

Petitioners Liberty Energy, Inc. and Liberty
Oilfield Services LLC
Hearing Presentation for IPR2024-01274
U.S. Patent No. 11,091,992

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History**
- II. Dispute Overview**
- III. Substitute Claims 45–46 and 54–59 Are Indefinite**
- IV. Substitute Claims 44 and 50 Lack Written Description**
- V. Obviousness of Substitute Claims 41–42: Grounds 12A**
- VI. Obviousness of Substitute Claim 43: Grounds 13A**
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A**
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A**
- IX. Obviousness of Substitute Claim 50: Grounds 16A**
- X. Obviousness of Substitute Claim 51: Grounds 17A**
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US011091992B2

(12) **United States Patent**
Broussard et al.

(10) **Patent No.:** **US 11,091,992 B2**
(45) **Date of Patent:** ***Aug. 17, 2021**

(54) **SYSTEM FOR CENTRALIZED MONITORING AND CONTROL OF ELECTRIC POWERED HYDRAULIC FRACTURING FLEET**

(58) **Field of Classification Search**
CPC E21B 43/26
See application file for complete search history.

(71) **Applicant:** **U.S. Well Services, LLC**, Houston, TX (US)

(56) **References Cited**
U.S. PATENT DOCUMENTS

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FOREIGN PATENT DOCUMENTS

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
This patent is subject to a terminal disclaimer.

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(Continued)

(21) **Appl. No.:** **15/978,838**

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(22) **Filed:** **May 14, 2018**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2018/0258746 A1 Sep. 13, 2018

A system and method are disclosed for centralized monitoring and control of a hydraulic fracturing operation. The system includes an electric powered fracturing fleet and a centralized control unit coupled to the electric powered fracturing fleet. The electric powered fracturing fleet can include a combination of one or more of: electric powered pumps, turbine generators, blenders, sand silos, chemical storage units, conveyor belts, manifold trailers, hydration units, variable frequency drives, switchgear, transformers, and compressors. The centralized control unit can be configured to monitor and/or control one or more operating characteristics of the electric powered fracturing fleet.

Related U.S. Application Data

(63) Continuation of application No. 14/884,363, filed on Oct. 15, 2015, now Pat. No. 9,970,278, which is a (Continued)

(51) **Int. Cl.**
E21B 43/26 (2006.01)

(52) **U.S. Cl.**
CPC **E21B 43/26** (2013.01)

20 Claims, 3 Drawing Sheets

LIBERTY EXHIBIT 1001. Page 1

Patent Owner cites the '363 and '838 applications
to support the substitute claims

'992 Patent: Overview of Substitute Independent Claims

Claim 41. (Proposed substitute for original claim 1) [41p] A system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid from the wellbore into the formation, the system comprising:

[41a] an electric pump fluidly connected to the well, and configured to pump fluid into the wellbore; and

[41b] a centralized control unit coupled to the electric pump,

[41c] wherein the centralized control unit is configured to:
monitor the electric pump; and

[41d] a variable frequency drive that controls a speed of the electric pump;

[41e] the system further comprising a generator electrically connected to the electric pump to provide power to the electric pump,

[41f] wherein the generator is a natural gas generator,

[41g] the system further comprising a gas filtration skid,

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;

[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, gas pressures, gas temperatures, valve statuses, and filter bypass status;

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;

[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, outlet valves, bypass valves, and pressure release;

[41l] the system further comprising a gas compressor,

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;

[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;

[41o] wherein the centralized control unit is coupled to the electric pump via one or more of cabling, Ethernet, or wirelessly; and

[41q] wherein the centralized control unit is further configured to reset a fault occurring in the variable frequency drive.

'992 Patent: Overview of Substitute Independent Claims

Claim 47. (Proposed substitute for original claim 8) [47a] A method, comprising:

pumping fracturing fluid into a well in a formation with an electrically powered pump, the fracturing fluid having at least a liquid component and a solid proppant, and inserting the solid proppant into the cracks to maintain the cracks open, thereby allowing passage of oil and gas through the cracks;

[47b] monitoring at a centralized control unit the electrically powered pump;

[47c] wherein the centralized control unit is coupled to the electrically powered pump via one or more of cabling, Ethernet, or wirelessly; and

[47d] controlling the speed of the pump with a variable frequency drive,

[47e] wherein the centralized control unit is configured to reset a fault occurring in the variable frequency drive;

[47f] the method further comprising powering the electrically powered pump with a generator,

[47g] wherein the generator is a turbine generator;

[47h] the method further comprising monitoring operating characteristics of the turbine generator; and

[47i] wherein the monitored operating characteristics of the turbine generator include at least turbine air inlet filter transmitter failure.

'992 Patent: Overview of Substitute Independent Claims

Claim 56. (Proposed substitute for original claim 17) [56p] A system for centralized monitoring and control of a hydraulic fracturing operation, comprising:

[56a] an electric powered fracturing fleet, the electric powered fracturing fleet comprising:

a combination of one or more of: electric powered pumps, electric motors, turbine generators, blenders, sand silos, chemical storage units, conveyor belts, manifold trailers, hydration units, variable frequency drives, switchgear, transformers, compressors;

[56b] a centralized control unit coupled to electric powered fracturing fleet; and

[56c] an emergency power off unit coupled to the centralized control unit, the electric powered pumps and the turbine generators, the emergency power off unit configured to substantially immediately cut power to the turbine generators when activated,

[56d] wherein the centralized control unit is configured to:

monitor one or more operating characteristics of the electric powered fracturing fleet; and control one or more operating characteristics of the electric powered fracturing fleet;

[56e] wherein the centralized control unit is coupled to the electric powered fracturing fleet via one or more of cabling, Ethernet, or wirelessly;

[56f] the system further comprising one or more generators electrically connected to the electric pump to provide power to the electric pump;

[56g] wherein the one or more generators are turbine generators, and

[56h] wherein the centralized control unit is further configured to monitor operating characteristics and control the one or more turbine generators, and

[56i] wherein the monitored operating characteristics of the one or more turbine generators include at least turbine air inlet filter transmitter failure.

Procedural History Post-Institution: '992 Patent

- Patent Owner filed a Non-Contingent Motion to Amend (Paper 13)
 - Petitioners filed Opposition to Motion to Amend (Paper 16)
- Board issued Preliminary Guidance (Paper 20) finding that:
 - “Petitioner has shown a reasonable likelihood that proposed subst. claims 21–40 are **unpatentable**” as “**indefinite**”
 - The “cited prior art references **disclose** the newly added claim limitations” except the “turbine air inlet filter transmitter failure” limitation of proposed subst. claims 23 and 32.
- Patent Owner filed a Non-Contingent Revised Motion to Amend (Paper 21)
 - Petitioners filed Opposition to Revised Motion to Amend (Paper 24)
 - Patent Owner filed a Reply to the Opposition (Paper 29)
 - Petitioner filed a Sur-Reply to the Reply
- Patent Owner did **not** submit an expert declaration with its Reply (Paper 29)

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Dispute Overview

- PO Disputes:
 - SCs 45-46 and 54-59: Whether the term “substantially immediately” is indefinite
 - SC 44 : Whether “hydraulic system” lacks written description support
 - SC 50: Whether “controlling compression of liquefied natural gas” lacks written description support
 - Whether *Coli*’s control center can be combined with the other asserted references
 - Ground 12A: Whether *Clancy* discloses SC [41n]’s monitored operating characteristic of “enclosure exhaust fan run status”
 - Ground 12A: Whether *Armstrong* discloses SC [41n]’s monitored operating characteristic of “valve statuses”
 - Grounds 14A/19A: Whether a POSITA would have looked to *Thompson* for SC [46c]/[55b]’s “wherein the signal is transmitted over armored shielded CAT5E cabling”
 - Ground 15A: Whether *Bliss* is analogous art and whether *Bliss* and *Ekanayake* render obvious SC [47i]/[56i]’s monitored operating characteristic of “turbine air inlet filter transmitter failure”
 - Ground 15A: Whether *Birch* discloses SC [52c]’s monitored operating characteristic of “gas fuel main valve discharge pressure transmitter failure”
 - Ground 16A: Whether *Delaney* is analogous art and can be combined to disclose SC [50c]’s monitored operating characteristic of “hydraulic oil level”
 - Ground 17A: Whether *Birch* discloses SC [51c]’s monitored operating characteristic of “gas fuel control pressure transmitter failure”
 - Ground 18A: Whether *Rusnak* discloses SC [53c]’s monitored operating characteristic of “the torque”
 - Ground 20A: Whether *Delaney* is analogous art and can be combined to render SC [44c], [44d] obvious
 - Ground 21A: Whether *Coli* discloses SC [58]’s monitoring of “transformers”

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Substitute Claims 45–46 and 54–59 Are Indefinite

- Substitute Claims 45–46 and 54–59 recite “substantially immediately”:

[45b] wherein the emergency power off unit is configured to substantially immediately cut power from the generator when activated,₂

[46b] wherein the switchgear is responsive to a signal from the centralized control unit to open a breaker to substantially immediately cut power to the generator,₂

Substitute Claims 45–46 and 54–59 Are Indefinite

- Substitute Claims 45-46 and 54-59 recite “substantially immediately”:

Claim 54. (Proposed substitute for original claim 15) [54a] The method of [claim 9] claim 48, further comprising:

providing an emergency power off unit coupled to the centralized control unit, the electrically powered pump and the generator; and

substantially immediately cutting power to the generator by activating the emergency power off unit

Claim 55. (Proposed substitute for original claim 16) [55a] The method of [claim 15] claim 54, the emergency power off unit comprising an auxiliary power and switchgear, each coupled to the generator and the centralized control unit, the method further comprising

signaling the switchgear from the centralized control unit to open a breaker to **substantially immediately** cut power to the generator

[56c] an emergency power off unit coupled to the centralized control unit, the electric powered pumps and the turbine generators, the emergency power off unit configured to **substantially immediately** cut power to the turbine generators when activated,

Claim 57. (Proposed substitute for original claim 18) [57a] The system of [claim 17] claim 56, the emergency power off unit comprising an auxiliary power and switchgear, each coupled to the one or more turbine generators and the centralized control unit, the switchgear responsive to a signal from the centralized control unit to open a breaker to **substantially immediately** cut power to the one or more turbine generators;

- Claims 58 & 59 depend from claim 56

“Substantially Immediately” Is a Subjective Term of Degree

- There is no objective standard for determining how quickly power must be cut for it to be “substantially immediately.” [Ex. 1052 (Durham Decl.) ¶75]
- The specification does **not** provide any **objective baseline** to enable a POSITA to differentiate “substantially immediately” from other durations, such as “immediately.” [Ex. 1052 (Durham Decl.) ¶77]
 - “Terms of degree are problematic if their baseline is unclear.” *See Liberty Ammunition, Inc. v. United States*, 835 F.3d 1388, 1395 (Fed. Cir. 2016)
- PO does **not** contest that “substantially immediately” depends “on the **unpredictable vagaries** of any one person’s opinion” and may be different in different contexts.
 - *Datamize, LLC v. Plumtree Software, Inc.*, 417 F.3d 1342, 1350-51 (Fed. Cir. 2005)

“Substantially Immediately” Is a Subjective Term of Degree

- PO's identified passages do not provide reasonable certainty as to the scope of “substantially immediately.”

configuration. Electric fleets, however, are amenable to an **emergency power off configuration**. Referring now to FIG. 3, the EPO 43 can include power (or optionally, plural auxiliary power sources) coupled to the monitor/control data van 40 via, for example, armored shielded CAT5E cabling to a switchgear 47. The switchgear 47 couples the data van 40 to turbine(s) 23 (or the EER(s) coupled to the turbines). In certain embodiments, the shielded CAT5E cabling may run from the data van 40, to an auxiliary trailer that includes switchgear 47, to a gas compressor (not shown), and to the EER/Turbine 23. Upon activation of the EPO 43, breakers open in the switchgear 47, **cutting power to the generator 22**. The gas compression will turn off, **cutting fuel to the turbine(s) 23**. Optionally, the EPO 43 is operated by a switch in the control vehicle 42 that sounds an audible alarm that the EPO 43 is imminently deployable. Alternatively, serial data and cables may be used instead of Ethernet.

EX1001, 7:28-44

In the monitor/control data van 40, a pump control station allows for remote control of operating characteristics of the pumps including, for example, RPM, enable/disable, and pressure trip Set point. The pump control station can also include the Emergency Stop, stops all pumps **substantially instantaneously**, as discussed further herein.

EX1001, 10:53-58

Personnel control and radio communications allow the monitor/control data van 40 operator to monitor and control the equipment operators at the site. An engineering station of the monitor/control data van 40 graphs and records everything the treater station and pump control station monitor, provides insight into the sand silo weights, and can optionally broadcasts live data to offsite viewers. Also at the engineering station, the Emergency Power Off can be configured to disable all equipment and open switchgear breakers **substantially instantaneously**.

EX1001, 11:42-51

LIBERTY EXHIBIT 1073, Page 15

Patent Owner's Expert, Dr. Nikolaou Could Provide No Restrictions or Bounds on "Substantially Immediately"

Q. If power were cut within five seconds, would that satisfy the term "substantially immediately"?

A. Again, "substantially" is used in the context of the specific system, and there is an engineering judgment as to how much that would be. There is no specific number assigned to it.

Q. If power were cut within 2 seconds, would that be considered immediately?

A. ... I would have to know more about the configuration of the system, the risk for letting power continue before it gets shut off.

Q. Is there an industry standard ... to satisfy the term "substantially immediately"?

A. ... How quickly that happens depends on the particular situation, like I said, the system, the design of the unit and so forth

Dr. Durham Did Not “Calculate” the Scope of “Substantially Immediately”

291. Although the specification of the ‘992 Patent provides **no clarity as to the metes and bounds of “substantially immediately”** (indeed the term is only used in the claims) such short periods of time as those identified in *Red Book* are faster than an operator could notice a problem and then take action. Accordingly, such short times are **at least one example of what would qualify as “substantially immediately”**.

- The prior art disclosing **an example** does not mean ‘992 provides reasonable certainty as to the scope of “substantially immediately”
- “[I]ndefiniteness of a claim does **not** always imply inability to conduct a prior-art analysis The questions are different. [E]ven if [the claim] is indefinite, such a conclusion would **not** imply that it is incapable of being compared to prior art.” *Cochlear Bone Anchored Sols. AB v. Oticon Med. AB*, 958 F.3d 1348, 1360 (Fed. Cir. 2020).

Ironburg Is Distinguishable

- *Ironburg*'s "elongate member" extending "substantially the full distance between the top edge and the bottom edge" of a video game controller:
 - was **not** subject to "engineering judgment"
 - did **not** have different meanings in different contexts without **any** objective guidance in the specification for a POSITA
- Substantially immediately is akin to PO's use of "continuous" in the previous substitute claims for which the Board found a reasonable likelihood of indefiniteness:

limitations. Mot. 15, 19, 22. These paragraphs **do not**—and the Specifications of the '838 application and the '363 application **do not** appear—to **disclose a time range** for which a particular torque and a particular power output **must be maintained for them to be considered "continuous."** Testimony of Dr. Nikolaou appears to support Petitioner's position that the term "continuous" **varies based on a vendor's definition** and that there is **no fixed or standardized definition** for this term. Opp. 2–3. Thus, the term "continuous" does not provide enough certainty as to the scope of the claims.

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Substitute Claim 44 Requires that the System for Hydraulic Fracturing Further Comprise “a hydraulic system”

Claim 41. (Proposed substitute for original claim 1) [41p] A system for hydraulically fracturing an underground formation in an oil or gas well to extract oil or gas from the formation, the oil or gas well having a wellbore that permits passage of fluid from the wellbore into the formation, the system comprising:

Claim 44. (Proposed substitute for original claim 5) [44a] The system of [claim 4] claim 43, further comprising: a variable frequency drive that controls the plurality of electric pumps,
[44b] the system further comprising a hydraulic system,

There Is No Written-Description Support in the Specification

- PO identified EX2005, ¶¶44-46, 59; EX1001, 9:4-18, 10:30-34 (same as EX2005 ¶¶44-46, 59), which at best disclose a hydraulic motor's monitored operating characteristics

[0044] In an embodiment, the electrically powered fracking fleet can include a hydraulic motor.

For the hydraulic motor, monitoring can include monitoring the soft starter, the motor winding temperatures, the motor RPM, the voltage, the torque, and the current (amperage). Control of the hydraulic motor can include running or disabling the motor.

[0045] In an embodiment, the electrically powered fracking fleet can include vibration monitoring for the equipment, including the hydraulic motor, discharge motor, suction pump, discharge pump, discharge manifold, discharge iron, and suction hoses.

[0046] In an embodiment, the electrically powered fracking fleet can include hydraulic system monitoring for the equipment, including the system pressure, the charge pressure, the temperature, the hydraulic oil level, and the filter status.

[0059] In an embodiment, monitoring at the hydraulic motor of the hydration unit can include hydraulic system monitoring, including of operating characteristics such as system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

PO's Expert, Dr. Nikolaou Admitted There Is No Detailed Description

Q. How does the 992 patent describe what the hydraulic system is?

...

