | Application Number | |
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| | |
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| Organization Name | AmpliSine Labs, LLC. |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 000314.000003 |
|---|---|---|
| | Application Number | |
| Title of Invention | Remote Control of Fluid-Handling Devices | |

| **Mailing Address Information:** | | | |
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| **Address 1** | 9502 HWY 87 | | |
| Address 2 | | | |
| **City** | Lubbock | **State/Province** | TX |
| **Country** [i] | US | Postal Code | 79423 |
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|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Attorney Docket Number:** | 000314.000003 |
| Filed as Small Entity | |

**Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a) Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| Utility filing Fee (Electronic filing) | 4011 | 1 | 98 | 98 |
| Utility Search Fee | 2111 | 1 | 310 | 310 |
| Utility Examination Fee | 2311 | 1 | 125 | 125 |
| Request for Prioritized Examination | 2817 | 1 | 2400 | 2400 |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| Publ. Fee- early, voluntary, or normal | 1504 | 1 | 300 | 300 |
| Processing Fee, except for Provis. apps | 1808 | 1 | 130 | 130 |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | **Total in USD ($)** | | **3363** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 14414316 |
| **Application Number:** | 13708557 |
| **International Application Number:** | |
| **Confirmation Number:** | 3874 |
| **Title of Invention:** | Remote Control of Fluid-Handling Devices |
| **First Named Inventor/Applicant Name:** | Aaron Phillips |
| **Customer Number:** | 35979 |
| **Filer:** | Joshua L. Tucker/Denise Wilcox |
| **Filer Authorized By:** | Joshua L. Tucker |
| **Attorney Docket Number:** | 000314.000003 |
| **Receipt Date:** | 07-DEC-2012 |
| **Filing Date:** | |
| **Time Stamp:** | 17:29:08 |
| **Application Type:** | Utility under 35 USC 111(a) |

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| Submitted with Payment | yes |
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| Payment was successfully received in RAM | $3363 |
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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | 314-003PatentApplication.pdf | 156123<br>250dbc27208be94dbfc0c270d4a2d49d1c1fd91f | yes | 29 |
| | **Multipart Description/PDF files in .zip description** | | | | |
| | **Document Description** | | **Start** | **End** | |
| | Specification | | 1 | 23 | |
| | Claims | | 24 | 28 | |
| | Abstract | | 29 | 29 | |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Drawings-only black and white line drawings | 314-003Figures.pdf | 330940<br>99548c1c832715fc55e8cffbdad3c6e35ef7345a | no | 3 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Oath or Declaration filed | 314-003PhillipsDeclaration.pdf | 207646<br>319356da8d06e5d6bac9dad29bc6a4323b9101b7 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | TrackOne Request | 314-003sb0424.pdf | 140629<br>516aad72f7701f204eabe43e307a9c13ea70da23 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 5 | Application Data Sheet | 314-003ADS.pdf | 1063883<br>6fe0f2bd61b945f9ad3c332042ff5e113a51e476 | no | 5 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 6 | Fee Worksheet (SB06) | fee-info.pdf | 39715<br>a75651dc9e16abd6cded4bd800e0ecc404767d9d | no | 2 |
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**PATENT APPLICATION**

# REMOTE CONTROL OF FLUID-HANDLING DEVICES

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

**[001]** The present invention relates generally to fluid-handling devices and, more specifically, to remote control of fluid-handling devices.

### 2. Description of the Related Art

**[002]** Fluid-handling devices, such as valves, pumps, and various other forms of process equipment, in many use cases, are widely geographically distributed. For example, when such devices are used to extract petroleum products from an oil well, the associated fluid source or receptacle may be in a relatively remote location, as oil wells are generally distributed relative to one another and located remote from metropolitan areas. Similar issues arise in relation to petro-water disposal facilities, re-injection facilities, and petroleum pumping stations, all of which tend to be geographically distributed and include fluid-handling equipment.

**[003]** When monitoring or controlling such sites, it can be time-consuming and expensive for a technician to manually adjust or otherwise control fluid-handling devices, as the technician will incur costs and delays by traveling to the device to make adjustments or gather data in person. And these adjustments and inspections often occur relatively frequently, as process conditions and market demand fluctuate, thereby further increasing costs.

**[004]** Some systems exist for exercising remote monitoring of fluid-handling devices, such as various supervisory control and data acquisition (SCADA) systems, but many of these systems fail when a network connection is lost. Remote logic controlling such systems generally ceases to exercise control when the remote logic is disconnected in the event of a network failure. Further, some SCADA systems require the installation of special-purpose software on a

computing device in order to exercise control remotely, which tends to deter users from exercising remote control of fluid-handling devices due to the burden of configuring each computer from which remote control is exercised.

## SUMMARY OF THE INVENTION

**[005]** The following is a non-exhaustive listing of some aspects of the present techniques. These and other aspects are described in the following disclosure.

**[006]** In some aspects, the present techniques include a system for remotely controlling fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system including: an input/output module operable to communicate with a fluid-handling device; a network interface; memory; and one or more processors communicatively coupled to the input/output module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps including: receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and sending the translated command to the local controller..

**[007]** Some aspects include a tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations including: receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and sending the translated command to the local controller.

**[008]** Some aspects include a process, including: receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and sending the translated command to the local controller.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[009]** The above-mentioned aspects and other aspects of the present techniques will be better understood when the present application is read in view of the following figures in which like numbers indicate similar or identical elements:

**[0010]** Figure 1 illustrates an example of a command-center server and site master-controller in accordance with some embodiments;

**[0011]** Figure 2 illustrates an example of a process by which remote control of fluid-handling devices is exercised in accordance with some embodiments; and

**[0012]** Figure 3 illustrates an example of a computing device by which the hardware and processes of Figures 1 and 2 may be implemented.

**[0013]** While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. The drawings may not be to scale. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but to the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

## DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

**[0014]** Figure 1 illustrates a computing environment 10 having a control system 12 that, in some implementations, addresses some or all of the above-mentioned deficiencies in certain SCADA

systems for exercising remote control of fluid-handling devices. As explained in greater detail below, the control system 12 of this embodiment includes a command-center server 14 and site master-controllers 16 (specifically, in this example, three such site master-controllers 18, 20, and 22) that cooperate to facilitate remote control at a fluid-handling site 24 from user devices 26 or 28 via the Internet 30. Each site master-controller 16 may be co-located with a corresponding fluid-handling site 24 and, in some embodiments, may include logic that implements remotely issued commands, such that once a command is issued from user devices 26 or 28 and received at a site master-controller 16, the site master-controller 16, in some embodiments, executes the command to completion, even if Internet access is lost before the command is fully executed. Further, the site master-controller 16 of some embodiments may be operative to translate commands into various device-specific protocols, such that a single implementation of the site master-controller 16 is relatively versatile regardless of the type of fluid-handling device being controlled. And in some implementations, the command-center server 14 may be operative to present a command interface and receive commands via a web interface in a web browser on user devices 26 and 28, such that fluid-handling devices can be controlled remotely without the need to install special-purpose software on the computing device through which remote control is exercised. It should be noted, however, that not all embodiments provide all of these benefits, as various engineering and cost trade-offs are envisioned, and some embodiments may provide other or none of these benefits.