A. So I am not finding a detailed description of the hydraulic motor in 992. I am only finding the general description ... that the electrically powered fracking fleet can include the hydraulic motor.

Q. [M]y question was about the hydraulic system. Are you saying that the hydraulic motor is part of the hydraulic system that's claimed?

A. So you wanted the hydraulic system. Okay. So there is no detailed description of the hydraulic system.

PO's Interpretation is Nonsensical and Renders [44b]'s "Hydraulic System" Superfluous

Claim 44. (Proposed substitute for original claim 5) [44a] The system of [claim 4] claim 43, further comprising: a variable frequency drive that controls the plurality of electric pumps,
[44b] the system further comprising a hydraulic system.

- Under PO's view, [44b] would recite "the [hydraulic fracturing] system further comprising a hydraulic [fracturing] system"
- PO's argument confirms that the specification fails to sufficiently disclose a "hydraulic system," as the specification fails to disclose **what is** the recited "hydraulic system" and what components it comprises
- Further, written description considers whether the specification discloses "sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought."
 - See *TurboCare Div. of Demag Delaval Turbomachinery Corp. v. Gen. Elec. Co.*, 264 F.3d 1111, 1119 (Fed. Cir. 2001).
- It does **not** consider whether a POSITA would have "understood" the term "hydraulic system." (See PO Reply, 4)

Substitute Claim 50: There Is No Written Description Support for “controlling compression of liquefied natural gas”

Claim 50. (Proposed substitute for original claim 11) [50a] The method of [claim 9] claim 48, further comprising controlling compression of the liquefied natural gas;

- The specification only discloses compressing natural gas in its **gaseous** state, as confirmed by Dr. Durham:

by a single operator. The functions can include: monitoring and control of the gas compression for the turbines (and in particular, of pressure and temperature, or load percentage),

EX1001, 5:31-33

can be powered by natural gas. For example, the generators can be powered by liquefied natural gas. The liquefied natural gas can be converted into a gaseous form in a vaporizer prior to use in the generators. The use of natural

EX1001, 4:34-37

87. The specification contains no support for “controlling compression of the liquefied natural gas”. Although the specification does contain disclosures of compressors and compression of natural gas, these disclosures always refer to compression of natural gas in its gaseous state, i.e., “gas compression”.⁵⁵ Liquefied natural gas is not a gas; it is a liquid, as the name suggests.

Ex. 1052 (Durham Decl.) ¶187

- Liquefied** natural gas is referenced only in relation to **vaporization**—the **opposite** of compression [Ex. 1052 (Durham Decl.) ¶¶88-92]
- PO offers **no** expert testimony to the contrary

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Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
12A	41, 42	<i>Coli, Birch, Rusnak, Armstrong, Clancy, Trobaugh, Teets, and Broussard</i> 079
12B	41, 42	Ground 12A references and what is otherwise available to the public

Substitute Claim 41 Added Limitations

[41e] the system further comprising a generator electrically connected to the electric pump to provide power to the electric pump,

[41f] wherein the generator is a natural gas generator,

[41g] the system further comprising a gas filtration skid,

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;

[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, gas pressures, gas temperatures, valve statuses, and filter bypass status;

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;

[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, outlet valves, bypass valves, and pressure release;

[41l] the system further comprising a gas compressor,

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;

[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;

The Combination of *Coli* with the Other Asserted References Is Proper

- PO argues that none of the prior art suggests which operating characteristics a POSITA should or would monitor
- PO **incorrectly limits** *Coli*'s centralized monitoring and control, which applies "for the entire fracturing operation [] at a single location." RMTA at 10-12; EX1004, [0072]
- Each reference is in the **same field of endeavor** (controlling and/or monitoring industrial equipment) and/or is **reasonably pertinent to the problem addressed** by the '992 Patent (controlling and/or monitoring industrial equipment from a centralized location)
- **Nothing** in *Coli* teaches away from monitoring for failures
- The **motivations** for why a POSITA would monitor or control each operating characteristic recited in the Substitute Claims are **uncontested**
 - *E.g.*, SC 41: application of known techniques (monitoring/controlling a gas filtration skid and compressor) to a known system (*Coli/Armstrong's* control system) ready for improvement
 - *E.g.*, SC 42: application of known techniques (liquefied natural gas) to a known system (turbine generators) ready for improvement

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(19) **United States**
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(54) **MOBILE, MODULAR, ELECTRICALLY POWERED SYSTEM FOR USE IN FRACTURING UNDERGROUND FORMATIONS**

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(57) **ABSTRACT**

The present invention provides a method and system for providing on-site electrical power to a fracturing operation, and an electrically powered fracturing system. Natural gas can be used to drive a turbine generator in the production of electrical power. A sealable, electrically powered fracturing fleet is provided to pump fluids for the fracturing operation, obviating the need for a constant supply of diesel fuel to the site and reducing the site footprint and infrastructure required for the fracturing operation, when compared with conventional systems.

40

The present invention provides a method and system for providing on-site electrical power to a fracturing operation, and an electrically powered fracturing system. Natural gas can be used to drive a turbine generator in the production of electrical power. A scalable, electrically powered fracturing fleet is provided to pump fluids for the fracturing operation, obviating the need for a constant supply of diesel fuel to the site and reducing the site footprint and infrastructure required for the fracturing operation, when compared with conventional systems.

- *Coli's* system monitors and controls an entire fracturing operation



EX1004, [0072]

Armstrong’s PLC Controls the FCS

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(54) Title: FUEL- CONDITIONED SKID

(57) Abstract: A fuel-conditioning skid for an engine. The fuel-conditioning skid includes an inlet that is connectable to a source to receive a flow of fuel containing undesirable compounds. An outlet is connectable to the engine to deliver a flow of fuel that is substantially free of undesirable compounds. An inlet cleaner is in fluid communication with the inlet and is operable to remove a portion of the undesirable compounds. A compressor is in fluid communication with the inlet cleaner to receive the flow of fuel at a first pressure and discharge the flow of fuel at a second pressure. The second pressure is greater than the first pressure. A purifier is in fluid communication with the inlet cleaner to receive the flow of fuel. The purifier is operable to remove substantially all of the remaining undesirable compounds from the flow of fuel.

WO 2004/099587 A2

LIBERTY EXHIBIT 1054, Page 1
Liberty Energy, Inc. and Liberty Oilfield Services LLC v. U.S. Well Services, LLC, IPR2024-01274

Fig. 5 illustrates another construction of the fuel-conditioning skid 60'''. The skid

...

A programmable logic controller (PLC) or other microprocessor-based control unit performs protective functions (alarms, trips, interlock/permissives), control functions (sequencing, logic, PID control), and information functions (operator interface, interface to other systems). Once started, the PLC controls the FCS exhaust flow rate and pressure. A

EX1054, 19:1, 19-22

Pet. Opp. to RMTA at 5; EX1054, Cover, 19:1, 19-22; EX1052, ¶¶137, 178, 203

LIBERTY EXHIBIT 1073, Page 31

 US 20070269317A1	
(19) United States (12) Patent Application Publication (11) Clancy	(10) Pub. No.: US 2007/0269317 A1 (43) Pub. Date: Nov. 22, 2007
(54) NATURAL GAS COMPRESSOR AND A SYSTEM FOR OPERATING THE SAME	
(76) Inventor: Sandy Albert Clancy, Paradise (CA) Correspondence Address: FROMMER LAWRENCE & HAUG 745 FIFTH AVENUE, 10TH FL. NEW YORK, NY 10151	(52) U.S. CL. 417/54 (57) ABSTRACT A power engine natural gas compressor system to optimize the extraction of natural gas from a reservoir and related gathering systems. The system is controlled by a distributed control system, which is a computer readable program, and allows for humane machine interface allowing for a more efficient use of the available power supply resulting in increased efficiency. Through the use of an integrated control system the present invention achieves a precise control of the overall operation of the system, which would be impossible to achieve through manual manipulation. The system of the present invention is a system capable of multiple functions with minimal losses with respect to efficiency. Different from the compressors found in the market the system uses a sophisticated process and control system, and is constructed and arranged in such a way that someone with little to no training can operate and maintain it
(21) Appl. No.: 11/728,996 (22) Filed: Mar. 28, 2007 (30) Foreign Application Priority Data May 19, 2006 (CA) 2,544,366	Publication Classification (51) Int. Cl. E21B 43/34 (2006.01)

EX1055, [0003]

PO Does Not Dispute that *Armstrong* Discloses [41g]: “a gas filtration skid”

[41g] “the system further comprising a gas filtration skid”

Dr. Nikolaou

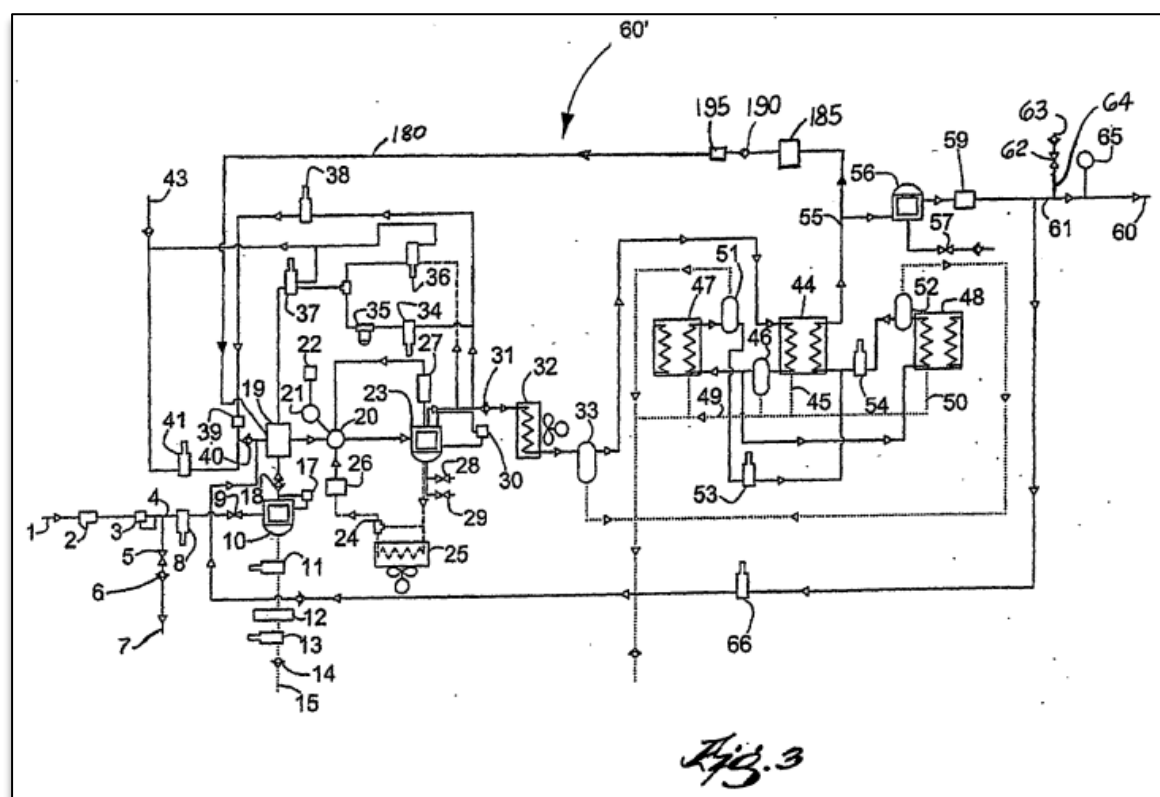
A. A gas filtration skid, as described in the patent, is a system that is used to remove impurities from natural gas that will be fed in the context of this patent to generator, a gas generator.

. . .

So a filtration system remove -- removes these impurities to make sure that the gas is suitable as to -- to be used as a fuel in the generator. And that system is on a skid as is specified in the patent.

PO Does Not Dispute that *Armstrong* Discloses [41g]: “a gas filtration skid”

[41g] “the system further comprising a gas filtration skid”



A fuel-conditioning skid 60', illustrated schematically in Fig. 3, conditions the fuel as described above and increases the delivery pressure of the fuel to a level suited to the particular engine to which the fuel skid is supplying fuel. The fuel-conditioning skid may

EX1054, 8:18-20

3 could be placed downstream of a strainer 2 to reduce the supply gas pressure. The fuel flows through the inlet strainer 2 to remove large particulates, including rust, weld slag, filings, and other debris. A purge assembly, consisting of a tee 4, a manual valve 5, and a

EX1054, 9:10-12

An inlet liquid separator and filter tank 10 removes (i.e., knocks out) at least a portion of the liquid components from the incoming gas, and also filters out particulates, typically in the 1 to 10 micron size range. A coalescer filter could also be used in this device for liquid separation if desired.

EX1054, 9:20-23

PO Does Not Dispute that *Armstrong* Discloses [41h]-[41i]: monitoring “water separator status”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid; [41i] wherein the monitored operating characteristics of the gas filtration skid include at least **water separator status**, particulate filter status, gas pressures, gas temperatures, valve statuses, and filter bypass status;

- *Armstrong* discloses a liquid drain arrangement for draining liquid from separator tank 10

atmospheric pressure. A liquid drain arrangement consisting of two solenoid valves 11, 13 and a liquid reservoir 12 can be **used to drain liquid from** the sub-atmospheric **separator tank 10**. During a drain cycle, valve 11 would be opened to permit liquid to fill the

EX1054, 9:25-10:2

chilled to a suitable temperature (e.g., 55-65 degrees F) in the first cooling stage. During this chilling process, more undesirable compounds (including **water** and heavy hydrocarbons) **condense out of the fuel and are drained** from the heat exchanger via a drain line 45. The chilled fuel leaves the first heat exchanger and **flows to a coalescing separator 46** where additional undesirable compounds may be separated and drained.

EX1054, 13:17-21

- A switch 17 sends an alarm/stop signal to the FCS to reduce the likelihood of liquid slipping past the separator 10.

this flow, in much the same manner as an automobile carburetor draws in fuel. **A float switch and/or a pressure switch 17 may be used to send an alarm or stop signal to the FCS control to reduce the likelihood of liquid slipping past the separator 10** in the event that the drain system fails to remove sufficient moisture from the separator tank 10.

EX1054, 10:11-14

PO Does Not Dispute that *Clancy* Discloses [41h]-[41i]: monitoring “water separator status”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
 [41i] wherein the monitored operating characteristics of the gas filtration skid include at least **water separator status**, particulate filter status, gas pressures, gas temperatures, valve statuses, and filter bypass status;

- *Clancy* discloses separator 9 (water separator) to drain water and switches to monitor its level (status)

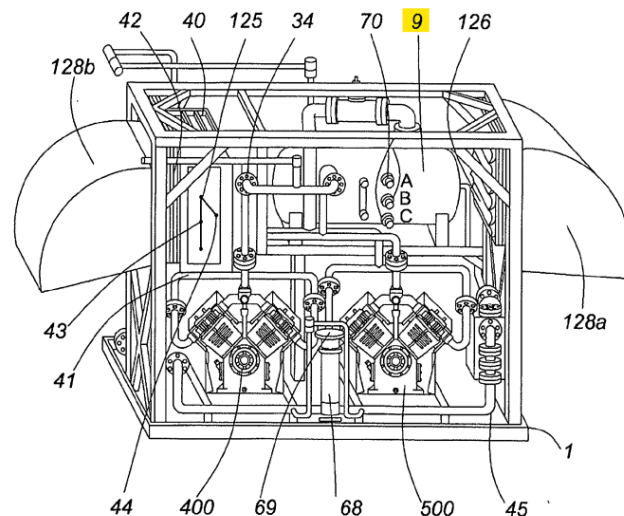


FIG. 6A

[0032] Once past the second 3" valve the flow proceeds into a separator (9), which is preferably a pressure vessel, see FIG. 6a, which is used to separate the gas and liquids in the flow. The liquids are directed to the drain (63) in the base of the pressure vessel (9) through the use of gravity and the gas is allowed to escape through the top of the separator.

EX1055, [0032]

may require the isolation to take place. A water valve (120) is used to direct produced water flow, to gas line or any other location.