**[0015]** In some embodiments, the command-center server 14 includes a web server 32, a data store 34, and a site server 36. The command-center server 14 may act as a central node through which any of a plurality of user devices, such as user devices 26 and 28 (e.g., laptops, tablets, desktop computers, smartphones, and the like), issue commands to any of a plurality site master-controller 16, provided that such access is authorized. Only two user devices and three site master-controllers are shown for simplicity of explanation, but implementations including substantially more of each are envisioned, such as more than several hundred or several thousand user devices and more than several hundred or several thousand site master-controllers, for example. That said, embodiments are also consistent with a single user device and a single site master-controller.

**[0016]** The illustrated web server 32 may be operative to send instructions to present a control interface on the user devices 26 and 28, for example in a web browser on an operating system executed by processors and stored by memory of the user devices 26 or 28. The web server 32 may be operative to receive a request for such an interface from one of the user devices 26 or 28, send instructions (for example HTML JavaScript, and cascading stylesheets) to the user devices 26 that when rendered in a browser of the user devices 26 or 28, presents the control interface. The control interface may include buttons, text-input fields, and the like, that when interacted with by a user (e.g., touching, clicking, keying in text, and the like) generated events handled by the control interface and which cause corresponding commands to be sent from the user devices 26 or 28 to the command-center server 14. Other embodiments may have a special-purpose application executing on the user devices 26 and 28 for presenting the control interface and sending commands to the command-center server 14, e.g., a smartphone app that communicates via a web-based application program interface. The command-center server may interact with the user devices 26 and 28 via an Internet Protocol (IP) address of the command-center server and a port, such as port 80, which may be different from a port by which the command-center server 14 communicates with the various site master-controller 16, as described below, to keep traffic from the different components separate.

**[0017]** The web server 32 may also be operative to send instructions to present reports, and interfaces by which such reports are selected, to the user devices 26 or 28 responsive to user requests for such information or interfaces. As explained in greater detail below, the site master-controller 16 may report various process data, and the web server 32 may present this process data to users upon request. This process data may be stored in the data store 34.

**[0018]** In the data store 34 of some embodiments, the site master-controllers 16 may be organized according to user accounts, with each site master-controller 16 corresponding to at least one user account and some user accounts corresponding to multiple site master-controllers 16, as some users may have, for example, a plurality of oil wells or other facilities which the user wishes to control or monitor. In some embodiments, the data store 34 includes a plurality of account records, each account record having one or more user names, one or more user passwords, billing information (e.g., billing address, subscription price, and invoicing data), and identifiers of one or more site master-controllers (e.g. an IP address of each site master-

controller) with which users under the corresponding account are authorized to interact (e.g., issue commands or view reports of data from the site master-controller). The data store 34 may encode such arrangements of data in a variety of formats, including a relational database, program state, hierarchical key-value pairs, a flat file, or other information encoded in a tangible, non-transitory, machine-readable medium, such as a hard drive or random access memory.

**[0019]** The illustrated site server 36 may be operative to interface between the command-center server 14 and the site master-controllers 16 by directing commands received via the web server 32 to the site master-controller 16 to which the command is addressed and receiving process data from the respective site master-controllers to be stored in the data store 34 or presented to the users via the web server 32. In some embodiments, the site server 36 is operative to receive a command via the web server 32, identify an IP address of the site master-controller 16 to which the command is addressed, and send the command to the respective site master-controller 16, for example via an IP address of the command set center server (which may be the same as that of the web server 32 or different) and via a port of the command-center server 14 (which may be different from a port used for the web server 32, or some embodiments may use the same port).

**[0020]** The data store 34, web server 32, and site server 36 may be co-located, for example in a single computing device, or these components 32 and 34 may be distributed across a number of computing devices, either co-located or physically distributed. The web server 32 and site server 36 may be operative to issue queries to the data store 34 to implement requests from the user devices 26 or 28, and the web server 32 may communicate with the site server 36 to effectuate commands.

**[0021]** In some embodiments, each site master-controller 16 controls a respective fluid-handling site 24 (only one of which is shown for site master-controller 18, though each of the other site master-controllers 20 and 22 may be associated with their own, differently located fluid-handling site, or some sites may have multiple site master controllers). The site master-controller 16 may receive commands from the command-center server 14 and implement those commands to completion, for example without further feedback to, and control signals from, the command-center server 14, such that the command can be executed even if a network connection to the command-center server 14 is temporarily lost. Further, the site master-controller 16 may be

operative to report process data to the command-center server 14 for storage in the data store 34 and presentation via the web server 32 on user devices 26 and 28.

**[0022]** In some embodiments, the site master-controllers 16 are physically located at an associated fluid-handling site 24. For example, the site master-controller 18 may be connected to the fluid-handling site via a private network through which communications are sent without passing through the public Internet, and in some cases, the site master-controller 18 may be within a mile of the fluid-handling site 24, to give one example of co-location. The site master-controllers 16 may be geographically remote from one another, the command-center server 14, and the user devices 26 and 28 (each of which may also be remote from one another). For example, each of these components may be more than 1 mile from one another or not connected to one another via a private network. In some cases, though, some sites may have multiple site master-controllers co-located at a single site or some user devices may be co-located.

**[0023]** To execute commands at the fluid-handling site 24, the site master-controller 18 translates the received commands into a protocol appropriate for a corresponding fluid-handling device 38 (identified individually by reference numbers 40, 42, 44, 46, and 48). Accordingly, the features of the fluid-handling site 24 are described before addressing internal components of the exemplary site master-controller 18 to explain the environment in which the site master-controller 18 operates.

**[0024]** In this embodiment, the fluid-handling site 24 includes a plurality of fluid-handling devices 38 that are fluidly coupled to a fluid source 50 or a fluid receptacle 52, such that fluids (e.g., liquids or gases) can flow to, from, or through the respective fluid-handling device 38. The illustrated embodiment includes five fluid-handling devices, but other embodiments may include different numbers of such devices coupled to the various site master-controllers 16.

**[0025]** The fluid-handling devices may be any of a variety of different types of devices that handle fluids. For example, the fluid-handling devices may be a valve, a pump, a process chamber (for instance a oil/water separation tank), or a process filter, or level switch. In some cases, the fluid-handling device may include an actuator, for instance an electric motor or a hydraulic drive, by which fluid flow or other parameters are manipulated, a sensor 56 by which process parameters are measured, or a local controller 58 by which power to the actuator 54 is

modulated. Fluid-handling devices 38 may include a variety of types of sensors, for instance, a temperature, viscosity, flowrate, fluid level, pressure, conductivity, or other parameter sensor.

**[0026]** The illustrated fluid-handling device 40 is shown with feedback control of the actuator 54 by the local controller 58 based on measurements from the sensor 56, but other embodiments may include an actuator with feed-forward control, including actuators controlled by an on-off switch without sensor feedback. The local controller 58 may be operative to receive a command to drive the actuator 54 from a current setpoint to a target setpoint and control the flow of power (e.g. hydraulic or electric power) to the actuator 54 to implement the requested change of state. For instance, the controller 58 may receive a command to change a speed, pressure, or flowrate of a pump and may respond by increasing or decreasing a flow of electric or hydraulic power to an electrical or hydraulic motor driving such a pump. Or the controller 58 may receive a command to open or close a valve and, in response, may increase or decrease a flow of electric or hydraulic power to a corresponding actuator that opens or closes the valve.