EX1055, [0044]

[0046] Any liquids collected on the drain (63) on the bottom of the pressure vessel are drained from the bottom through a fourth 2" pipe (64), see FIG. 10, leading to a basket strainer (65). The strainer has an upstream valve (66) and a downstream valve (67) to allow for the basket to be removed and cleaned. The strainer is used to keep any foreign material from passing to the water pump (68), see FIG. 6a, as this can cause plugging and eventual failure of the pump. The pump is a multi stage centrifugal pump with a vertical orientation and is driven by a hydraulic motor (69) attached to the top of the water pump. The pump is started and stopped from the level switches (70) which are located on the side of the (pressure vessel 9). A pressure safety valve-PSV (123) for the water pump is provided, see FIG. 10. The middle-level switch (70b) is the initiating action for starting the pump, the lowest-level switch (70c) is used to turn the pump off. The highest-level switch (70a) is used for initiating an ESD of the system in the event of a high level situation. This can occur if the pump fails to start or the volume of water coming into the pressure vessel (9) is too great. The liquid is discharged from the pump and is

LIBERTY EXHIBIT EX1055, [0046]

PO Does Not Dispute that *Armstrong* Discloses [41h]-[41i]: monitoring “particulate filter status”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, **particulate filter status**, gas pressures, gas temperatures, valve statuses, and filter bypass status;

- *Armstrong* discloses FCS particulate filters → see [41g] – a gas filtration skid
- A pressure switch **monitors filter status**, including the level of particles deposited on the filter surface—i.e., filter fouling

against overpressure and to allow for periodic maintenance and oil replacement. A pressure switch 30 could also be used to determine and **monitor the extent of coalescer filter fouling.**

EX1054, 12:4-6

Dr. Nikolaou

Q. Would the extent of **filter fouling be an example of particulate filter status?**

A. One of the characteristics, yes. It would -- **it would be.**

EX1053, 23:22-24:4

PO Does Not Dispute that *Armstrong* Discloses [41h]-[41i]: monitoring “gas pressures” and “gas temperatures”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid; [41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, **gas pressures, gas temperatures**, valve statuses, and filter bypass status;

- *Armstrong* discloses a pressure gauge to monitor the FCS's gas pressures
- *Armstrong* discloses temperature sensors to monitor gas temperatures

regulator 3 on skids 60' that include the regulator 3. A pressure gauge may be attached to the FCS 60' downstream of the pressure regulator 3 to indicate the gas pressure. An inlet

EX1054, 9:15-16

separator device 33. A variable frequency drive (VFD) 42 (shown in Fig. 5) could be used to drive a fan 58 to more accurately control the temperature of the fuel leaving the aftercooler 32. The cooling may cause some undesirable compounds to condense out of

EX1054, 13:10-12

The VFD 22 varies the motor speed in response to a measured parameter, such as a fuel pressure, to maintain the parameter (fuel delivery pressure) within a desired range. Fuel temperature sensors and/or switches measure and ensure proper gas conditions from the compressor 20.

EX1054, 10:23-11:1
LIBERTY EXHIBIT 1073, Page 38

PO Does Not Dispute that *Clancy* Discloses [41h]-[41i]: monitoring “gas pressures” and “gas temperatures”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, **gas pressures, gas temperatures**, valve statuses, and filter bypass status;

- *Clancy* discloses pressure sensors to monitor gas pressures

allowed for this selected compressor. Two pressure sensors (11) and (12) are located upstream and downstream respectively of the first back-pressure valve (10). The sensor (11) on the upstream side sends a pressure value to the DCS which is used to determine whether the compressors need to speed up or slow down to maintain the targeted pressure. Additionally the pressure can be trended to determine performance and activate the ESD of the system in the event of a high pressure or low pressure. Also, alarm set points can be set to alert the operator to the potential of an impending shut down allowing for alternative measures to be taken.

EX1055, [0033]

- *Clancy* discloses temperature sensors to monitor gas temperatures

suction hoses. The gas flows are passed by first and second temperature sensors (31) and (32) for monitoring the discharge gas flow temperature, see FIG. 4. The temperature can be used to alert the operator of faulty valves or other anomalies associated with the compression process. Again the sensors communicate to the DCS which can provide graphing details, high temperature alarms, and shut downs.

EX1055, [0037]

combined gas flow to an after-cooler (34) see FIG. 6. The combined gas flow will first pass by a third pressure sensor (35) which again communicates to the DCS and provides protection from over pressuring the system in the event of some form of blockage happening down stream of the compressors. Additionally, there is a pressure safety valve (PSV) (36) located on the common 2" pipe (33) between the after-cooler and compressors and is set to relieve at the systems maximum design pressure of 300psi. The after-

EX1055, [0038]

after-cooler to a discharge pipe (46) located downstream. A fifth temperature sensor (47) is positioned in the downstream pipe and communicates the temperature to the DCS which can use this information to speed up or slow down the cooler fan based on the desired set point. Trending, alarms and shutdown functions can also be generated from the temperatures indicated. The system must ensure that hot gas flow

EX1055, [0041]

Armstrong Discloses [41h]-[41i]: monitoring “valve statuses”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
 [41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, gas pressures, gas temperatures, **valve statuses**, and filter bypass status;

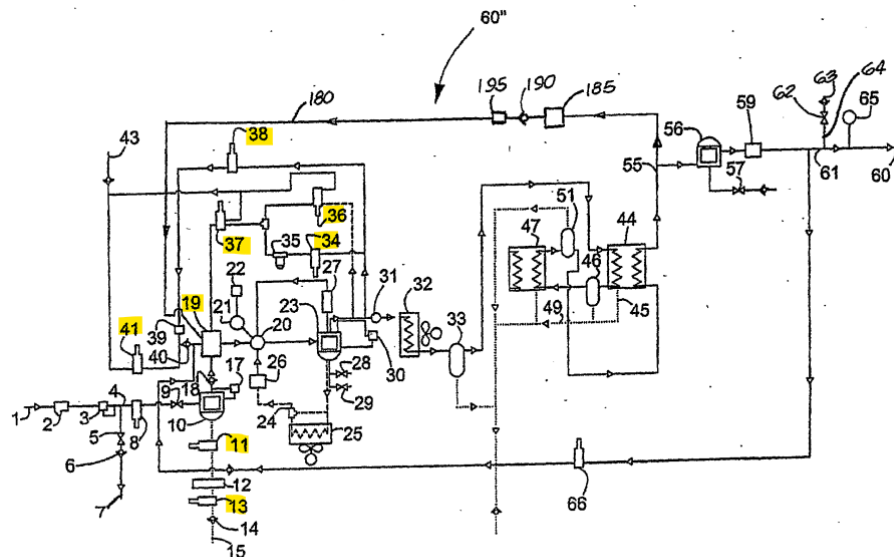


Fig. 1

tank 10. During a drain cycle, valve 11 would be opened to permit liquid to fill the reservoir 12. **Valve 11 then closes and valve 13 opens to drain liquid** out through a check valve 14 to the drain system 15. This system reduces the amount of air that is admitted

EX1054, 10:2-4

while operating at the motor's minimum speed. A fuel bypass control system may be employed to further reduce the fuel flow rate. The fuel bypass control system uses bypass fuel to control and reduce the fuel flow rate. To reduce the fuel flow rate, the bypass line with solenoid **valves 34 and 37 are opened**, while **valve 36, 38, and 41 are closed**. The modulating valve 35 partially or fully opens **the inlet valve 19** using recirculated fuel pressure. The inlet valve then "throttles" the inlet fuel flow going to the inlet side of the gas compressor 20. By effectively reducing the inlet pressure to the compressor 20, the amount of flow pumped to the rest of the FCS 60' is reduced.

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EX1054, 12:15-22

- PO's single-sentence conclusory assertion—aimed **only** at *Armstrong* and **not** at *Clancy* (see next slide) and **unsupported** by expert testimony—fails to rebut obviousness

PO Does Not Dispute that *Clancy* Renders Obvious [41h]-[41i]: monitoring “valve statuses”

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, gas pressures, gas temperatures, **valve statuses**, and filter bypass status;

- It would have been obvious to monitor *Clancy's* valve (6)' status to determine that it was open and to safely complete initial start-up.

[0031] In the compressor skid (1) of preferred embodiment of this invention, as seen in FIG. 1, a natural gas and liquids flow is provided to the skid via a 3" 300 ansi connection (2) passing through a 3" ball valve (3). See FIG. 1. The ball valve is used to isolate the skid in the event of maintenance or if manual isolation is required. A check valve (4) is located next in the pipeline (5) which is used to prevent any reversal of flow backwards toward the source of suction. From the check valve the flow passes through a second 3" valve (6), which has an electric 120-volt actuator (7) attached to the valve stem (not shown). This actuator is used to open the second 3" valve (6) for initial start up and closes the second 3" valve (6) in the event of an emergency shut down (ESD). The electric actuator is preferably a class

EX1055, [0031]

LIBERTY EXHIBIT 1073, Page 41

[41h] wherein the centralized control unit is further configured to monitor operating characteristics of the gas filtration skid;
[41i] wherein the monitored operating characteristics of the gas filtration skid include at least water separator status, particulate filter status, gas pressures, gas temperatures, valve statuses, and **filter bypass status**;



EX1056, [0031]

- A POSITA would have understood that the output information includes the status of the filter bypass.

PO Does Not Dispute that *Armstrong* Discloses [41j]-[41k]: controlling “inlet valves”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
 [41k] wherein the controllable operating characteristics of the gas filtration skid include at least **inlet valves**, outlet valves, bypass valves, and pressure release;

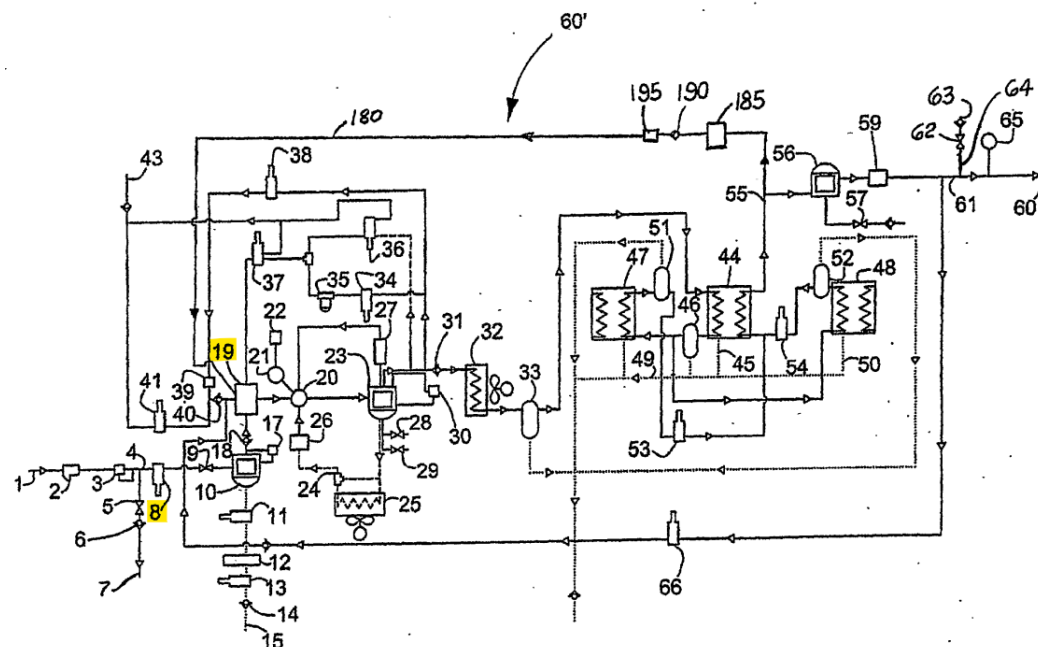


Fig. 3

the FCS 60' downstream of the pressure regulator 3 to indicate the gas pressure. **An inlet solenoid valve 8** may be used to externally shut off the gas and isolate the FCS 60'. In

EX1054, 9:16-17

does not flow backward into the fuel supply lines. **The fuel then feeds into an inlet valve 19** that controls the flow rate to a compressor such as an oil-flooded screw-type compressor 20. The compressor 20 boosts the fuel pressure to a predetermined level

EX1054, 10:17-19

with solenoid valves 34 and 37 are opened, while valve 36, 38, and 41 are closed. The modulating valve 35 partially or fully opens **the inlet valve 19** using recirculated fuel pressure. The **inlet valve then "throttles" the inlet fuel flow** going to the inlet side of the gas compressor 20. By effectively reducing the inlet pressure to the compressor 20, the

LIBERTY EXHIBIT 1073, Page 43
 EX1054, 12:18-21

PO Does Not Dispute that *Clancy* Discloses [41j]-[41k]: controlling “inlet valves”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, outlet valves, bypass valves, and pressure release;

[0031] In the compressor skid (1) of preferred embodiment of this invention, as seen in FIG. 1, a natural gas and liquids flow is provided to the skid via a 3" 300 ansi connection (2) passing through a 3" ball valve (3). See FIG. 1. The ball valve is used to isolate the skid in the event of maintenance or if manual isolation is required. A check valve (4) is located next in the pipeline (5) which is used to prevent any reversal of flow backwards toward the source of suction. From the check valve the flow passes through a second 3" valve (6), which has an electric 120-volt actuator (7) attached to the valve stem (not shown). This actuator is used to open the second 3" valve (6) for initial start up and closes the second 3" valve (6) in the event of an emergency shut down (ESD). The electric actuator is preferably a class

EX1055, [0031]

PO Does Not Dispute that *Armstrong* Discloses [41j]-[41k]: controlling “outlet valves”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, **outlet valves**, bypass valves, and pressure release;

- *Armstrong* discloses an outlet valve (fuel solenoid) between the FCS outlet 60 and microturbines
- The PLC controller controls the solenoid valve

pressure fluctuations due to fuel supply and demand issues. The receiver tank would preferentially be located **between the FCS outlet 60 and the microturbine(s)** 10' or other engines that use the fuel. A **fuel solenoid** could be used to ensure that when the FCS 60' is depressurized for service or maintenance, the receiver tank remains pressurized.

EX1054, 16:12-15

A programmable logic controller (PLC) or other microprocessor-based control unit performs protective functions (alarms, trips, interlock/permissives), control functions (sequencing, logic, PID control), and information functions (operator interface, interface to other systems). Once started, the PLC controls the FCS exhaust flow rate and pressure. **A pressure sensor 65 located near the outlet 60 of the FCS 60', 60'', 60''' senses the FCS outlet pressure.** A proportional-integral-derivative (PID) control algorithm is used to

LIBERTY EXHIBIT 1073, Page 45
EX1054, 19:19-24

PO Does Not Dispute that *Clancy* Discloses [41j]-[41k]: controlling “outlet valves”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, **outlet valves**, bypass valves, and pressure release;

- *Clancy* discloses controlling outlet valves (valves 49 and 50) for starting/stopping gas flow.
- Valves 49 and 50 are discharge valves, as they are downstream of the discharge pipe 46

[0042] The cooled gas flow is then led from discharge pipe (46) to three different directions. A first flow is directed through a gas fuel line (60) in which fuel gas flows. The fuel gas flow is piped then to the engine skid to power the engine (300). The fuel line is equipped with a first manual valve (49) for starting and stopping the flow of gas at the operator's discretion. In FIG. 8, downstream from the manual valve a second ball valve (50) is located with an electric actuator (51), which is used to open the fuel supply during start up and close the fuel supply in the event of an ESD situation. This is a safeguard to protect the engine compartment from any further fuel being allowed to flow into the skid.

EX1055, [0042]

PO Does Not Dispute that *Armstrong* Discloses [41j]-[41k]: controlling “bypass valves”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
 [41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, outlet valves, **bypass valves**, and pressure release;

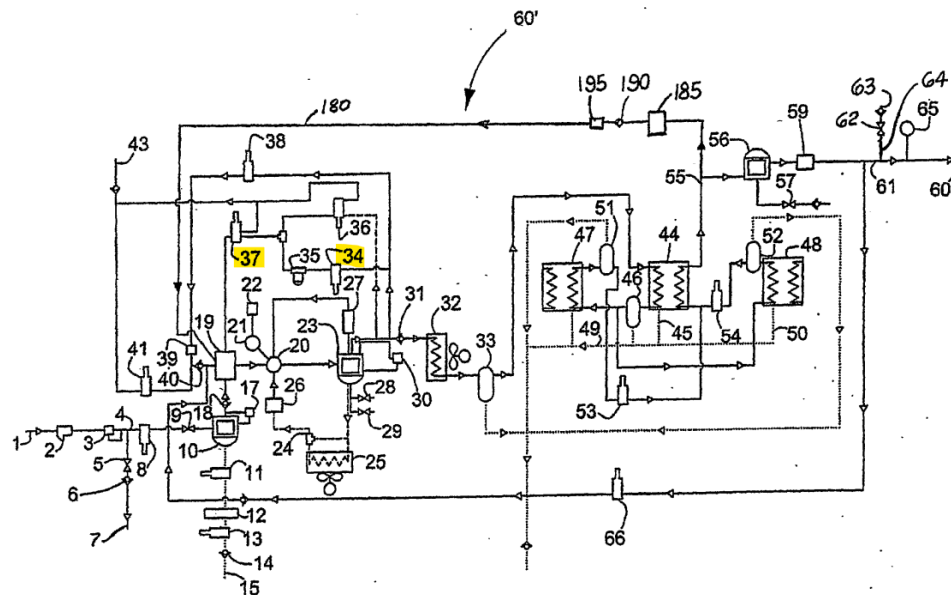


Fig. 3

while operating at the motor's minimum speed. A **fuel bypass control system** may be employed to further reduce the fuel flow rate. The fuel bypass control system uses bypass fuel to control and reduce the fuel flow rate. To reduce the fuel flow rate, **the bypass line with solenoid valves 34 and 37 are opened**, while valve 36, 38, and 41 are closed. The modulating valve 35 partially or fully opens the inlet valve 19 using recirculated fuel pressure. The inlet valve then "throttles" the inlet fuel flow going to the inlet side of the gas compressor 20. By effectively reducing the inlet pressure to the compressor 20, the

EX1054, 12:15-21

PO Does Not Dispute that *Armstrong* Discloses [41j]-[41k]: controlling “pressure release”

[41j] wherein the centralized control unit is further configured to control operating characteristics of the gas filtration skid;
[41k] wherein the controllable operating characteristics of the gas filtration skid include at least inlet valves, outlet valves, bypass valves, and **pressure release**;

To **purge the skid 60' of high-pressure gas, solenoid valve 8 closes, and valves 66, 38 and 41 open.** The minimum pressure check valve 31 inhibits the backward flow of fuel in the system through to the vent 43. The **high-pressure fuel** downstream of the minimum pressure check valve 31 **flows through the skid 60'** to location 61. The dry, clean gas then flows back to the entrance of the inlet valve 40 through the line with valve 66. The gas then flows from the inlet valve 40, through the compressor 20, separator tank 23, out to the bypass line 38, and **eventually out of the vent 43.** This method of purging will

EX1054, 17:17-23

PO Does Not Dispute that *Armstrong* and *Clancy* Disclose [411]: “gas compressor”

[411] the system further comprising a gas compressor,

Armstrong:

does not flow backward into the fuel supply lines. The fuel then feeds into an inlet valve 19 that controls the flow rate to a compressor such as an oil-flooded screw-type compressor 20. The compressor 20 boosts the fuel pressure to a predetermined level suitable for engine operation. The screw compressor 20 is driven by an electric motor 21 through a gearset/adaptor/coupling arrangement. The electric motor 21 is driven by a variable frequency drive (VFD) 22, sometimes also referred to as a variable speed drive.

EX1054, 10:17-22

Clancy:

[0009] The present invention seeks to provide a natural gas compressor for optimizing the extraction of natural gas from a reservoir or associated gathering system, comprising

EX1055, [0009]

- A POSITA would have been motivated to combine such a gas compressor with *Coli's* system to pressurize fuel for the engine

PO Does Not Dispute that *Armstrong* Discloses [41m]-[41n]: monitoring “compressor motor run status”

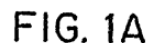
[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
[41n] wherein the monitored operating characteristics of the gas compressor include at least **compressor motor run status**, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;

- *Armstrong* monitors compressor speed using pressure sensor 65
- A POSITA would have understood that monitoring compressor speed monitors the compressor motor run status
 - if the motor speed is zero, the motor is not running
 - if the speed is non-zero, then the motor is running

A **programmable logic controller (PLC)** or other microprocessor-based control unit performs protective functions (alarms, trips, interlock/permissives), **control functions** (sequencing, logic, PID control), and information functions (operator interface, interface to other systems). Once started, **the PLC controls the FCS exhaust flow rate and pressure**. A **pressure sensor 65** located near the outlet 60 of the FCS 60', 60'', 60''' **senses the FCS outlet pressure**. A proportional-integral-derivative (PID) control algorithm is used to **adjust the gas compressor speed** by adjusting the variable frequency drive device 22. A

EX1054, 19:19-25

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;



EX1057, [0057]

EX1057, [0017]

EX1057, [0061]

Clancy Renders Obvious [41m]-[41n]: monitoring “enclosure exhaust fan run status”

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
 [41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, **enclosure exhaust fan run status**, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;

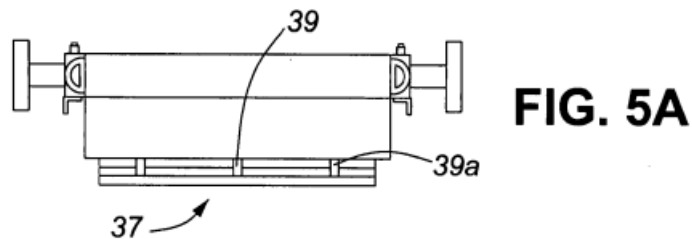


FIG. 5A

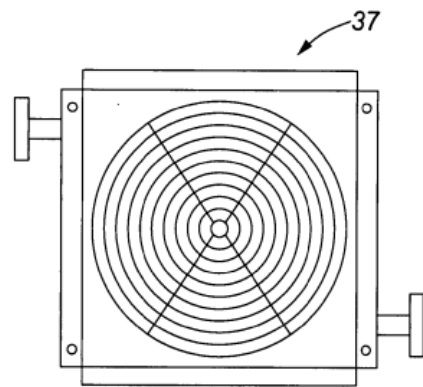


FIG. 5B

[0039] As it can be seen from FIGS. 5a, 5b, 5c and 5d, a cooler fan (37) is powered by a hydraulic motor (38) attached to the fan shaft (39) by way of a coupler (39a). The after-cooler is designed to minimize the effects of sound pollution which is generated from moving high volumes of air. Two recycle louvers (40) and (41) are located on the top and bottom of the ducting (125), see FIG. 6, and an outlet louver (42) on the outlet of the ducting (125). These louvers are linked together by a linkage (43), which is connected to an electric actuator (44), which is controlled from the DCS. In the event that the room temperature falls, the electric actuator is sent a signal to open the two recycle louvers and as a result the outlet louver begins to close as the recycle and outlet louvers are interconnected by the linkage. This system is designed to maintain a set temperature as input by the field operator and is monitored via a fourth temperature sensor (45) located on the base of the adjacent wall at the opposite side of the ducting.

- A POSITA would have been motivated to monitor the fan run status so that the DCS would know whether operating *Clancy's* louvers would impact temperature, or whether the exhaust fan required service or maintenance.

EX1055, [0039]

LIBERTY EXHIBIT 1073, Page 52

Clancy Renders Obvious [41m]-[41n]: monitoring “enclosure exhaust fan run status”

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, **enclosure exhaust fan run status**, compressor inlet pressure, compressor discharge pressure, and oil pump discharge pressure;

- *Clancy's* cooler fan is an enclosure exhaust fan. It directs air out of the outlet louver, thereby removing air and qualifying as an enclosure exhaust fan, even under PO's purported definition
- PO does **not** offer any expert testimony to the contrary

[0039] As it can be seen from FIGS. 5a, 5b, 5c and 5d, a cooler fan (37) is powered by a hydraulic motor (38) attached to the fan shaft (39) by way of a coupler (39a). The after-cooler is designed to minimize the effects of sound pollution which is generated from moving high volumes of air. Two recycle louvers (40) and (41) are located on the top and bottom of the ducting (125), see FIG. 6, and an outlet louver (42) on the outlet of the ducting (125). These louvers are linked together by a linkage (43), which is connected to an electric actuator (44), which is controlled from the DCS. In the event that the room temperature falls, the electric actuator is sent a signal to open the two recycle louvers and as a result the outlet louver begins to close as the recycle and outlet louvers are interconnected by the linkage. This system is designed to maintain a set temperature as input by the field operator and is monitored via a fourth temperature sensor (45) located on the base of the adjacent wall at the opposite side of the ducting.

EX1055, [0039]

LIBERTY EXHIBIT 1073, Page 53

PO Does Not Dispute that *Clancy* Discloses [41m]-[41n]: “compressor inlet pressure”

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, **compressor inlet pressure**, compressor discharge pressure, and oil pump discharge pressure;

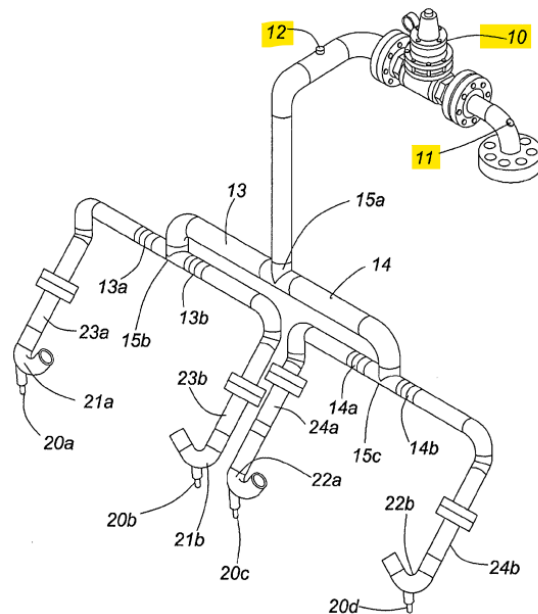


FIG. 2

[0033] The gas passes from the top of the pressure vessel through a first back-pressure valve (10), as represented in FIG. 2, which is placed in the flow line to regulate the downstream pressure which must be maintained at a pressure no greater than 15 psi which is the max suction pressure allowed for this selected compressor. Two pressure sensors (11) and (12) are located upstream and downstream respectively of the first back-pressure valve (10). The sensor (11) on the upstream side sends a pressure value to the DCS which is used to determine whether the compressors need to speed up or slow down to maintain the targeted pressure. Additionally the pressure can be trended to determine performance and activate the ESD of the system in the event of a high pressure or low pressure. Also, alarm set points can

EX1055, [0033]

PO Does Not Dispute that *Armstrong* Discloses [41m]-[41n]: monitoring “compressor discharge pressure”

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor; [41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, **compressor discharge pressure**, and oil pump discharge pressure;

- *Armstrong* discloses monitoring an FCS outlet pressure, which discloses and renders obvious monitoring compressor discharge pressure, as the FCS outlet pressure is controlled by the compressor speed.

other systems). Once started, the PLC controls the FCS exhaust flow rate and pressure. A **pressure sensor 65** located near the outlet 60 of the FCS 60', 60'', 60''' **senses the FCS outlet pressure**. A proportional-integral-derivative (PID) control algorithm is used to adjust the gas compressor speed by adjusting the variable frequency drive device 22. A

EX1054, 19:22-25

suitable for engine operation. The **screw compressor 20 is driven by an electric motor 21** through a gearset/adaptor/coupling arrangement. The electric motor 21 is driven by a variable frequency drive (VFD) 22, sometimes also referred to as a variable speed drive. The **VFD 22 varies the motor speed in response to a measured parameter, such as a fuel pressure**, to maintain the parameter (fuel delivery pressure) within a desired range. Fuel

EX1054, 10:20-24
LIBERTY EXHIBIT 1073, Page 55

PO Does Not Dispute that *Clancy* Discloses [41m]-[41n]: monitoring “compressor discharge pressure”

[41m] wherein the centralized control unit is further configured to monitor operating characteristics of the gas compressor;
[41n] wherein the monitored operating characteristics of the gas compressor include at least compressor motor run status, oil pump run status, enclosure exhaust fan run status, compressor inlet pressure, **compressor discharge pressure**, and oil pump discharge pressure;

- *Clancy* discloses monitoring compressor discharge pressure with third pressure sensor (35).
- As the third pressure sensor (35) is measuring pressure between the compressor and the after cooler, it is measuring compressor discharge pressure

[0038] Both gas flows, heated from the compression process, coming from the two compressors are then combined back into one common fifth 2" pipe (33) which leads the combined gas flow to an after-cooler (34) see FIG. 6. The combined gas flow will first pass by a third pressure sensor (35) which again communicates to the DCS and provides protection from over pressuring the system in the event of some form of blockage happening down stream of the compressors. Additionally, there is a pressure safety valve

EX1055, [0038]

Substitute Claim 42 Added Limitations

RMTA:

Claim 42. (Proposed substitute for original claim 2) [42a] The system of [claim 1] claim 41, further comprising:
a generator electrically connected to the electric pump to provide power to the electric pump,
wherein the generator is powered by liquefied natural gas, and

MTA:

Claim 22. (Proposed substitute for original claim 2) [22a] The system of [claim 1] claim 21, further comprising:
a generator electrically connected to the electric pump to provide power to the electric pump, wherein the generator is powered by liquefied natural gas,

The Preliminary Guidance Agreed that *Broussard079* Discloses [42a]: “generator is powered by liquefied natural gas”

[42] wherein the generator is powered by liquefied natural gas, and

Limitation	Claim(s)	Citation(s)
generator is powered by liquefied natural gas	22 [42] , 29, 40	Ex. 1004 [Coli] ¶¶ 10, 38, 40; Pet. 7; Ex. 1024 [Broussard079] ¶¶ 9, 24; Ex. 1022 [Durham Decl.] ¶¶ 73, 76

PG, 11

- Further, PO does **not** dispute that *Broussard079* discloses [42a]

[0024] Referring back to FIG. 1, also included in the equipment is a plurality of electric generators 22 that are connected to, and provide power to, the electric motors 14 on the pump vehicles 12. To accomplish this, the electric generators 22 can be connected to the electric motors 14 by power lines (not shown). The electric generators 22 can be connected to the electric motors 14 via power distribution panels (not shown). In certain embodiments, the electric generators 22 can be powered by natural gas. For example, the generators can be powered by liquefied natural gas. The liquefied natural gas can be converted into a gaseous form in a vaporizer prior to use in the generators. The use of natural gas to power the

EX1024, [0024]

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History
- II. Dispute Overview
- III. Substitute Claims 45–46 and 54–59 Are Indefinite
- IV. Substitute Claims 44 and 50 Lack Written Description
- V. Obviousness of Substitute Claims 41–42: Grounds 12A
- VI. Obviousness of Substitute Claim 43: Grounds 13A**
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
13A	43	<i>Coli, Birch, Rusnak, Armstrong, Clancy, Trobaugh, Teets, Hunt, and Gensel</i>
13B	43	Ground 13A references and what is otherwise available to the public

Substitute Claim 43 Added Limitations

RMTA:

Claim 43. (Proposed substitute for original claim 4) [43a] The system of [claim 1] claim 41, wherein the electric pump is a plurality of electric pumps,

[43b] the system further comprising a switch gear,

[43c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,

[43d] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

MTA:

Claim 24. (Proposed substitute for original claim 4) [24a] The system of [claim 1] claim 21, wherein the electric pump is a plurality of electric pumps,

[24b] the system further comprising a switch gear,

[24c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,

[24d] wherein operating characteristics include at least the status of a fire alarm.

The Preliminary Guidance Agreed that *Gensel* Discloses [43]: “a switch gear” and monitoring “the status of a fire alarm”

[43b] the system further comprising a switch gear,
[43c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,
[43d] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

Limitation	Claim(s)	Citation(s)
switch gear	24 [43], 30, 38, 39	Pet. 58–65; Ex. 1033 [Gensel], ¶ 186
status of fire alarm	24 [43], 30, 38	Pet. 58–65; Ex. 1033 [Gensel], Abstr., ¶¶ 2, 63–66; Ex. 1022 [Durham Decl.] ¶ 113

PG, 12

The Preliminary Guidance Agreed that *Gensel* Discloses [43]: “a switchgear” and monitoring “the status of a fire alarm”

[43b] the system further comprising a switch gear,
[43c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,
[43d] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

- *Gensel* discloses a switchgear and monitoring fire alarms
- Switchgears were prone to fires
- It would have been obvious to incorporate this functionality into *Coli*'s system
- PO does **not** dispute that *Gensel* discloses [43]

[0001] The present invention relates to a fire extinguishing system according to the features of the first patent claim.

[0002] The invention is suited for casings, in particular for casings for electronics, or switchgear cabinets, into which the electronic units may be plugged in or built in, for example by

EX1033, [0001]-[0002]

eous form effective for extinguishing. The fire detection is made by means of sensors adapted to the fire parameters, which are technically denoted as automatic fire alarms. As

EX1033, [0031]

Outline of Arguments: IPR2024-01274 ('992 Patent)

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- VI. Obviousness of Substitute Claim 43: Grounds 13A
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A**
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
14A	45, 46	<i>Coli, Birch, Hunt, Rusnak, Armstrong, Clancy, Trobaugh, Teets, Smith, Bromell, and Thompson</i>
14B	45, 46	Ground 14A references and what is otherwise available to the public

Substitute Claim 45 Added Limitations

RMTA:

[45c] wherein the emergency power off unit is operated by a switch that sounds an audible alarm.

MTA:

[26c] wherein the emergency power off unit is operated by a switch that sounds an audible alarm.

The Preliminary Guidance Agreed that *Smith* and *Bromell* Disclose [45c]: “emergency power off unit”

[45c] wherein the emergency power off unit is operated by a switch that sounds an audible alarm.

Limitation	Claim(s)	Citation(s)
emergency power off unit is operated by a switch that sounds an audible alarm	26 [45] , 35	Ex. 1035 [Smith], 1:1–3, 1:24–29; Ex. 1036 [Bromell], 1:19–21; 1:33–36; Ex. 1022 [Durham Decl.] ¶¶ 142, 144; Ex. 1023 [Nikolaou Dep.], 63:9–19

PG, 13

This invention relates to means for shut-ting down large hydraulic turbines and connected generators, and the primary ob-

EX1035, 1:1-3

electrical connections and elements, to shut down a turbine unit in an emergency by simply closing a switch to energize and ac-tuate a movable electrical part, which effects

EX1035, 1:24-27

This invention relates to drilling rig control, and more particularly to a determination of off-normal operation upon the deviation of one of three variables from individually established levels.