**[0027]** In some cases, the local controllers 58 may have relatively limited processing power, such that more complicated changes in state are executed responsive to multiple commands to the respective fluid-handling device 38. For example, a fluid-handling device 38 with feed-forward control may receive a command to adjust to a target setpoint, return sensor data to the site master-controller 18, and received a subsequent command to adjust further based on a determination made by the site master-controller 18 based on the sensor data. In another example, a stuck-valve may be loosened by a series of commands issued from the site master-controller 18 causing a local controller 58 to oscillate between states, working the stuck-valve loose. Similarly, shocks to up-stream or down-stream fluid-handling devices may be mitigated by a series of commands gradually changing the state of a given fluid-handling device, for instance gradually ramping up or down the speed of a pump or gradually opening or closing a valve. In some embodiments, an action that affects the system, yet originates from outside the system, may use logic from a controller in the local system, such as a relatively drastic or rapid reduction in a specific tank level, which may indicate that a leak in a tank may exists, and the outside logic may provide which tank is experiencing the leak.

**[0028]** The site master-controller 18, in some embodiments, communicates with the fluid-handling devices 38 via a plurality of control buses 60 (individually labeled as 62, 64, and 66). Each control bus 60 may be operative to convey commands to one or more of the fluid-handling devices 38 using a different protocol. In this example, control bus 66 communicates with fluid-handling devices 42 and 40, control bus 64 communicates with fluid-handling device 44, and control bus 62 communicates with fluid-handling devices 46 and 48, but this arrangement is merely exemplary, and other embodiments may include more or fewer control buses, more or fewer fluid-handling devices per control bus, and more or fewer control buses per fluid-handling device. The control buses 60 may be serial or parallel control buses conveying digital or analog signals.

**[0029]** In one particular implementation, intended to serve merely as an example, the control bus 66 conveys commands and data using a serial communication protocol, such as the Modbus remote terminal unit (RTU) protocol, in which commands and other data are encoded in binary signals packaged in frames having redundant bits for detecting errors. The fluid-handling devices 40 and 42 on the bus 66, in this example, each have a unique address on the bus 66 by which commands from the site master-controller 68 are addressed to specific fluid-handling devices 40 or 42, and these addresses may be stored in memory of the site master-controller 18 as described in greater detail below. In some examples, site master-controller 18 acts as a master device on the bus 66, controlling which devices are permitted to transmit signals on the bus 66 at a given point in time. In this example, the fluid-handling devices 42 and 40 may include a bus interface that detects when a command is addressed to the respective fluid-handling device and stores the command for further processing, for example by a local controller 58 that implements the command. For example, fluid-handling device 40 may be a pump, and the bus 66 may convey commands to the local controller 58 to increase the speed of the actuator 54, for example an electric motor speed, to increase a pumping flowrate or pressure. In another example, the site master-controller 18 may issue a command on bus 66 to fluid-handling device 40 to return a value sensed by sensor 56, for example a measured pump speed, pressure, or flowrate.

**[0030]** In another aspect of this particular exemplary implementation, the bus 64 conveys a single value, for example a binary on/off value encoded in a voltage or current, or an analog control signal, encoded in a current or voltage, to one fluid-handling device 44 via a single wire

(or pair of wires, if a reference different from ground is used). In some cases, the value may be a voltage ranging from 0 to 5 V, or some other range, in which a relatively low voltage, below a threshold, corresponds to an off signal, and a relatively high voltage, above a threshold, corresponds to an on signal. In some cases, the same command may be conveyed to multiple fluid-handling devices connected in series or parallel, or multiple commands may be conveyed by multiple wires in parallel to a single fluid-handling device or multiple fluid-handling devices, for instance one on-off signal per fluid-handling device. As explained in greater detail below, one or more instances the bus 64 may connect to a data acquisition board of the site master-controller 18 for manipulating voltage or current to encode commands. In one example, the bus 64 conveys a binary value to a local controller for a valve actuator as a voltage-high or voltage-low signal, commanding the valve to open or close, respectively. In some cases, instances of the bus 64 may also return data to the site master-controller 18, for example as an analog signal indicating the state of a sensor. In some embodiments, instances of the bus 64 may connect to sensors on fluid-handling devices that are also connected to the bus 66 or the bus 62, e.g., returning sensor values, while the other buses convey commands.

**[0031]** In another aspect of this particular exemplary implementation, the bus 62 is an Ethernet bus, forming a private local area network by which the site master-controller 18 communicates with fluid-handling devices 46 and 48 via the Ethernet protocol. Examples of various forms of constraints and set point targeting that might be implemented with such communication are described below with reference to local controllers. In this example, data is conveyed in frames of binary data, and each of the site master-controller 18 and the fluid-handling devices 46 and 48 are associated with a respective network address that, when included in such a frame, indicates that the frame is addressed to the associated device. Frames may include redundancy to detect corrupted frames, and access to the bus 62 may be controlled in a distributed fashion, by each device sensing whether a transmission by the device caused a collision on the bus 62, e.g., using carrier-sense multiple-access techniques with collision detection. In this example, fluid-handling devices 46 and 48 may include network interfaces, such as network interface cards or integrated devices that detect frames addressed to the corresponding fluid-handling device 46 or 48, capture the frames, and store commands encoded in the frames (e.g., in a buffer) for subsequent processing by a local controller. Similarly, the fluid-handling devices 46 and 48 may return data

to the site master-controller 18, for example data from sensors of the fluid-handling devices, using the Ethernet protocol.

**[0032]** As noted above, the site master-controller 18, in this embodiment, like the other site master-controller 20 and 22, is operative to receive commands from the command-center server 14 and translate those commands in accordance with both protocols of the respective buses 62, 64, or 66 and command formats supported by the fluid-handling devices 38 (e.g., command codes, on-off signals, application-program interfaces, and the like, depending on the device). To this end, in this embodiment, the site master-controller 18 includes a network interface 68, a site management module 70, a protocol multiplexer 72, command translators 74 (individually labeled as 76, 78, 80), controllers 82 (individually labeled as 84, 86, 88, 90, 92, and 94), and input/output modules 96 (individually labeled as 98, 100, and 102). The site master-controller 18 may also include a report buffer 104 that stores data to be reported back to the command-center server 14.

**[0033]** The illustrated network interface 68 is operative to communicate with the command-center server 14 via the Internet 30 (e.g., via the Internet and other networks, such as a local area network, a cellular network, or the like). In some embodiments, the site management module 70 communicates with the network interface 68 via application program interfaces of an operating system in which the site master-controller 18 is executed.

**[0034]** The illustrated site-management module 70 is operative to coordinate the operation of the other components of the site master-controller 18. In some cases, the site management module 70 monitors a network socket defined by an Internet protocol address and port of the site master-controller 18 and handles events, e.g., incoming commands, from the network socket. In some embodiments, the site-management module 70 is implemented with multiple threads, in a system in which one thread sends and receives data request; one thread controls and monitors the current state of the system, causing other threads to be synced with current information; one thread writes to writeable devices (e.g., devices having memory) to set the target state of each device; one thread that handles server interaction for updating and receiving; one thread that handles user interaction (e.g., presenting interfaces on an local display, receiving user input, and handling events from such input); and one thread that eliminates threads that become problematic.