EX1036, 1:33-36

pressure. Each of these three variables in monitored, and a departure of any one of the three from an established level may be used to sound an alarm. A sudden decrease

EX1036, 1:19-21

- Further, PO does **not** dispute that *Smith* and *Bromell* disclose [45c]

Substitute Claim 46 Added Limitations

RMTA:

[46c] wherein the signal is transmitted over armored shielded CAT5E cabling.

MTA:

[27c] wherein the signal is transmitted over armored shielded CAT5E cabling.

The Preliminary Guidance Agreed that *Thompson* Discloses [46c]: “signal is transmitted over armored shielded CAT5E cabling”

[46c] wherein the signal is transmitted over armored shielded CAT5E cabling.

Limitation	Claim(s)	Citation(s)
signal is transmitted over armored shielded CAT5E cabling	27 [46] , 36	Ex. 1037, Abstr., ¶¶ 8, 15, 49; Pet. 33–34; Ex. 1022 [Durham Decl.] ¶¶ 151, 152;

PG, 13

- *Thompson* discloses armored shielded CAT5E cabling
- A POSITA would have been motivated to look to *Thompson* for details of Ethernet cables, such as shielded CAT5E cabling, to protect the cable from damage and prevent interference

An enhanced cable assembly for field data distribution system includes a cable member formed by a plurality of twisted conductor pairs bundled within a conductive shield and an insulative sheath. The cable assembly is terminated by a pair

EX1037, Abstract

sheath. The cable may also include an outer “armor” layer which reduces damage from being chewed by animals and from other hazards. Each end of the cable includes a cable connector with a plurality of sets of contacts to which the cable conductors are connected. The cable connector is configured to be compatible with the configuration of the box connector. The conductor pairs, in cooperation with the cable connector, are configured to comply with Category 5E specifications, often referred to as Cat 5E. Category 5E conductor

EX1037, [0015] EXHIBIT 1073, Page 69

SC 46: PO's Motivation to Combine Challenge Is Unfounded

[46c] wherein the signal is transmitted over armored shielded CAT5E cabling.

- *Coli* supplies the motivation to consider *Thompson*: communication is “typically sent via **hardwired cable**.” EX1004, [0066].
- PO's expert agrees that **Ethernet was well-known** long before the time of invention → no blueprint from '992 required

Q. Was it common in 2015 for signals to switchgears to be transmitted over armored shielded Cat5e cabling?

A. The technology was definitely available at the time, yes.

EX1053, 96:4-8

- Availability of unshielded Ethernet cabling does **not** teach away from or discourage use of armored shielded cabling
- PO does **not** dispute or offer **any expert testimony** rebutting that armored shielded cabling, which *Thompson* discloses, would solve the problem

Outline of Arguments: IPR2024-01274 ('992 Patent)

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- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A**
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
15A	47-49, 52, 54 56-57, 59	<i>Coli, Birch, Rusnak, Ekanayake, Bliss, Broussard079, and Gensel</i>
15B	47-49, 52, 54 56-57, 59	Ground 17A references and what is otherwise available to the public

Substitute Claims 47 & 56 Added Limitations

[47f] the method further comprising powering the electrically powered pump with a generator,

[47g] wherein the generator is a turbine generator;

[47h] the method further comprising monitoring operating characteristics of the turbine generator; and

[47i] wherein the monitored operating characteristics of the turbine generator include at least turbine air inlet filter transmitter failure.

[56f] the system further comprising one or more generators electrically connected to the electric pump to provide power to the electric pump;

[56g] wherein the one or more generators are turbine generators, and

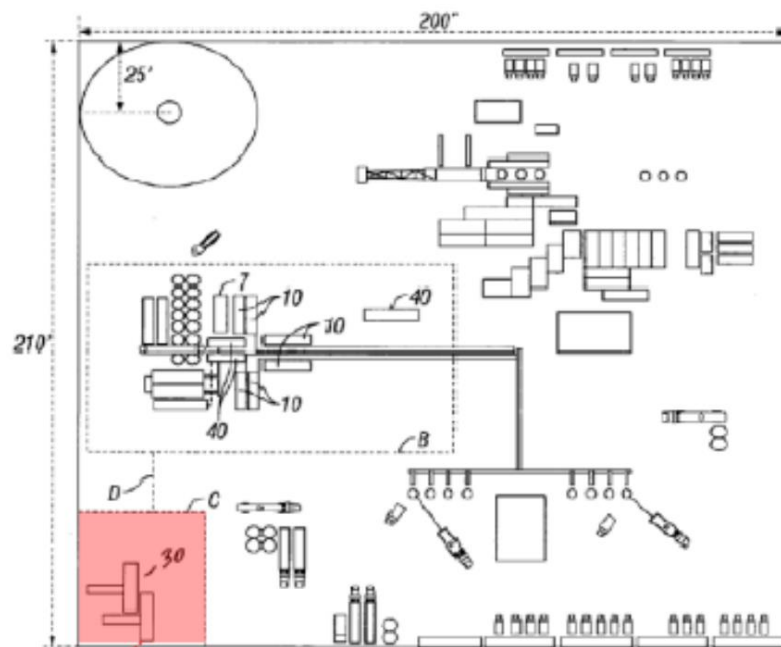
[56h] wherein the centralized control unit is further configured to monitor operating characteristics and control the one or more turbine generators, and

[56i] wherein the monitored operating characteristics of the one or more turbine generators include at least turbine air inlet filter transmitter failure.

PO Does Not Dispute that [47f]-[47g] & [56f]-[56g] Are Obvious

[47f] the method further comprising powering the electrically powered pump with a generator,
[47g] wherein the generator is a turbine generator;

[56f] the system further comprising one or more generators electrically connected to the electric pump to provide power to the electric pump;
[56g] wherein the one or more generators are turbine generators, and



turbine generators 30

FIG. 2

the fracturing site. One or more natural gas-powered turbine generators 30 are located in region C on the site, which is located a remote distance D from region B where the trailers 10 and fracturing modules 20 are located, for safety reasons.

EX1004, [0038]

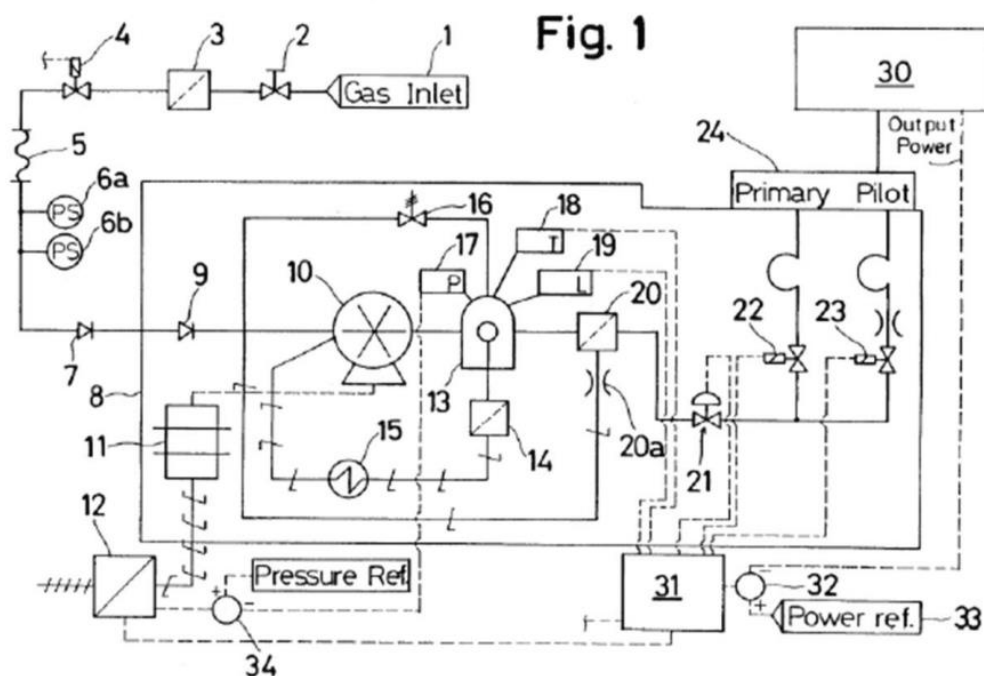
electric motor 21 and a fluid pump 22 coupled thereto. During fracturing, fracturing module 20 is operatively associated with turbine generator 30 to receive electric power therefrom.

EX1004, [0040]

PO Does Not Dispute that [47h] & [56h] Are Obvious

[47h] the method further comprising monitoring operating characteristics of the turbine generator; and

[56h] wherein the centralized control unit is further configured to monitor operating characteristics and control the one or more turbine generators, and



In order to achieve these objects, there is provided a gaseous fuel compression control system for a gas turbine engine comprising:

a screw compressor driven by an electric motor for compressing gaseous fuel for supply to the gas turbine engine, a power sensor for sensing the output power of the gas turbine engine, and modulating means for controlling the frequency of electrical power supplied to the electric motor, so as to control speed of the motor, in response to a control signal derived directly or indirectly from the power sensor.

EX1005, 1:60-67

- A POSITA would have been motivated and found it obvious to implement the central control monitoring features taught by *Birch* into *Coli* so that the control system of *Coli* controls and monitors the compression of natural gas flowing into the gas turbines

Ekanayake and Bliss Disclose [47i], [56i]: monitoring “turbine air inlet filter transmitter failure”

[47i] wherein the monitored operating characteristics of the turbine generator include at least turbine air inlet filter transmitter failure.

[56i] wherein the monitored operating characteristics of the one or more turbine generators include at least turbine air inlet filter transmitter failure.

- *Ekanayake* describes wirelessly communicating the degree of fouling of a fouling detection instruction in a filter assembly

To provide a safe and efficient operation, air entering a gas turbine for power generation applications is filtered. The gas turbine air inlet system may include an inlet filter house and associated ducting. In a typical installation, there may be

EX1027, 1:24-27

In another embodiment a filter assembly includes a filter element; a supporting structure connected to the filter element; and a fouling detection assembly attached to the filter component. The fouling detection component includes a fouling detection instrument; and a communication module.

EX1027, 2:19-23

filter component. At least one of the filter assemblies includes a fouling detection instrument; and a wireless communication module.

EX1027, 2:27-29

filter assemblies; wirelessly communicating the degree of fouling; and servicing the filter system when the degree of fouling exceeds a predetermined level.

EX1027, 2:33-35

Ekanayake and Bliss Disclose [47i], [56i]: monitoring “turbine air inlet filter transmitter failure”

[47i] wherein the monitored operating characteristics of the turbine generator include at least turbine air inlet filter transmitter failure.

[56i] wherein the monitored operating characteristics of the one or more turbine generators include at least turbine air inlet filter transmitter failure.

- *Ekanayake* discloses that load cells determine whether a filter is dirty and convert loads into electrical signals:

automatically triggered to clean the affected filters. A range of weight values between a loaded (i.e., dirty) and unfilled (i.e., clean) filters may be used to start or stop a pulse air system, and otherwise direct maintenance of filters.

EX1027, 3:23-26

Currently, load cells may be applied to loads from 0-500, 000 pounds with accuracy of 0.03% to 0.25% full scale. With

EX1027, 4:34-35

Strain gauge load cells, as discussed herein, convert the load acting on them into electrical signals. The strain gauges

EX1027, 11:56-57

- *Bliss* describes monitoring for transmitter failure using a weighing apparatus:

stored on the weighing apparatus. This weighing apparatus makes periodic tests to determine the health of the load cells in the system, producing a log file to record events such as any detected failure, suspicious reading, overload condition, or any user defined parameter, and is network enabled to be

EX1058, 2:41-45

- Obvious for *Coli's* control system to monitor the status of *Ekanayake's* filter assembly and wireless communication module using *Bliss's* technique to ensure that these components are operating properly

PO's Argument Re: [47i], [56i]: "turbine air inlet filter transmitter failure" Is Unfounded

- PO offers **no** expert testimony that Bliss is non-analogous art
- PO offers **no** expert testimony contradicting Dr. Durham's testimony that a POSITA would have been motivated to look to *Bliss* for details of techniques of monitoring load cell failures to ensure that components are operating properly and to know when appropriate action is needed.
 - PO's expert agrees that load cells were known to monitor filters in turbine generators:

Q. Were load cells known to monitor turbine generators in 2015?

A. Yes.

EX1053, 80:12-15

PO's Argument Re: [47i], [56i]: "turbine air inlet filter transmitter failure" Is Unfounded

- SC 47 and 56 are not limited to using only pressure sensors to monitor for turbine air inlet filter transmitter failure
- A POSITA would understand that '992's "turbine air inlet filter high," identified by PO, includes filter weight, which is what a load cell measures
 - The only expert testimony on the subject is that a POSITA would **not** have understood this to be limited to pressure:

Q. A POSITA would understand turbine air filter high to potentially mean turbine air inlet filter differential pressure reading is high; is that right?

A. **No**, I don't think you can get that from that reading. It says what it says. "Turbine air filter high." So it's something about the air in the filter is high.

Q. What would a POSITA understand based on knowledge of a POSITA what "turbine air inlet high" means?

A. Just exactly what I said. Some parameter associated with a turbine air inlet filter is high, above a threshold.

Q. What might some of those parameters be to your knowledge according to a POSITA?

A. Temperature could be one pressure, differential pressure, fouling level, weight. Probably some other ones that I'm missing, but it could include an awful lot of things

PO's Argument Re: [47i], [56i]: "turbine air inlet filter transmitter failure" Is Unfounded

- *Bliss* and *Ekanayake's* load cells are transmitters, as they transmit the measured weight via electrical signals → load cell failure = transmitter failure
- PO's expert *agrees* that an air inlet filter transmitter is "[a]nything that could be used to transmit a signal," and that load cells measure filter weight and then transmit that measurement

Q. What components would you use to implement an air inlet filter transmitter?

A. Anything that could be used to transmit a signal.

EX1053, 74:8-11

Q. And then the load cells would transmit a - an electrical signal that's indicative of the weight, correct?

A. Yes. Yeah. They -- the load cell would function as a sensor, basically, and there would be a measurement that could be transmitted for further processing, yes. That is correct.

EX1053, 75:15-22

Substitute Claim 48's Added Limitation Is Unpatentable For the Same Reasons as SC 42, Which PO Does Not Dispute

Claim 48. (Proposed substitute for original claim 9) [48a] The method of [claim 8] claim 47, further comprising: powering the electrically powered pump with a generator,
wherein the generator is fueled by liquefied natural gas; and

Claim 42. (Proposed substitute for original claim 2) [42a] The system of [claim 1] claim 41, further comprising:
a generator electrically connected to the electric pump to provide power to the electric pump,
wherein the generator is powered by liquefied natural gas, and

Substitute Claim 49's Added Limitation Is Unpatentable For the Same Reasons as SC 43

Claim 49. (Proposed substitute for original claim 10) [49a] The method of [claim 9] claim 48, wherein the natural gas is selected from the group consisting of field natural gas, compressed natural gas, and liquid natural gas, the method further comprising monitoring, by the centralized control unit, operating characteristics of a switch gear, wherein:

[49b] the operating characteristics of the switch gear include the status of a fire alarm.

Claim 43. (Proposed substitute for original claim 4) [43a] The system of [claim 1] claim 41, wherein the electric pump is a plurality of electric pumps,

[43b] the system further comprising a switch gear,

[43c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,

[43d] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

Substitute Claim 52 Added Limitations

RMTA:

Claim 52. (Proposed substitute for original claim 13) [52a] The method of [claim 9] claim 48, wherein the generator is a turbine generator; the method further comprising

controlling the turbine generator; and

[52b] monitoring operating characteristics of the turbine generator;

[52c] wherein the monitored operating characteristics of the turbine generator include gas fuel main valve discharge pressure transmitter failure, and backup system relay failure.

MTA:

Claim 33. (Proposed substitute for original claim 13) [33a] The method of [claim 9] claim 29, wherein the generator is a turbine generator; the method further comprising

controlling the turbine generator-and

[33b] monitoring operating characteristics of the turbine generator

[33c] wherein the monitored operating characteristics include gas fuel main valve discharge pressure transmitter failure, and backup system relay failure.

Coli Discloses [52b]: monitoring “operating characteristics”

[52b] monitoring operating characteristics of the turbine generator;

- Coli's "control center 40" "monitor[s]" "the entire fracturing operation," including turbine generators

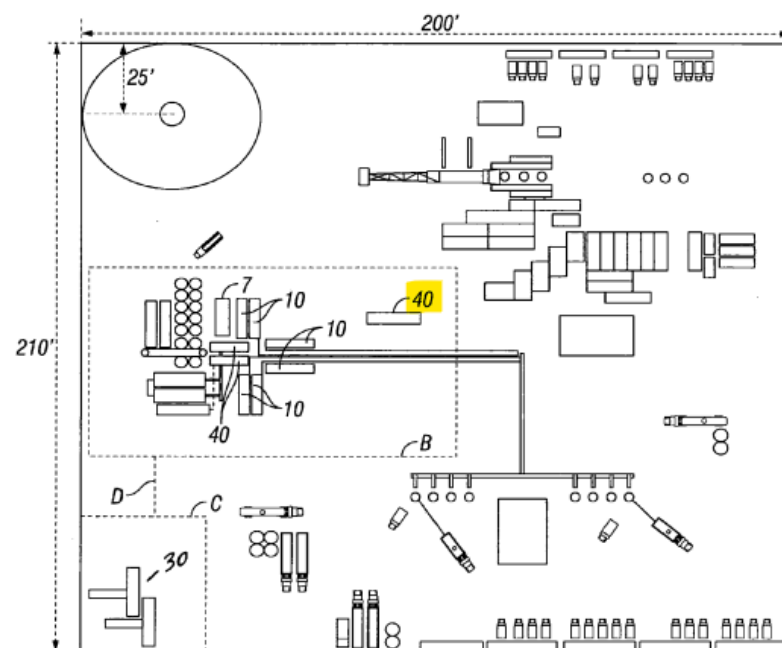


FIG. 2

[0010] In certain illustrative embodiments, the dedicated source of electrical power is a turbine generator. A source of natural gas can be provided, whereby the natural gas drives the turbine generator in the production of electrical power.

EX1004, [0010]

[0072] Suitable controls and computer monitoring for the entire fracturing operation can take place at a single central location, which facilitates adherence to pre-set safety parameters. For example, a control center 40 is indicated in FIG. 2 from which operations can be managed via communications link 41. Examples of operations that can be controlled and

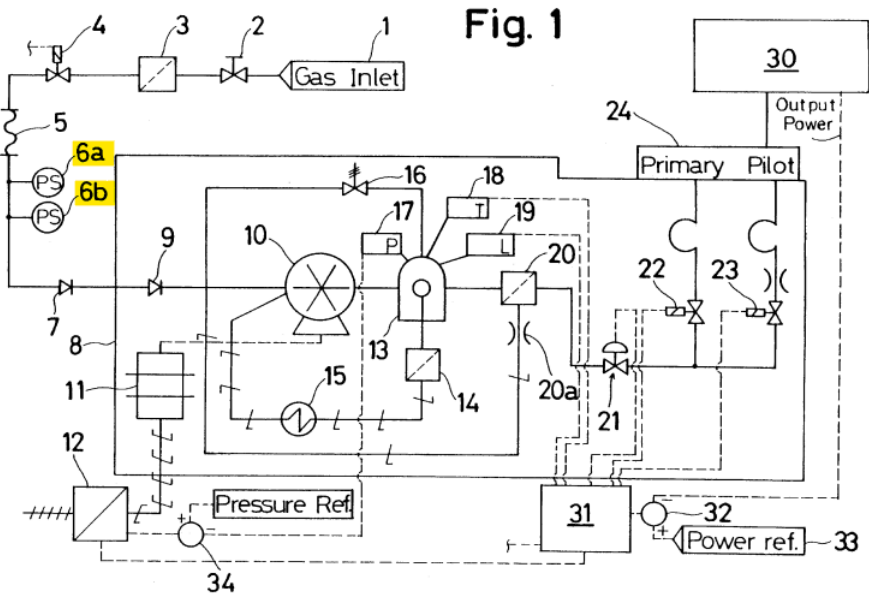
EX1004, [0072]

The Preliminary Guidance Agreed that *Birch* Discloses [52c]: monitoring “gas fuel main valve discharge pressure transmitter failure”

[52c] wherein the monitored operating characteristics of the turbine generator include **gas fuel main valve discharge pressure transmitter failure**, and backup system relay failure.

Limitation	Claim(s)	Citation(s)
gas fuel main valve discharge pressure transmitter failure	33 [52]	Ex. 1005 [Birch], 2:30–39, Fig. 1; Ex. 1022 [Durham Decl.] ¶ 160

PG, 13



system. The gas passes through a plug cock 2, a particulate filter 3, a solenoid isolating valve 4, a flexible connection 5, under and over pressure electronic sensors 6a and 6b and through an approved non-return valve 7.

EX1005, 2:36-39

- It would have been obvious to monitor whether such a transmitter failed, consistent with well-known pressure transmitter functionality, and to improve safety

PO's Argument Re: SC [52c] "gas fuel main valve discharge pressure transmitter failure" Is Wrong

[52c] wherein the monitored operating characteristics of the turbine generator include **gas fuel main valve discharge pressure transmitter failure**, and backup system relay failure.

- *Birch's* pressure sensors monitor pressure of gas fuel mains supply 1 → a POSITA would have understood the sensors monitor a gas fuel main valve discharge pressure
- *Birch* discloses pressure sensors transmitting a pressure value

atmosphere. In the separator tank 13, there are provided a level switch 19 for monitoring the oil level, a pressure sensor 17 for monitoring the discharge (gas) pressure and a thermocouple 18 for monitoring the discharge (gas) temperature. If an oil leak occurs and the lower oil level is detected by the level switch 19, or if the increase of the discharge (gas) temperature is detected by the thermocouple 18, these error signals are sent to a controller 31 which shuts down the system, thereby preventing the escape of gas.

EX1005, 3:4-12

- PO offers **no** expert testimony contrary to Dr. Durham's testimony that it was well known for pressure sensors to transmit failure codes.

The Preliminary Guidance Agreed that *Hunt* Discloses [52c]: monitoring “backup system relay failure”

[52c] wherein the monitored operating characteristics of the turbine generator include gas fuel main valve discharge pressure transmitter failure, and backup system relay failure.

Limitation	Claim(s)	Citation(s)
backup system relay failure	33 [52]	Pet. 54–55; Ex. 1008 [Hunt] ¶ 46; Ex. 1022 [Durham Decl.] ¶ 161

PG, 13

- It would have been obvious to monitor switchgear control relay 229’s status, including for failure, to determine whether backup power was available
- Further, PO does **not** dispute that *Hunt* discloses “backup system relay failure”

increased protection. Switchgear control relay 229 is connected to engage or disengage switchgear 221, thus coupling or decoupling power buses 240 and 260. For example, MCM 205 may issue a close command by energizing switchgear control relay 229 which in turn engages switchgear 221, coupling the two buses. Any interruption in control signal 227

EX1008, [0046]

Substitute Claim 54's Added Limitation Is Unpatentable For the Same Reasons as SC [45c]

[54b] wherein the emergency power off unit is operated by a switch that sounds an audible alarm.

[45c] wherein the emergency power off unit is operated by a switch that sounds an audible alarm.

Substitute Claim 57's Added Limitations Are Unpatentable For the Same Reasons as SC [43c], [43d]

[57b] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,

[57c] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

[43c] wherein the centralized control unit is further configured to monitor operating characteristics of the switch gear,

[43d] wherein the monitored operating characteristics of the switch gear include at least the status of a fire alarm.

Substitute Claim 59's Added Limitation Is Unpatentable For the Same Reasons as SC [42a]

[59b] wherein the one or more turbine generators are fueled by liquefied natural gas.

Claim 42. (Proposed substitute for original claim 2) [42a] The system of [claim 1] claim 41, further comprising:
a generator electrically connected to the electric pump to provide power to the electric pump,
wherein the generator is powered by liquefied natural gas, and

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History
- II. Dispute Overview
- III. Substitute Claims 45–46 and 54–59 Are Indefinite
- IV. Substitute Claims 44 and 50 Lack Written Description
- V. Obviousness of Substitute Claims 41–42: Grounds 12A
- VI. Obviousness of Substitute Claim 43: Grounds 13A
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A**
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
16A	50	<i>Coli, Birch, Rusnak, Ekanayake, Bliss, Broussard079, Allam</i>
16B	50	Ground 16A references and what is otherwise available to the public

Substitute Claim 50 Added Limitations

Claim 50. (Proposed substitute for original claim 11) [50a] The method of [claim 9] claim 48, further comprising controlling compression of the liquefied natural gas;

[50b] wherein the generator is fueled by liquefied natural gas,

[50c] the method further comprising monitoring operating characteristics of a hydraulic system,

[50d] wherein the monitored operating characteristics of the hydraulic system include system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

Substitute Claim 50's "liquefied gas" Limitation Is Unpatentable For the Same Reasons as SC [42a], [48a]

Claim 50. (Proposed substitute for original claim 11) [50a] The method of [claim 9] claim 48, further comprising controlling compression of the liquefied natural gas;

[50b] wherein the generator is fueled by liquefied natural gas,

Claim 42. (Proposed substitute for original claim 2) [42a] The system of [claim 1] claim 41, further comprising:
a generator electrically connected to the electric pump to provide power to the electric pump,
wherein the generator is powered by liquefied natural gas, and

Claim 48. (Proposed substitute for original claim 9) [48a] The method of [claim 8] claim 47, further comprising: powering the electrically powered pump with a generator,
wherein the generator is fueled by liquefied natural gas; and

PO Does Not Dispute that *Allam* Discloses [50a]: “controlling compression of the liquefied natural gas”

[50a] The method of [claim 9] claim 48, further comprising controlling compression of the liquefied natural gas;

- *Allam* discloses compressing liquefied natural gas (LNG) and controlling such compression:

The natural gas fuel for the power system combustor can be taken from the discharge of a high pressure LNG pump and compressed to the required pressure for combustion in a second LNG pump.

EX1064, 8:30-33

water and discharging through a bath stack 28. Flow of the compressed LNG stream 32 can be controlled as desired. For example, first control valve 29 and second control valve 49 can be used to determine the routing of the LNG. These, in combination with a variety of further pumps and water bath heaters in the LNG facility (not illustrated), can be used to alternate the flow path of the LNG stream to ensure continuous supply of LNG to the power generation system if the LNG pump 25 goes offline and continuous heating of all the

EX1064, 15:39-47

- A POSITA would have been motivated to combine *Allam* with the combination to ensure LNG supply to gas turbine generators

Substitute Claim 50's Added [50c], [50d] Limitations Are Unpatentable For the Same Reasons as SC [44b]-[44d] (*Infra* Grounds 20A/20B)

[50c] the method further comprising monitoring operating characteristics of a hydraulic system,

[50d] wherein the monitored operating characteristics of the hydraulic system include system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

[44b] the system further comprising a hydraulic system,

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system,

[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History
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- V. Obviousness of Substitute Claims 41–42: Grounds 12A
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- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A**
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
17A	51	<i>Coli, Birch, Rusnak, Hunt, Ekanayake, Bliss, Broussard079, Kohlenberger, Weiher, and Newman</i>
17B	51	Ground 21A references and what is otherwise available to the public

Substitute Claim 51 Added Limitations

RMTA:

Claim 51. (Proposed substitute for original claim 12) [51a] The method of [claim 9] claim 48, wherein the generator is a turbine generator; the method further comprising

[51b] monitoring operating characteristics of the turbine generator;

[51c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

MTA:

Claim 32. (Proposed substitute for original claim 12) [32a] The method of [claim 9] claim 29, wherein the generator is a turbine generator; the method further comprising

[32b] monitoring operating characteristics of the turbine generator

[32c] wherein the monitored operating characteristics include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, turbine air inlet filter transmitter failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, engine serial number, and turbine air inlet filter transmitter failure.

Kohlenberger Discloses [51c]: monitoring “fuel system air supply pressure transmitter failure”

[52c] wherein the monitored operating characteristics of the turbine generator include at least **fuel system air supply pressure transmitter failure**, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

- *Kohlenberger* discloses sensors (transmitters) for monitoring pressure at the gas turbine's air inlet (fuel system air supply pressure)
- Further, PO does **not** dispute that it was known for pressure transmitters to transmit failure codes

lower the temperature of the cooling coils 12,14,16. This motor/turbine control center 46 **has sensors** (not shown) within the air inlet **to insure that the air entering the turbine cabinet 48 is of constant temperature and pressure** to optimize the performance of the gas turbine 42.

EX1026, 6:2-6

Birch Discloses [51c]: monitoring “thermocouple input module thermistor failure”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, **thermocouple input module thermistor failure**, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

- *Birch* discloses a thermocouple for monitoring discharge temperature
- Further, PO does **not** dispute that it was known for a thermocouple-based temperature transmitter to transmit failure codes

atmosphere. In the separator tank **13**, there are provided a level switch **19** for monitoring the oil level, a pressure sensor **17** for monitoring the discharge (gas) pressure and a thermocouple **18** for monitoring the discharge (gas) temperature. If an oil leak occurs and the lower oil level is detected by the level switch **19**, or if the increase of the discharge (gas) temperature is detected by the thermocouple **18**, these error signals are sent to a controller **31** which shuts down the system, thereby preventing the escape of gas.

EX1005, 3:4-13

PO Does Not Dispute that *Coli* and *Rusnak* Disclose [51c]: monitoring “start VFD configuration failure”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, **start VFD configuration failure**, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

- *Coli* discloses variable frequency drives (VFDs):

[0065] A control system can be provided for regulating various equipment and systems within the electric powered fractioning operation. For example, in certain illustrative embodiments, the control system can regulate fracturing module 20 in delivery of treatment fluid from blender module 30 to pumps 22 for delivery to the wellbore. Controls for the electric-powered operation described herein are a significant improvement over that of conventional diesel powered systems. Because electric motors are controlled by variable frequency drives, absolute control of all equipment on location can be maintained from one central point. When the system

EX1004, [0065]

- *Rusnak* discloses a controller 30 that controls a VFD and automatically resets a faulted condition:

[0020] Referring to FIG. 1, there is shown a pumping system 10 having a variable frequency drive (VFD) 20 with a controller 30 for controlling the pumping system according to the present invention. The VFD 20 is coupled to an AC motor 40 which turns a centrifugal pump 50 at a rotational speed (n). The controller 30 operates the VFD 20 to control flow, speed or pressure of the pumping system 10, and to identify and report pump system problems. As shown, the controller 30

EX1007, [0020]

condition that initiated the action). When auto restart is enabled by the user setting a value greater than zero for the number of restarts of the auto retry (Auto Rstrt Tries), and an auto reset fault occurs, the controller 30 will stop and remain in the fault condition. After the number of seconds in the user defined delay of the auto retry (Auto Rstrt Delay) has elapsed, the controller 30 will automatically reset the faulted condition. The controller 30 will then issue an internal start

LIBERTY EXHIBIT 1073, Page 102
EX1007, [0080]

PO Does Not Dispute that *Weiher* Discloses [51c]: monitoring “generator circuit breaker failure to open”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, **generator circuit breaker failure to open**, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

- *Weiher* discloses a circuit breaker electronic trip unit that provides an alarm if the circuit breaker fails to open (stuck breaker):

stiff lubrication in bearings and sliding contacts. An extreme form of sluggish operation is a “stuck breaker” condition, in which **the circuit breaker fails to open**. A stuck breaker can be

EX1028, 3:1-3

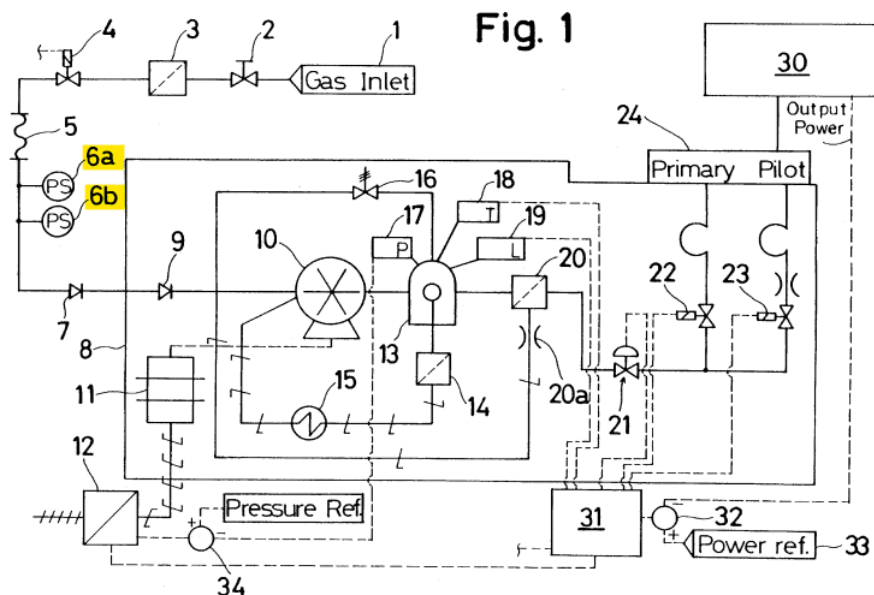
time. An electronic trip unit is discussed below that is able to automatically determine a sluggish circuit breaker operation and **a stuck breaker condition**. The electronic trip unit can **provide an appropriate indication or alarm**, and also trip an upstream circuit breaker, if a sluggish operation or a stuck breaker is detected. Maintenance can then be performed on

EX1028, 3:61-66

PO Does Not Dispute that *Birch* Discloses [51c]: monitoring “gas fuel supply pressure transmitter failure”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, **gas fuel supply pressure transmitter failure**, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and engine serial number.