**[0035]** The site manager module 70 may also be operative to transmit data with the network socket, using the network interface 68, to the command-center server 14. For example, the site manager module 70 may periodically retrieve data from the report buffer 104, such as alarms, measurements from sensors, and other data associated with the fluid-handling site 24, and push this data to the command-center server 14. Or the site management module 70 may be operative to receive requests for such data being pulled from the command-center server 14, and retrieve the corresponding data from the report buffer 104 for transmission back to the command-center server 14. Further, the site manager module 70 may be operative to request measurements, alarms, and other data from the fluid-handling devices via the components 72, 74, 82, and 96, and store this data in the report buffer 104 for transmission to the command-center server 14.

**[0036]** In this embodiment, when the site management module 70 receives a command via the network interface 68, or issues its own command (e.g., to poll sensors or alarm logs), the command is conveyed to a protocol multiplexer 72, which may be operative to determine which control bus 60 and fluid-handling device 38 will receive a corresponding translated command. For example, the protocol multiplexer 72 may store in memory records for communicating with the fluid-handling devices 38. Each record may correspond to a individual fluid-handling device 38 or an individual actuator or sensor of a fluid-handling device, and each record may include a unique identifier of the corresponding device, actuator, or sensor; a control bus address of the device, actuator, or sensor (for those components on a control bus that is addressable); an identifier of the control bus 62, 64, or 66 through which the site master-controller 18 communicates with the device, actuator, or sensor; and an identifier of the protocol through which such communication occurs.

**[0037]** When a command is received at the protocol multiplexer 72, in some embodiments, the command includes the identifier of the device, actuator, or sensor to which the command is directed, and using this identifier, the protocol multiplexer 72 retrieves the corresponding record from memory to identify the appropriate protocol. In this example, based on the protocol in the record, the protocol multiplexer 72 selects among the command translators 74, each of which corresponds to a different protocol. For example, the command translator 80 may correspond to a protocol of control bus 66, such as the modbus RTU protocol; the command translator 78 may corresponds to a protocol of the control bus 64, such as a binary or analog voltage or current

signal conveyed via a data acquisition board; and the command translator 76 may corresponds to a protocol of the control bus 62, such as the Ethernet protocol.

**[0038]** The command translators 74 may be operative to translate a received command from an input format to a format configured to effectuate changes in the fluid-handling devices 38. For instance, a generic command to open a valve may be sent from the control-center server 14, and that command may be translated to differently depending on the specific protocol used to communicate with the corresponding valve at a given site, with different sites potentially employing different protocols for the task. Translating commands may abstract the details of the site-specific implementations away from those implementing the command-center server 14, facilitating relatively rapid deployment of new features or sites.

**[0039]** In one example of translation, the command translator 80 may receive a command to increase a pump speed, and the command translator may determine a corresponding command via calculation or look-up table, such as a modbus function code and associated data, that when conveyed via the control bus 66 causes a corresponding fluid-handling device 40 or 42 to change state. In some embodiments, prior to execution, the command is checked for validity, to ensure the current conditions of the system warrant that the commanded action occur to preventing harm to the fluid-handling devices.

**[0040]** For example, some embodiments may store in memory accessible to the command translator 80 system constraints describing acceptable patterns of input and output parameters. The system constraints may be selected to prevent damage to the system, e.g., a maximum speed for a pump, a maximum or minimum liquid height for a tank, a maximum or minimum fluid pressure, a maximum or minimum flow rate, an impermissible pattern of open valves that would leak oil outside of the system, etc. A command may be compared against these constraints to determine whether the command would cause the system to violate one of the constraints. In response to determining that the command would violate a constraint, the command may be rejected, an override confirmation may be requested from the operator, or the command may be executed to the extent permitted by the constraints, for instance.

**[0041]** Some embodiments may execute the translated commands in different modes. For instance, in an automatic mode, the command translator 80 may select set points to keep the

system within the above-described constraints, execute a process recipe in which a collection of set points are targeted, or to target other output set points given the above described constraints. In another example, the system may operate in a mixed automatic mode in which the user selects which devices are manually controlled while other devices are automatically controlled. In a third example, a manual mode, each of the devices may be controlled manually.

**[0042]** In another example, the command translator 78 may be operative to determine whether a command corresponds to a particular voltage or current on an individual instance of the control bus 64. For example, a command to dislodge a stuck valve may be translated by the command translator 78 into a sequence of on and off signals conveyed via a high and low voltage on an individual wire corresponding to bus 64.

**[0043]** In another example, the command translator 76 may be operative to translate commands into a format configured to change the state of fluid-handling devices 46 or 48. Or in some embodiments, command translator 76 is operative to pass through and un-translated command if appropriately formatted as received from the command-center server 14.

**[0044]** Some embodiments may include controllers 82 operative to execute control routines implicated by the translated commands on an individual device 38, actuator 54, or sensor 56. To this end, the commands translator 74, in addition to transmitting commands, may also route the translated command to a controller 82 corresponding to the specific device, actuator, or sensor to which the command is directed. The controllers 82 may determine set points corresponding to (or conveyed in) the command, send control signals configured to drive the fluid-handling device to the set points, and receive feedback from the fluid-handling device 38 indicative of whether the fluid-handling device 38 has achieved the target set point. In some embodiments, the controllers 82 include proportional-integral-derivative controllers for exercising feedback control, or the controllers 82 may include feed forward control algorithms (e.g., look-up tables or formulas for calculating commands based on set points). Further, in some embodiments, the controllers 82 may change the set point over time in accordance with the received command, for example a command to gradually ramp up a motor speed, a command to gradually open a valve, or a command to oscillate the position of a valve to dislodge a stuck valve. Algorithms for

changing the set point may be stored in memory accessible to the controllers 82 responsive to a translated command implicating the specific algorithm.

**[0045]** The illustrated input/output modules 26 include, in some embodiments, link-layer devices that accommodate the particular features of the physical medium with which control buses 62, 64, and 66 are implemented. In some cases, the input/output modules 96 also perform encoding and decoding at the network and transport layer, for example packaging data in appropriately structured frames for the respective control bus 60. In one example, the input/output module 102 includes a modbus modem, the input/output module 100 includes a data acquisition board (for example a printed circuit board having one or more digital-to-analog converters or analog-to-digital converters), and the input/output module 98 includes an Ethernet network interface card.

**[0046]** The site master-controller 18, thus, may be operative to receive commands from the site server 36 of the command-center server 14, translate those commands, identify the appropriate control bus 60 and, if needed, address on the control bus, and implement the command once received, even if network access is lost after the command is issued from the command-center server 14. Further, the site master-controller 18, in some embodiments, is operative to retrieve sensor data, alarms, and other site data, and buffer such data in the report buffer 104, before the data is periodically returned to the command-center server 14, such that buffered data is not lost if network access ceases intermittently. Accordingly, some embodiments provide control and monitoring of remote fluid handling sites 24 that is relatively robust to interruptions in network service, and some embodiments facilitate such monitoring and control via a web browser on user devices 26 and 28, such that the addition of new devices or users is relatively simple compared to systems that require special purpose applications. Again though, not all embodiments provide these benefits, and some embodiments may provide other benefits.