- *Birch* discloses monitoring pressure of a mains supply that provides natural gas to a turbine generator's compressor:



Referring first to FIG. 1, hydrocarbon gas, usually natural gas at low pressure, enters the system from a mains supply 1. Items 2 to 7 are required by British Gas in this embodiment and protect the mains supply from being under- or over-pressurized by a fault developing in the compressor system. The gas passes through a plug cock 2, a particulate filter 3, a solenoid isolating valve 4, a flexible connection 5, under and over pressure electronic sensors 6a and 6b and through an approved non-return valve 7.

EX1005, 2:30-39

Birch Discloses [51c]: monitoring “gas fuel control pressure transmitter failure”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, **gas fuel control pressure transmitter failure**, utility circuit breaker closed, generator frequency, and engine serial number.

- *Birch* discloses a pressure sensor 17 for monitoring the discharge pressure of a compressor
- *Birch* explains that the pressure measurements generated by pressure sensor 17 **control the operation of the compressor**, which ultimately dictates **how much compressed gas** (i.e., “fuel”) **is provided to the turbine generator**
- PO does **not** dispute that *Birch*’s pressure sensor 17 is a gas fuel control pressure transmitter, or Dr. Durham’s testimony that it was well known in the art for pressure sensors to transmit failure codes
- PO “cannot show nonobviousness by attacking references individually where the grounds of unpatentability are based on combinations.” *Hulu, LLC v. SITO Mobile R&D IP*, IPR2021-00158, Paper 34, *41 (PTAB Apr. 15, 2022).

atmosphere. In the separator tank 13, there are provided a level switch 19 for monitoring the oil level, a pressure sensor 17 for monitoring the discharge (gas) pressure and a thermocouple 18 for monitoring the discharge (gas) temperature. If an oil leak occurs and the lower oil level is detected

EX1005, 3:4-8

circuit 39 and a firing circuit 40. The current pressure signal of the pressure sensor 17 is compared in a first comparator-34 with a pressure reference 41, and an output signal of the first comparator 34 is sent to the compensator 35. In

EX1005, 3:44-47

PO Does Not Dispute that *Coli* Discloses [51c]: monitoring “utility circuit breaker closed”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, **utility circuit breaker closed**, generator frequency, and engine serial number.

- The combined *Coli-Birch-Rusnak-Hunt* system includes a switchgear, which includes circuit breakers that control the coupling of a turbine generator bus to a utility bus. EX1052 [Durham Decl.], ¶ 521.
- *Coli's* control system “monitor[ing]” “the entire fracturing operation” (EX1004, [0072]) would have monitored the utility circuit breaker’s status, including whether it is open or closed

PO Does Not Dispute that *Hunt* Discloses [51c]: monitoring “generator frequency”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, **generator frequency**, and engine serial number.

[0040] FIG. 5 is a system state diagram 500 describing the freerun state 425 for an example of a power generation system, such as, for example, power generation system 200. As indicated, **MCM 205** verifies no load is connected to the generator power bus 240 and **proceeds to monitor the frequency of the power produced by generator 215**, as depicted

EX1008, [0040]

power bus 1140. Generator power bus 1140 is **monitored by supervisory relay 1120A** including sensor circuitry 1141 **capable of sensing**, for example, voltage, current, **frequency**, and/or phase of **the power produced by generator 1115**.

EX1008, [0054]

PO Does Not Dispute that *Newman* Discloses [51c]: monitoring “engine serial number”

[52c] wherein the monitored operating characteristics of the turbine generator include at least fuel system air supply pressure transmitter failure, thermocouple input module thermistor failure, start VFD configuration failure, generator circuit breaker failure to open, gas fuel supply pressure transmitter failure, gas fuel control pressure transmitter failure, utility circuit breaker closed, generator frequency, and **engine serial number**.

Disclosure of invention

One object of the present invention is to provide a life tracking system (LTS) for automatically identifying and recording in permanent record the configurations of a gas turbine engine by exact module type and serial number. Another object of the present invention

EX1029, 1:49-55

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History
- II. Dispute Overview
- III. Substitute Claims 45–46 and 54–59 Are Indefinite
- IV. Substitute Claims 44 and 50 Lack Written Description
- V. Obviousness of Substitute Claims 41–42: Grounds 12A
- VI. Obviousness of Substitute Claim 43: Grounds 13A
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A**
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
18A	53	<i>Coli, Birch, Rusnak, Ekanayake, Bliss, and Discenzo</i>
18B	53	Ground 18A references and what is otherwise available to the public

Substitute Claim 53 Added Limitations

RMTA:

[53b] the method further comprising monitoring operating characteristics of the variable frequency drive,

[53c] wherein the monitored operating characteristics of the variable frequency drive include motor winding temperatures, the motor RPM, the voltage, the torque, and the current (amperage).

MTA:

[34b] the method further comprising monitoring operating characteristics of the variable frequency drive,

[34c] wherein the monitored operating characteristics include motor winding temperatures, the motor RPM, the voltage, the torque, and the current (amperage).

The Preliminary Guidance Agreed that *Discenzo* Discloses [53c]: monitoring “motor winding temperatures”

[53c] wherein the monitored operating characteristics of the variable frequency drive include **motor winding temperatures**, the motor RPM, the voltage, the torque, and the current (amperage).

Limitation	Claim(s)	Citation(s)
motor winding temperature	34 [53]	Ex. 1038 [<i>Discenzo</i>], 6:40–41, 8:66–9:13

PG, 13

- *Discenzo* discloses monitoring an electric motor’s “winding temperature”
- Further, PO does **not** dispute that *Discenzo* discloses “motor winding temperatures”

in the motor. The processor may be a microprocessor. The **sensors may be used to sense various parameters including**, but not limited to, from one to three phases of current, one to three phases of voltage, one to five axis of vibration with accelerometers that are imbedded inside the motor, one to three proximity probes to monitor shaft displacement in two radial directions and an axial direction, motor speed such as through an encoder, motor location such as through a GPS sensor, air gap field strength, changes in magnetic field strength at one or more locations around the motor winding, **motor winding temperature** at one or more locations, and the

EX1038, 3:1-12

power to the motor. In an embodiment, **intelligent motor 102 samples** three phases of voltage, load end and fan end bearing temperatures, **winding temperature**, and vibration, and receives sampled motor current and voltage from three phases from power management device **115**, which may be a VFD.

EX1038, 6:39-43

intelligent motor may determine the condition of the windings, the bearings, the rotor, out of balance condition, torque, or the health of a pump connected to the motor. The intelligent motor may locally display that data on an LED and/or it could **send the machinery health information back through network 205 to a control system, such as a monitoring** or a maintenance management system. The health information may

EX1038, 8:66-9:5

The Preliminary Guidance Agreed that *Rusnak* Discloses [53c]: monitoring “the motor RPM”

[53c] wherein the monitored operating characteristics of the variable frequency drive include motor winding temperatures, **the motor RPM**, the voltage, the torque, and the current (amperage).

Limitation	Claim(s)	Citation(s)
motor RPM	34 [53]	Ex. 1007 [<i>Rusnak</i>] ¶¶ 2, 3; Ex. 1022 [Durham Decl.] ¶ 173

PG, 13

- *Rusnak*’s VFD measures motor speed (motor RPM)
- Further, PO does **not** dispute that *Rusnak* discloses “motor RPM”

[0002] Variable frequency drives (VFD) are used to adjust motor speed of the pump by controlling the frequency of the electrical power supplied to the motor so as to regulate flow within a pump system. It is known in the prior art to use of a VFD and an external processor to control a centrifugal pump. The VFD is used to vary pump speed and provide speed and torque measurements. Typically, prior art VFD techniques

EX1007, [0002]

The Preliminary Guidance Agreed that *Rusnak* Discloses [53c]: monitoring “the voltage”

[53c] wherein the monitored operating characteristics of the variable frequency drive include motor winding temperatures, the motor RPM, **the voltage**, the torque, and the current (amperage).

Limitation	Claim(s)	Citation(s)
voltage	34 [53]	Ex. 1007 [<i>Rusnak</i>] ¶ 5;

PG, 13

- *Rusnak* discloses monitoring a VFD’s voltage
- Further, PO does **not** dispute that *Rusnak* discloses “the voltage”

[0005] A method of controlling operation of a centrifugal pump in a fluid pumping system having a variable frequency drive powering an alternating current (AC) motor which turns said centrifugal pump is disclosed. The method comprises internally monitoring automatically output current and voltage of the VFD to the AC motor without the need for an external sensor; calculating automatically output power based on monitored values of said output current and voltage;

EX1007, [0005]

The Preliminary Guidance Agreed that *Rusnak* Discloses [53c]: monitoring “the torque”

[53c] wherein the monitored operating characteristics of the variable frequency drive include motor winding temperatures, the motor RPM, the voltage, **the torque**, and the current (amperage).

Limitation	Claim(s)	Citation(s)
torque	34 [53]	Ex. 1007 [<i>Rusnak</i>] ¶ 3;

PG, 13

- *Rusnak*’s VFD measures motor torque
- Nothing in *Rusnak* teaches away from monitoring Torque in view of *Rusnak*
- *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005) (“A statement that a particular combination is not a preferred embodiment does not teach away absent clear discouragement of that combination.”)

[0002] Variable frequency drives (VFD) are used to adjust motor speed of the pump by controlling the frequency of the electrical power supplied to the motor so as to regulate flow within a pump system. It is known in the prior art to use of a VFD and an external processor to control a centrifugal pump. The VFD is used to vary pump speed and provide speed and torque measurements. Typically, prior art VFD techniques

EX1007, [0002]

[0003] In other prior art pump control methods, relationships (curves) are developed between TDH and Torque for minimum and maximum allowable flow points over a variety of speeds and used to identify the operating point of the pump and determine if it is operating within an allowable minimum and maximum flow range. Pump performance curves, relationships between BHP, flow and TDH, and between BHP, torque and speed, as well the Affinity laws are used to develop the TDH vs. torque curves. Motor torque and speed values from a VFD are supplied to a processor where TDH, torque and speed relationships are used in a processor to identify the operating point of the pump and determine if the pump is operating within the allowable minimum and maximum allowable flow ranges. This method has been deployed in a VFD.

EXHIBIT 1073, Page 115
EX1007, [0003]

The Preliminary Guidance Agreed that *Rusnak* Discloses [53c]: monitoring “the current (amperage)”

[53c] wherein the monitored operating characteristics of the variable frequency drive include motor winding temperatures, the motor RPM, the voltage, the torque, and the current (amperage).

Limitation	Claim(s)	Citation(s)
current (amperage)	34 [53]	Ex. 1007 [<i>Rusnak</i>] ¶ 5;

PG, 13

- *Rusnak*’s VFD monitors output current
- Discenzo’s VFDs also monitor current
- Further, PO does **not** dispute that *Rusnak* or *Discenzo* discloses “the current (amperage)”

[0005] A method of controlling operation of a centrifugal pump in a fluid pumping system having a variable frequency drive powering an alternating current (AC) motor which turns said centrifugal pump is disclosed. The method comprises internally monitoring automatically output current and voltage of the VFD to the AC motor without the need for an external sensor; calculating automatically output power based on monitored values of said output current and voltage;

EX1007, [0005]

Variable frequency drives may continually monitor motor current or current and voltage to a motor to adjust the power to the motor. Such VFDs typically include a processor, such as a microprocessor, to control monitoring of and provide power to the motor. In an embodiment, intelligent motor 102

EX1038, 6:35-39; EX1073, Page 116

Outline of Arguments: IPR2024-01274 ('992 Patent)

- I. Overview of the '992 Patent and Procedural History
- II. Dispute Overview
- III. Substitute Claims 45–46 and 54–59 Are Indefinite
- IV. Substitute Claims 44 and 50 Lack Written Description
- V. Obviousness of Substitute Claims 41–42: Grounds 12A
- VI. Obviousness of Substitute Claim 43: Grounds 13A
- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A**
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
19A	55	<i>Coli, Birch, Rusnak, Hunt, Ekanayake, Bliss, Broussard079, and Thompson</i>
19B	55	Ground 19A references and what is otherwise available to the public

Substitute Claim 55's Added Limitation Is Unpatentable For the Same Reasons as SC [46c]

[55b] wherein signaling is transmitted over armored shielded CAT5E cabling.

[46c] wherein the signal is transmitted over armored shielded CAT5E cabling.

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- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A**
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
20A	44	<i>Coli, Birch, Rusnak, Armstrong, Clancy, Trobaugh, Teets, Hunt, Gensel, Delaney, and Weir</i>
20B	44	25A references and what is otherwise available to the public

Substitute Claim 44 Added Limitations

RM TA:

Claim 44. (Proposed substitute for original claim 5) [44a] The system of [claim 4] claim 43, further comprising: a variable frequency drive that controls the plurality of electric pumps,

[44b] the system further comprising a hydraulic system,

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system,

[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

MTA:

Claim 25. (Proposed substitute for original claim 5) [25a] The system of [claim 4] claim 24, further comprising: a variable frequency drive that controls the plurality of electric pumps,

[25b] the system further comprising a hydraulic system,

[25c] wherein the system is configured to monitor operating characteristics of the hydraulic system,

[25d] wherein the operating characteristics include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status.

PO Does Not Dispute that *Clancy* discloses [44b]: “a hydraulic system”

[44b] the system further comprising a hydraulic system,

reservoir or associated gathering system. In the preferred embodiment of this invention an engine generates power and transfers the power generated using a hydraulic system. The hydraulic system is used to drive two natural gas compressors, a natural gas after-cooler and a water pump, all of them controlled by a valve assembly.

EX1055, [0027]

- A POSITA would have been motivated to incorporate *Clancy's* hydraulic system to obtain power to drive the compressors and pumps

PO Does Not Dispute that *Delaney* and *Weir* Disclose [44c]-[44d]:
monitoring hydraulic system operating characteristics

[44c] wherein the system is configured to **monitor operating characteristics of the hydraulic system**;
[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status;

Delaney:

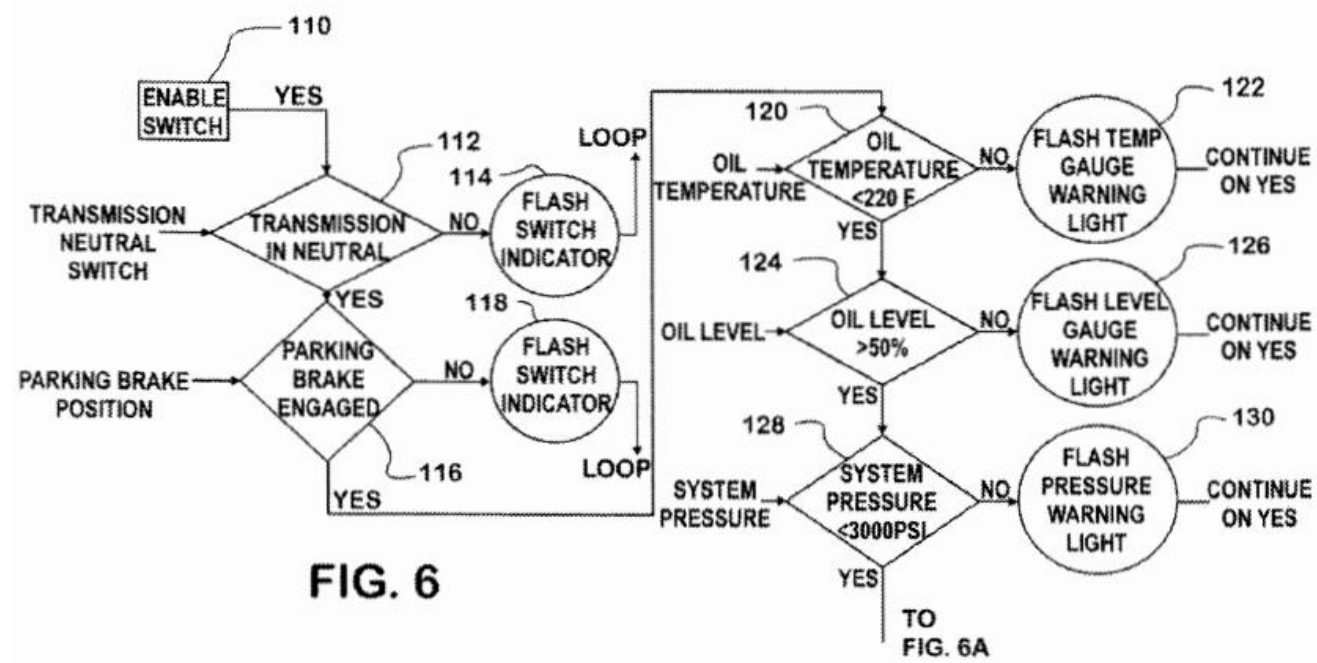


FIG. 6

Continued operation of the hydraulic PTO system may be programmed to depend upon working fluid condition related variables, namely hydraulic oil temperature, hydraulic oil level and system pressure, all falling within certain limits. Decision steps 120, 124 and 128 indicate compiling of the three variables and the generation of flashing warning lights at steps 122, 126 and 130 following the NO branches from the decision steps. In the preferred embodiment, when oil temperature meets or exceeds 220EF, oil level falls below 50% of the desired level, or system pressure meets or exceeds 3000 psi, warning lights are flashed. All conditions are periodically monitored by looping through the decision steps.