**[0047]** The components of the site master-controller 18 and command-center server 14 are described above with reference to discrete functional blocks and as discrete unitary components, but it should be understood that software or hardware by which these functional blocks or components are implemented may be distributed across multiple computing systems or multiple processes within a computing system, and code, stored in a tangible, non-transitory, machine-readable medium, for providing this functionality or the functionality described below may be

intermingled, conjoined, divided, or otherwise differently organized than the manner in which the functional blocks are illustrated.

**[0048]** Figure 2 illustrates an embodiment of a process 104 for exercising remote control of a fluid-handling site. The process 104 may be performed by the above-described site master-controllers 16, though embodiments are not limited to the implementations described above. Further, embodiments may include additional steps, fewer steps, and steps in a different order from the manner in which the process 104 is illustrated, which is not to suggest that any other feature described herein is required in all embodiments or cannot be modified.

**[0049]** In some embodiments, the process 104 includes receiving, via a network interface, from a remote user device, (e.g., via a command-center server) a command to change a state of a fluid-handling device to a target state, as illustrated by block 106. The command may be received from, for example, the above-describes site server 36, which may have received the command from a remote user device via a web browser of the user device. Further, the command to change the fluid-handling device to a target state may include a command that changes the fluid-handling device to a plurality of different states over time, such as a command to ramp up or down a motor speed or oscillate some parameter.

**[0050]** In some embodiments, the process 104 includes identifying a protocol and control bus of the fluid-handling device, as illustrated by block 108. Identifying a protocol and control bus may include parsing an identifier of a device, actuator, or sensor from the received command and retrieving a corresponding record based on the identifier, the record including an identifier of the protocol and control bus. In some embodiments, the retrieved record may also include an identifier of a control bus address of the corresponding device, actuator, or sensor.

**[0051]** In some embodiments, the process 104 includes translating the received command into a translated command based on the identified protocol, as illustrated by block 110. Examples of such translation are described above with reference to the command translators 74.

**[0052]** The process 104 may also include sending the translated command to a local controller of the fluid-handling device via the identified control bus, as illustrated by block 112. Sending the translated command may include exercising feedback control of the fluid-handling device based

on sensor data received from the fluid-handling device by adjusting a set point sent to the local controller. Or in some use cases, sending the translated command may include sending a sequence of set points that change over time.

**[0053]** In some embodiments, the process 104 includes receiving sensor data from the fluid-handling device confirming that the command was executed, as illustrated by block 114. As with the other features described herein, not all embodiments include this step. Using this data, some embodiments may exercise feedback control or may retrieve sensor measurements following the execution of a command for reporting to the user device. In some cases, the sensor data is retrieved regardless of whether a command was issued, for example periodically to monitor the state of the fluid-handling device. In one example, the fluid-handling device is an oil/water separation tank, and a set point of a pump is adjusted to change a fluid level in the tank, e.g., a level at which oil meets water or a level of the oil.

**[0054]** In some embodiments, the received sensor data is stored in local memory, as illustrated by block 116. For example, the received sensor data may be stored in the above-described report buffer 104.

**[0055]** In some embodiments, the process 104 further includes periodically sending the sensor data to the remote server for reporting to the user device, as illustrated by block 118. Periodically, data from the report buffer may be transmitted to the above-described command-center server 14 for compilation of reports requested by user devices 26 to 28. Similarly, alarms or other log data issued by fluid-handling devices may also be retrieved, stored, and transmitted to the command-center server 14 for reporting.

**[0056]** Thus, systems implementing the process 104, in some embodiments, offer relatively robust control and monitoring of fluid-handling devices that are geographically distributed. This is expected to lower the costs associated with operating such fluid-handling devices and facilitate the extraction of petroleum products and other processing of fluids.

**[0057]** Figure 3 is a diagram that illustrates an exemplary computing system 1000 in accordance with embodiments of the present technique. Various portions of systems and methods described herein, may include or be executed on one or more computer systems similar to computing

system 1000. Further, processes and modules described herein may be executed by one or more processing systems similar to that of computing system 1000.

**[0058]** Computing system 1000 may include one or more processors (e.g., processors 1010a-1010n) coupled to system memory 1020, an input/output I/O device interface 1030 and a network interface 1040 via an input/output (I/O) interface 1050. A processor may include a single processor or a plurality of processors (e.g., distributed processors). A processor may be any suitable processor capable of executing or otherwise performing instructions. A processor may include a central processing unit (CPU) that carries out program instructions to perform the arithmetical, logical, and input/output operations of computing system 1000. A processor may execute code (e.g., processor firmware, a protocol stack, a database management system, an operating system, or a combination thereof) that creates an execution environment for program instructions. A processor may include a programmable processor. A processor may include general or special purpose microprocessors. A processor may receive instructions and data from a memory (e.g., system memory 1020). Computing system 1000 may be a uni-processor system including one processor (e.g., processor 1010a), or a multi-processor system including any number of suitable processors (e.g., 1010a-1010n). Multiple processors may be employed to provide for parallel or sequential execution of one or more portions of the techniques described herein. Processes, such as logic flows, described herein may be performed by one or more programmable processors executing one or more computer programs to perform functions by operating on input data and generating corresponding output. Processes described herein may be performed by, and apparatus can also be implemented as, special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application specific integrated circuit). Computing system 1000 may include a plurality of computing devices (e.g., distributed computer systems) to implement various processing functions.

**[0059]** I/O device interface 1030 may provide an interface for connection of one or more I/O devices 1060 to computer system 1000. I/O devices may include devices that receive input (e.g., from a user) or output information (e.g., to a user). I/O devices 1060 may include, for example, graphical user interface presented on displays (e.g., a cathode ray tube (CRT) or liquid crystal display (LCD) monitor), pointing devices (e.g., a computer mouse or trackball), keyboards, keypads, touchpads, scanning devices, voice recognition devices, gesture recognition devices,

printers, audio speakers, microphones, cameras, or the like. I/O devices 1060 may be connected to computer system 1000 through a wired or wireless connection. I/O devices 1060 may be connected to computer system 1000 from a remote location. I/O devices 1060 located on remote computer system, for example, may be connected to computer system 1000 via a network and network interface 1040.

**[0060]** Network interface 1040 may include a network adapter that provides for connection of computer system 1000 to a network. Network interface may 1040 may facilitate data exchange between computer system 1000 and other devices connected to the network. Network interface 1040 may support wired or wireless communication. The network may include an electronic communication network, such as the Internet, a local area network (LAN), a wide area (WAN), a cellular communications network or the like.

**[0061]** System memory 1020 may be configured to store program instructions 1100 or data 1110. Program instructions 1100 may be executable by a processor (e.g., one or more of processors 1010a-1010n) to implement one or more embodiments of the present techniques. Instructions 1100 may include modules of computer program instructions for implementing one or more techniques described herein with regard to various processing modules. Program instructions may include a computer program (which in certain forms is known as a program, software, software application, script, or code). A computer program may be written in a programming language, including compiled or interpreted languages, or declarative or procedural languages. A computer program may include a unit suitable for use in a computing environment, including as a stand-alone program, a module, a component, a subroutine. A computer program may or may not correspond to a file in a file system. A program may be stored in a portion of a file that holds other programs or data (e.g., one or more scripts stored in a markup language document), in a single file dedicated to the program in question, or in multiple coordinated files (e.g., files that store one or more modules, sub programs, or portions of code). A computer program may be deployed to be executed on one or more computer processors located locally at one site or distributed across multiple remote sites and interconnected by a communication network.

**[0062]** System memory 1020 may include a tangible program carrier having program instructions stored thereon. A tangible program carrier may include a non-transitory computer readable storage medium. A non-transitory computer readable storage medium may include a machine readable storage device, a machine readable storage substrate, a memory device, or any combination thereof. Non-transitory computer readable storage medium may include, non-volatile memory (e.g., flash memory, ROM, PROM, EPROM, EEPROM memory), volatile memory (e.g., random access memory (RAM), static random access memory (SRAM), synchronous dynamic RAM (SDRAM)), bulk storage memory (e.g., CD-ROM and/or DVD-ROM, hard-drives), or the like. System memory 1020 may include a non-transitory computer readable storage medium may have program instructions stored thereon that are executable by a computer processor (e.g., one or more of processors 1010a-1010n) to cause the subject matter and the functional operations described herein. A memory (e.g., system memory 1020) may include a single memory device and/or a plurality of memory devices (e.g., distributed memory devices). In some embodiments, the program may be conveyed by a propagated signal, such as a carrier wave or digital signal conveying a stream of packets.

**[0063]** I/O interface 1050 may be configured to coordinate I/O traffic between processors 1010a-1010n, system memory 1020, network interface 1040, I/O devices 1060 and/or other peripheral devices. I/O interface 1050 may perform protocol, timing or other data transformations to convert data signals from one component (e.g., system memory 1020) into a format suitable for use by another component (e.g., processors 1010a-1010n). I/O interface 1050 may include support for devices attached through various types of peripheral buses, such as a variant of the Peripheral Component Interconnect (PCI) bus standard or the Universal Serial Bus (USB) standard.

**[0064]** Embodiments of the techniques described herein may be implemented using a single instance of computer system 1000, or multiple computer systems 1000 configured to host different portions or instances of embodiments. Multiple computer systems 1000 may provide for parallel or sequential processing/execution of one or more portions of the techniques described herein.

**[0065]** Those skilled in the art will appreciate that computer system 1000 is merely illustrative and is not intended to limit the scope of the techniques described herein. Computer system 1000 may include any combination of devices or software that may perform or otherwise provide for the performance of the techniques described herein. For example, computer system 1000 may include or be a combination of a cloud-computing system, a data center, a server rack, a server, a virtual server, a desktop computer, a laptop computer, a tablet computer, a server device, a client device, a mobile telephone, a personal digital assistant (PDA), a mobile audio or video player, a game console, a vehicle-mounted computer, or a Global Positioning System (GPS), or the like. Computer system 1000 may also be connected to other devices that are not illustrated, or may operate as a stand-alone system. In addition, the functionality provided by the illustrated components may in some embodiments be combined in fewer components or distributed in additional components. Similarly, in some embodiments, the functionality of some of the illustrated components may not be provided or other additional functionality may be available.

**[0066]** Those skilled in the art will also appreciate that, while various items are illustrated as being stored in memory or on storage while being used, these items or portions of them may be transferred between memory and other storage devices for purposes of memory management and data integrity. Alternatively, in other embodiments some or all of the software components may execute in memory on another device and communicate with the illustrated computer system via inter-computer communication. Some or all of the system components or data structures may also be stored (e.g., as instructions or structured data) on a computer-accessible medium or a portable article to be read by an appropriate drive, various examples of which are described above. In some embodiments, instructions stored on a computer-accessible medium separate from computer system 1000 may be transmitted to computer system 1000 via transmission media or signals such as electrical, electromagnetic, or digital signals, conveyed via a communication medium such as a network or a wireless link. Various embodiments may further include receiving, sending or storing instructions or data implemented in accordance with the foregoing description upon a computer-accessible medium. Accordingly, the present invention may be practiced with other computer system configurations.

**[0067]** It should be understood that the description and the drawings are not intended to limit the invention to the particular form disclosed, but to the contrary, the intention is to cover all

modifications, equivalents, and alternatives falling within the spirit and scope of the present invention as defined by the appended claims. Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description and the drawings are to be construed as illustrative only and are for the purpose of teaching those skilled in the art the general manner of carrying out the invention. It is to be understood that the forms of the invention shown and described herein are to be taken as examples of embodiments. Elements and materials may be substituted for those illustrated and described herein, parts and processes may be reversed or omitted, and certain features of the invention may be utilized independently, all as would be apparent to one skilled in the art after having the benefit of this description of the invention. Changes may be made in the elements described herein without departing from the spirit and scope of the invention as described in the following claims. Headings used herein are for organizational purposes only and are not meant to be used to limit the scope of the description.

**[0068]** As used throughout this application, the word “may” is used in a permissive sense (i.e., meaning having the potential to), rather than the mandatory sense (i.e., meaning must). The words “include”, “including”, and “includes” and the like mean including, but not limited to. As used throughout this application, the singular forms “a”, “an” and “the” include plural referents unless the content explicitly indicates otherwise. Thus, for example, reference to “an element” or "a element" includes a combination of two or more elements, notwithstanding use of other terms and phrases for one or more elements, such as “one or more.” The term "or" is, unless indicated otherwise, non-exclusive, i.e., encompassing both "and" and "or." Terms describing conditional relationships, e.g., "in response to X, Y," "upon X, Y,", “if X, Y,” "when X, Y," and the like, encompass causal relationships in which the antecedent is a necessary causal condition, the antecedent is a sufficient causal condition, or the antecedent is a contributory causal condition of the consequent, e.g., "state X occurs upon condition Y obtaining" is generic to "X occurs solely upon Y" and "X occurs upon Y and Z." Such conditional relationships are not limited to consequences that instantly follow the antecedent obtaining, as some consequences may be delayed, and in conditional statements, antecedents are connected to their consequents, e.g., the antecedent is relevant to the likelihood of the consequent occurring. Further, unless otherwise indicated, statements that one value or action is “based on” another condition or value encompass both instances in which the condition or value is the sole factor and instances in

which the condition or value is one factor among a plurality of factors. Unless specifically stated otherwise, as apparent from the discussion, it is appreciated that throughout this specification discussions utilizing terms such as "processing", "computing", "calculating", "determining" or the like refer to actions or processes of a specific apparatus, such as a special purpose computer or a similar special purpose electronic processing/computing device. In the context of this specification, a special purpose computer or a similar special purpose electronic processing or computing device is capable of manipulating or transforming signals, for instance signals represented as physical electronic, optical, or magnetic quantities within memories, registers, or other information storage devices, transmission devices, or display devices of the special purpose computer or similar special purpose processing or computing device.

## CLAIMS

What is claimed is:

1. A system for remotely controlling fluid-handling device of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station, the system comprising:

an input/output module operable to communicate with a fluid-handling device;

a network interface;

memory; and

one or more processors communicatively coupled to the input/output module, the network interface, and the memory, wherein the memory stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state;

translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and

sending the translated command to the local controller.

2. The system of claim 1, wherein the memory also stores instructions that when executed by the processors cause the processors to effectuate steps comprising:

receiving, from the fluid-handling device, sensor data indicative of the operation of the fluid-handling equipment obtained by sensors of the fluid-handling device; and

sending, to a remote data store, the received sensor data.

3. The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, a request for a data indicative of the operation of an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station coupled to the fluid-handling device;

retrieving, from the data store, data responsive to the request from the user device; and

sending, to the user device, the retrieved data for presentation to the user.

4. The system of claim 3, wherein the request is a request for data indicative of an amount of oil or other type of fluid extracted from, or injected into, an oil well, a petro water disposal or re-injection facility, or a petroleum pumping station to which the fluid-handling device is coupled, and wherein the retrieved data comprises data indicative of the amount of oil, produced fluid, or flowback fluid.

5. The system of claim 3, wherein the request is a request to view alarms issued by the fluid-handling device, and wherein the retrieved data comprises data indicative of the alarms.

6. The system of claim 3, wherein the retrieved data comprises messages provided to the web-server regarding attempts to address the alarms.

7. The system of claim 2, comprising the remote data store and a web-server, wherein the web-server is operative to perform steps comprising:

receiving, from a user device, the command to change the state of the fluid-handling device; and

determining a network address of the network interface; and

sending the command to the network interface.

8. The system of claim 1, wherein fluid-handling device comprises a pump, and wherein the command comprises a command to change a speed of the pump.

9. The system of claim 1, comprising a remote terminal unit through which the one or more processes communicate with the fluid-handling device, wherein translating the received command comprises:

identifying an address on a serial bus corresponding to a component of the fluid-handling device responsive to the received command;

identifying a command code operative to cause the component to execute the received command; and

sending to the address on the serial bus the command code.

10. The system of claim 1, comprising a digital-to-analog converter, wherein the fluid-handling device comprises a valve responsive to an output signal of the digital-to-analog converter, and wherein translating the received command comprises changing an output signal of the digital-to-analog converter responsive to the receive command.

11. The system of claim 1, wherein receiving the command comprises receiving the command via a first network socket, and wherein sending the translated command comprises sending the translated command via a second network socket.

12. The system of claim 1, wherein translating the command comprises selecting among an Internet Protocol, a modbus protocol, and an analog output to convey the translated command.

13. The system of claim 1, wherein the local controller comprises a processor operative to execute the translated command after losing a network connection to the network interface and before the fluid-handling device is in the target state.

14. The system of claim 1, comprising one of the following coupled to the fluid-handling device: an oil well, a salt water disposal well, a carbon-capture well, or a pump station.

15. The system of claim 1, wherein the fluid-handling device comprises an oil/water separation unit, and wherein the command comprises a command operative to change a level of the oil/water separation unit at which oil meets water.

16. The system of claim 15, wherein the oil/water separation unit comprises a pump having a variable-frequency drive, and wherein the local controller is operative to adjust a frequency of

the variable frequency drive until the level of the oil/water separation unit reaches a target level corresponding to the target state.

17. The system of claim 1, comprising:

a remote server coupled to the network interface via the Internet;

a plurality of oil-wells, petro water disposal or re-injection facilities, or petroleum pumping station, each oil well, petro water disposal or re-injection facility, or petroleum pumping station coupled to a corresponding one of a plurality of systems, each respective system being in communication with the remote server via the Internet and comprising:

a respective input/output module operable to communicate with a respective fluid-handling device;

a respective network interface;

a respective memory; and

a respective set of one or more processors communicatively coupled to the respective input/output module, the respective network interface, and the respective memory, wherein the respective memory stores instructions that when executed by the respective processors cause the respective processors to effectuate steps comprising:

receiving, via the respective network interface, from the remote user device, a respective command to change a respective state of the respective fluid-handling device to a respective target state;

translating the received respective command into a respective translated command operative to cause a respective local controller of the respective fluid-handling device to drive the respective fluid-handling equipment to the respective target state; and

sending the respective translated command to the respective local controller.

18. The system of claim 17, wherein the remote server comprises a user account data store storing data associating each of the respective systems with a single user account distinct from a plurality of other user accounts in the data store.

19. A tangible, non-transitory machine-readable medium storing instructions that when executed by a data processing apparatus cause the data processing apparatus to perform operations comprising:

receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state;

translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and

sending the translated command to the local controller.

20. A method, comprising:

receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state;

translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and

sending the translated command to the local controller.

## ABSTRACT

**[0069]** Provided is a process, including: receiving, via the network interface, from a remote user device, a command to change a state of the fluid-handling device to a target state; translating the received command into a translated command operative to cause a local controller of the fluid-handling device to drive the fluid-handling equipment to the target state, the local controller being responsive to the command and feedback from the fluid-handling device indicative of whether the fluid-handling device is in the target state; and sending the translated command to the local controller

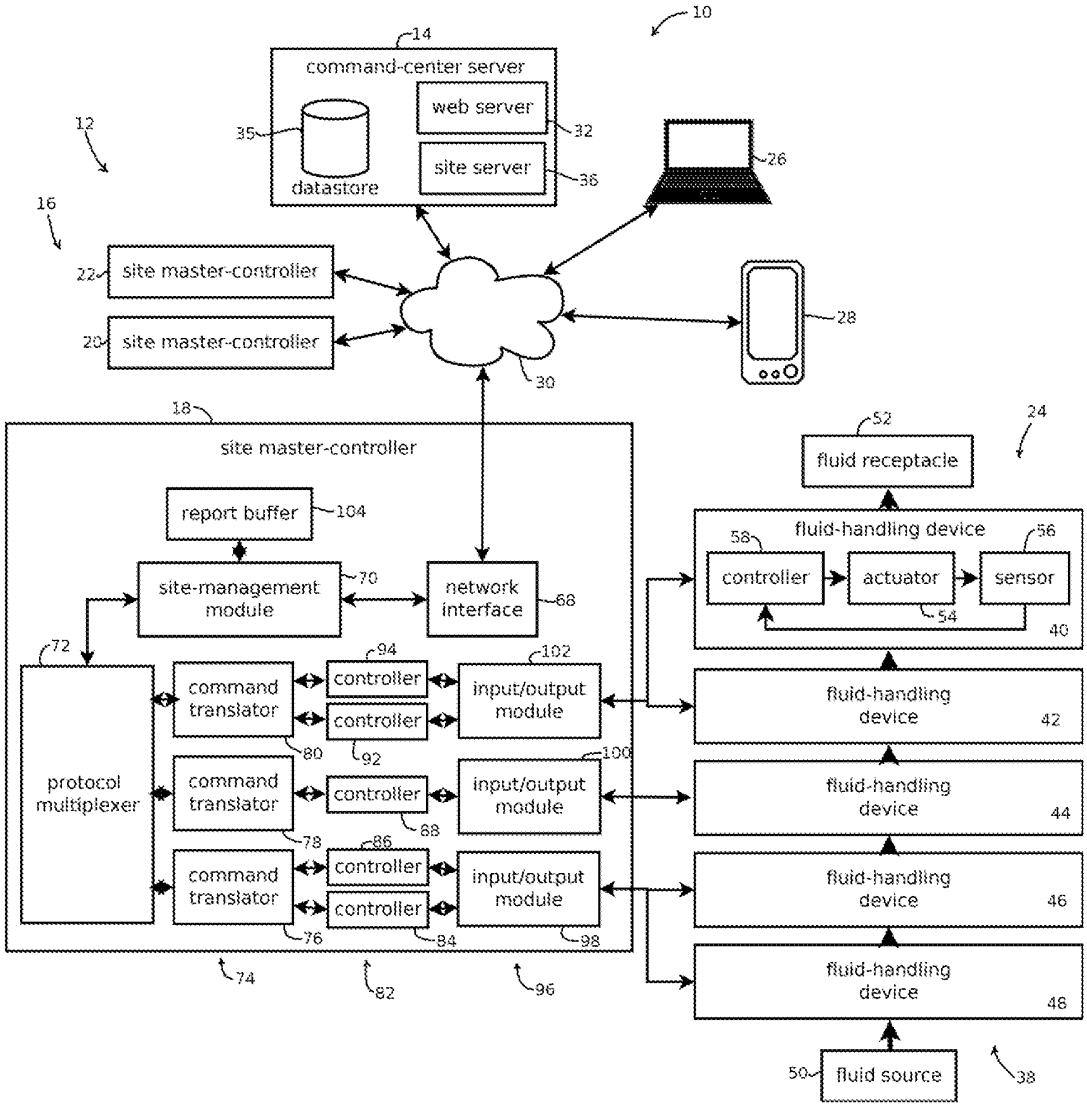

10
14
command-center server
web server
32
35
datastore
site server
36
12
26
16
22
site master-controller
20
site master-controller
28
30
18
site master-controller
report buffer
104
site-management module
70
network interface
68
72
protocol multiplexer
command translator
80
controller
94
controller
92
input/output module
102
command translator
78
controller
88
input/output module
100
command translator
76
controller
86
controller
84
input/output module
98
74
82
96
24
52
fluid receptacle
fluid-handling device
58
controller
actuator
54
sensor
56
40
fluid-handling device
42
fluid-handling device
44
fluid-handling device
46
fluid-handling device
48
50
fluid source
38

FIG. 1

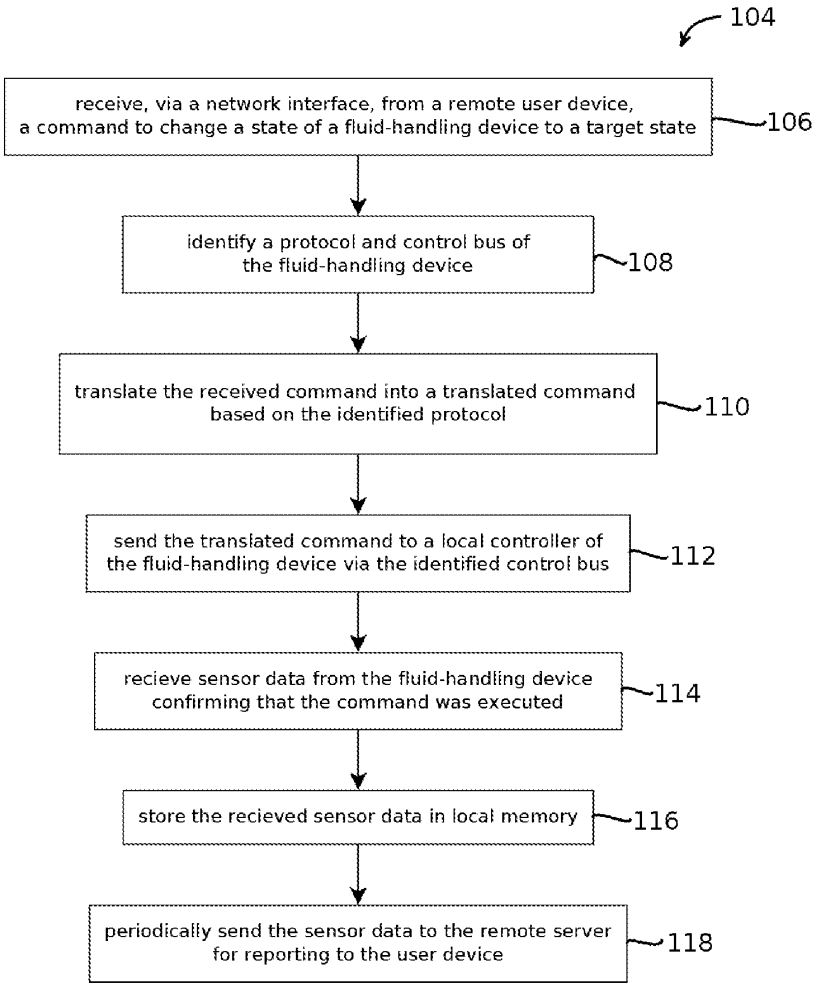

104
receive, via a network interface, from a remote user device, a command to change a state of a fluid-handling device to a target state
106
identify a protocol and control bus of the fluid-handling device
108
translate the received command into a translated command based on the identified protocol
110
send the translated command to a local controller of the fluid-handling device via the identified control bus
112
recieve sensor data from the fluid-handling device confirming that the command was executed
114
store the recieved sensor data in local memory
116
periodically send the sensor data to the remote server for reporting to the user device
118

FIG. 2

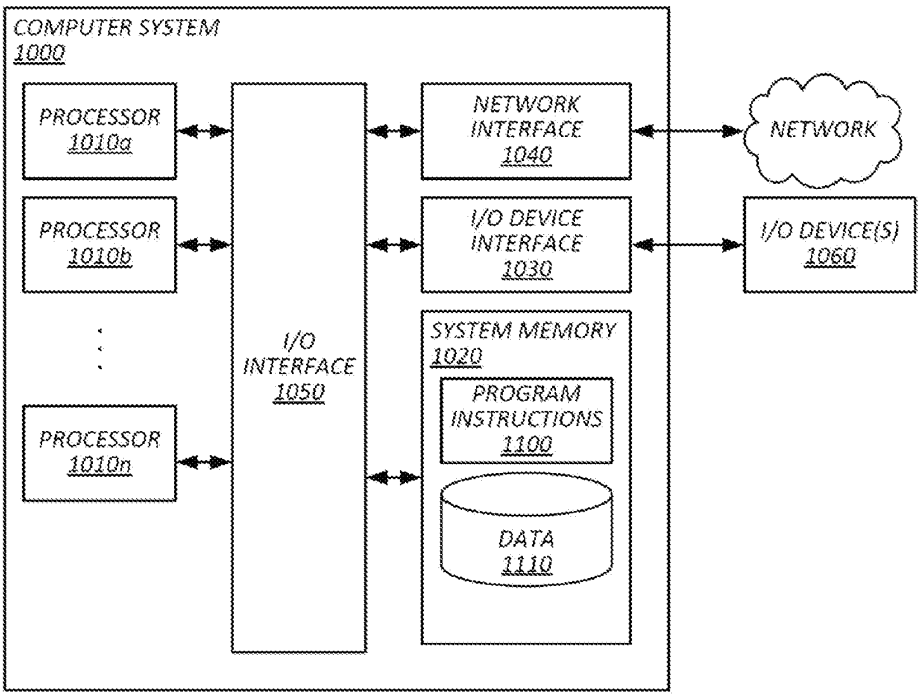

COMPUTER SYSTEM
1000
PROCESSOR
1010a
PROCESSOR
1010b
PROCESSOR
1010n
I/O
INTERFACE
1050
NETWORK
INTERFACE
1040
I/O DEVICE
INTERFACE
1030
SYSTEM MEMORY
1020
PROGRAM
INSTRUCTIONS
1100
DATA
1110
NETWORK
I/O DEVICE(S)
1060

FIG. 3