EX1059, 4:51-62

manifold. Valve positions in valve pack manifold 34 are controlled by a valve system controller 40, which includes solenoids to physically move the valves, and which monitors the hydraulic fluid level in reservoir 30 and the system oil pressure and temperature from manifold 34. Return filter 36 con-

EX1059, 3:21-25

PO Does Not Dispute that *Delaney* and *Weir* Disclose [44c]-[44d]: monitoring hydraulic system operating characteristics

[44c] wherein the system is configured to **monitor operating characteristics of the hydraulic system**;

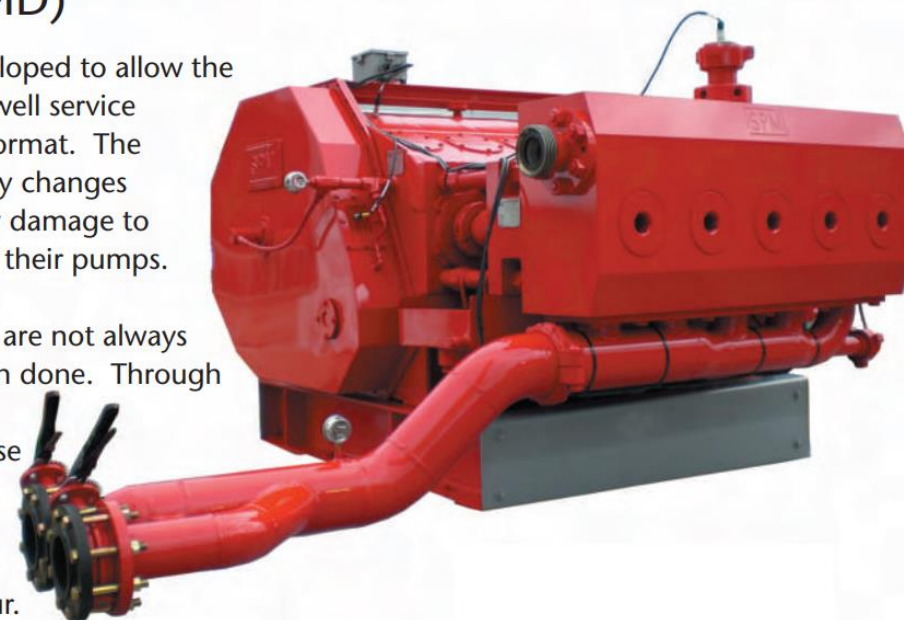
[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status;

Weir:

Pump Monitoring Device (PMD)

Weir SPM's Pump Monitoring Device was developed to allow the user to continually monitor the status of their well service pumps with real time data in an easy to read format. The PMD allows the operator to make the necessary changes during operation to minimize or prevent costly damage to pumping equipment and increase longevity of their pumps.

On a loud and hectic frac site, many problems are not always evident until it is too late and damage has been done. Through various sensors installed on the pump, the PMD provides a unique opportunity to diagnose problems such as insufficient charge pressure, discharge and suction valve failure, cavitation, as well as other issues by displaying "alarms" to notify the user of any problems as they occur.



EX1060, 34

PO Does Not Dispute that *Coli* and *Delaney* Disclose [44c]-[44d]: monitoring “system pressure” and “temperature”

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system;

[44d] wherein the monitored operating characteristics of the hydraulic system include at least **system pressure**, charge pressure, **temperature**, hydraulic oil level, and filter status;

- *Coli* teaches monitoring pump pressure:

[0069] The control system provided according to the present illustrative embodiments, being electrically powered, virtually eliminates these types of scenarios from occurring. A maximum pressure value set at the beginning of the operation is the maximum amount of power that can be sent to electric motor 21 for pump 22. By extrapolating a maximum current value from this input, electric motor 21 does not have the available power to exceed its operating pressure. Also,

EX1004, [0069]

- *Delaney* discloses monitoring system oil pressure and temperature:

manifold. Valve positions in valve pack manifold 34 are controlled by a valve system controller 40, which includes solenoids to physically move the valves, and which monitors the hydraulic fluid level in reservoir 30 and the system oil pressure and temperature from manifold 34. Return filter 36 condition is indicated by the pressure drop across the filter which is reported by a sensor to valve system controller 40, which reports the need for maintenance to ESC 62.

EX1059, 3:21-28

- A POSITA would have understood that, to set and effectuate a maximum pressure value of the pumps, the control system would monitor the pressure of the pump

PO Does Not Dispute that *Weir* Discloses [44c]-[44d]: monitoring “charge pressure”

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system;

[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and filter status;

Pump Monitoring Device (PMD)

Weir SPM's Pump Monitoring Device was developed to allow the user to continually monitor the status of their well service pumps with real time data in an easy to read format. The PMD allows the operator to make the necessary changes during operation to minimize or prevent costly damage to pumping equipment and increase longevity of their pumps.

On a loud and hectic frac site, many problems are not always evident until it is too late and damage has been done. Through various sensors installed on the pump, the PMD provides a unique opportunity to diagnose problems such as insufficient charge pressure, discharge and suction valve failure, cavitation, as well as other issues by displaying “alarms” to notify the user of any problems as they occur.



EX1060, 34

PO Does Not Dispute that *Delaney* Discloses [44c]-[44d]: monitoring “hydraulic oil level”

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system;

[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, **hydraulic oil level**, and filter status;

- *Delaney* discloses monitoring “hydraulic fluid [oil] level in reservoirs”:

manifold. Valve positions in valve pack manifold 34 are controlled by a valve system controller 40, which includes solenoids to physically move the valves, and which monitors the hydraulic fluid level in reservoir 30 and the system oil pressure and temperature from manifold 34. Return filter 36 condition is indicated by the pressure drop across the filter which is reported by a sensor to valve system controller 40, which reports the need for maintenance to ESC 62.

EX1059, 3:21-28

Three gauges are provided including a system pressure gauge 70, an hydraulic fluid temperature gauge 72 and an hydraulic fluid level gauge 74. The gauges may incorporate warning

EX1059, 2:64-66

PO Does Not Dispute that *Delaney* Discloses [44c]-[44d]: monitoring “filter status”

[44c] wherein the system is configured to monitor operating characteristics of the hydraulic system;

[44d] wherein the monitored operating characteristics of the hydraulic system include at least system pressure, charge pressure, temperature, hydraulic oil level, and **filter status**;

sure and temperature from manifold 34. Return filter 36 condition is indicated by the pressure drop across the filter which is reported by a sensor to valve system controller 40, which reports the need for maintenance to ESC 62.

EX1059, 3:25-28

A POSITA Would Have Been Motivated to Combine *Delaney* With the Combined System

- PO provides only attorney argument, unsupported by expert testimony, that *Delaney* is not analogous art
- But *Delaney* is analogous art → same field of endeavor of controlling and/or monitoring industrial equipment
 - *Clancy*: Hydraulic system on its compression skid and a hydraulic pump + DCS for diagnostics, control, and data logging. EX1055, [0003]-[0004], [0009], [0027]-[0028], [0061], [0073].
 - *Delaney*: Similar hydraulic system + electrical system control (ESC) providing similar control as Clancy's DCS and Coli's centralized monitoring/control. *Id.*; EX1059, 1:19-24, 3:49-51, 3:21-28; EX1004, [0072].
- A POSITA would have:
 - been motivated to look to *Delaney* regarding details of monitoring the hydraulic system;
 - recognized that both *Clancy* and *Delaney*'s hydraulic systems are similar and are designed to be transported; and
 - recognized that *Delaney*'s teachings are applicable to *Clancy*'s hydraulic system

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- VII. Obviousness of Substitute Claims 45–46: Grounds 14A
- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
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- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A**
- XV. Obviousness of Substitute Claims: Grounds 12B-21B

Grounds for Substitute Claims

Ground	Subst. Cl.	Prior Art
21A	58	<i>Coli, Birch, Rusnak, Hunt, Bliss, and McIver</i>
21B	58	26A references and what is otherwise available to the public

Substitute Claim 58 Added Limitations

RM TA:

Claim 58. (Proposed substitute for original claim 19) [58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and an electrical conveyor belt.

MTA:

Claim 39. (Proposed substitute for original claim 19) [39] The system of [claim 17] claim 37, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and electrical conveyor belt.

The Preliminary Guidance Agreed that *Coli* Discloses [58]: monitoring and controlling “electric motors”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, **electric motors**, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
electric motors	37, 39 [58]	Pet. 32–33; Ex. 1004 [Coli] ¶ 72; Ex. 1022 [Durham Decl.] ¶ 185

PG, 14

- *Coli* discloses controlling electric motors via a VFD
- Further, PO does **not** dispute that *Coli* discloses “electric motors”

[0072] Suitable **controls** and computer monitoring **for the entire fracturing operation** can take place at a single central location, which facilitates adherence to pre-set safety parameters. For example, a control center **40** is indicated in FIG. 2 from which operations can be managed via communications link **41**. Examples of operations that can be controlled and

EX1004, [0072]

[0011] In certain illustrative embodiments, **the electric motor** can be an AC permanent magnet motor and/or a variable speed motor. **The electric motor** can be capable of operation in the range of up to 1500 rpms and up to 20,000 ft/lbs of

EX1004, [0011]
LIBERTY EXHIBIT 1073, Page 134

The Preliminary Guidance Agreed a “switchgear” Is a Part of the Combined System

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
switch gear	24, 30, 38, 39 [58]	Pet. 58-65; Ex. 1022 [Durham Decl.] ¶ 186

PG, 12

- Dr. Durham explains that the combined *Coli-Birch-Rusnak-Hunt* system includes a switchgear. Pet. 58-65; EX1022 [Durham Decl.] ¶ 186
- PO does **not** dispute that a “switchgear” is a part of the combined system

The Preliminary Guidance Agreed that *Coli* Discloses [58]: monitoring and controlling “transformers”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
transformers	39 [58]	Ex. 1004 [Coli] ¶ 47; Ex. 1022 [Durham Decl.] ¶ 187

PG, 14

- *Coli* discloses an electrical transformer
- PO does **not** substantively rebut Dr. Durham’s supporting testimony

[0047] Electric motor 21 is operatively associated with turbine generator 30, in certain embodiments. Typically, each fracturing module 20 will be associated with a drive housing for controlling electric motor 21 and pumps 22, as well as an electrical transformer and drive unit 50 (see FIG. 3) to step down the voltage of the power from turbine generator 30 to a voltage appropriate for electric motor 21. The electrical transformer and drive unit 50 can be provided as an independent unit for association with fracturing module 20, or can be permanently fixed to the trailer 10, in various embodiments. If permanently fixed, then transformer and drive unit 50 can be scalable to allow addition or subtraction of pumps 22 or other components to accommodate any operational requirements.

The Preliminary Guidance Agreed that *Broussard079* Discloses [58]: monitoring and controlling “mobile turbines”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
mobile turbines	39 [58]	Pet. 36–39; Ex. 1024 [<i>Broussard079</i>] ¶ 8; Ex. 1022 [Durham Decl.] ¶ 188

PG, 14

- *Broussard079* discloses mobile turbines
- Further, PO does **not** dispute that *Broussard079* discloses “mobile turbines”

[0008] In one embodiment, the system further includes an A/C console and a variable frequency drive that controls the speed of the pumps. Furthermore, the electric pumps, as well as the electric generators, can be mounted on vehicles, and can be ported from one well to another. The vehicles can be trucks and can have at least five axles.

EX1024, [0008]

The Preliminary Guidance Agreed that *Coli* Discloses [58]: monitoring and controlling “rate and pressure of the overall system”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, **rate and pressure of the overall system**, vertical sand silos, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
rate and pressure of overall system	39 [58]	Ex. 1004 [Coli] ¶ 71; Ex. 1022 [Durham Decl.] ¶¶ 189-190

PG, 14

- *Coli* discloses controlling the rate of the overall system
- The combined system discloses monitoring/controlling various system pressures—e.g., pump pressure, turbine generate pressure (SC 51-52), hydraulic system pressure (SC [44d])
- Further, PO does **not** dispute these features

[0071] In contrast, the present operation utilizes a single point control that is not linked solely to blender operations, in certain illustrative embodiments. All operation parameters can be input prior to beginning the fractioning. **If a rate change is required, the system will increase the rate of the entire system with a single command.** This means that if pumps 22 are told to increase rate, then blender module 40 along with the chemical units and even ancillary equipment like sand belts will increase rates to compensate automatically.

EX1004, [0071]

The Preliminary Guidance Agreed that *Mclver* Discloses [58]: monitoring and controlling “vertical sand silos”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, **vertical sand silos**, and an electrical conveyor belt.

Limitation	Claim(s)	Citation(s)
vertical sand silos	39 [58]	Ex. 1039 [<i>Mclver</i>] ¶¶ 17, 56; Ex. 1022 [Durham Decl.] ¶ 191

PG, 14

- *Mclver* discloses monitoring and controlling vertical silos
- Further, PO does **not** dispute that *Mclver* discloses “vertical sand silos”

[0017] In certain embodiments, said storage system further comprises a base platform. In certain embodiments, said base platform comprises tire guide rails. In certain embodiments, said base platform is configured to support **three of said storage bins in a vertical position**. In certain embodiments,

EX1039, [0017]

operation (“the frac job). In preferred embodiments of the invention, the system will also be able to **monitor the level of sand in each silo**. In certain preferred embodiments, this

EX1039, [0056]

proppant amounts in real time, the system can furnish **the rate at which the sand or other proppant is being removed from the silo**, as well as the rate of sand delivery going into the blender

EX1039, [0056]

The Preliminary Guidance Agreed that *Mclver* Discloses [58]: monitoring and controlling “vertical sand silos”

[58] The system of [claim 17] claim 56, wherein the centralized control unit is further configured to monitor and control all of the following: compression of natural gas, electric motors, switchgear, transformers, mobile turbines, rate and pressure of the overall system, vertical sand silos, and **an electrical conveyor belt**.

Limitation	Claim(s)	Citation(s)
electrical conveyor belt	39 [58]	Ex. 1039 [<i>Mclver</i>] ¶¶ 44, 45, 54, 56; Ex. 1022 [Durham Decl.] ¶ 192

PG, 14

- *Mclver* discloses a VFD that controls the speed of its electrical dual conveyor belt system
- Further, PO does **not** dispute that *Mclver* discloses “an electrical conveyor belt”

[0044] FIG. 15 depicts a side view of two silos positioned side-by-side on two different base platforms. In between the two silos is a **dual belt conveyor system**.
[0045] FIG. 16 depicts an arrangement of six silos, in the “six pack” configuration, positioned vertically on two separate base platforms. In between the two rows of three silos is a **dual belt conveyor system**.

EX1039, [0045]-[0046]

[0056] In certain embodiments of the invention, **the dual belt conveyor** and the shuttle conveyors both **have Variable Frequency Drives (VFD)**. In certain embodiments, the end of

EX1039, [0056]

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- VIII. Obviousness of Substitute Claims 47–49, 52, 54, 56–57, 59: Grounds 15A
- IX. Obviousness of Substitute Claim 50: Grounds 16A
- X. Obviousness of Substitute Claim 51: Grounds 17A
- XI. Obviousness of Substitute Claim 53: Grounds 18A
- XII. Obviousness of Substitute Claim 55: Grounds 19A
- XIII. Obviousness of Substitute Claim 44: Grounds 20A
- XIV. Obviousness of Substitute Claim 58: Grounds 21A
- XV. Obviousness of Substitute Claims: Grounds 12B–21B**

Petitioners' Grounds 12B-21B Are Unchallenged By PO

- PO does **not** challenge what was otherwise known and available to the public under § 102(a)(1)
- Dr. Durham provides **uncontested** testimony that each of the limitations of Substitute Claims 41-59 were publicly available
- Dr. Durham provides **uncontested** testimony on the motivations to combine what was otherwise known and available to the public for Grounds 12B-21B
- PO's expert, Dr. Nikolaou, **admits** to the public availability of a majority of the Substitute Claims' added limitations

Petitioners’ Unchallenged Grounds 12B-21B

Ground	SC	Evidence of What Was Otherwise Available to the Public and a POSITA’s Motivations
12B	41[p]-[g]	Pet. Opp. to RMTA §1.C.1; EX1052, ¶¶241-247; EX1053, 10:20-11:2, 11:11-17, 12:13-13:12 ([41[g]]).
	41[h]-[n]	Pet. Opp. to RMTA §1.C.1; EX1052, ¶¶248-296; EX1053, 21:1-13, 22:20-23:2 (water separator status); <i>id.</i> , 24:20-25:2, 25:11-18, 27:7-9, 27:22-28:3, 29:7-10, 30:11-31:1, 32:21-33:1 (particulate filter status); <i>id.</i> , 34:2-10, 34:21-35:5, 35:17-36:7, 37:6-17, 38:20-39:6, 39:16-40:1, 40:11-17, 43:5-6 (gas pressures); <i>id.</i> , 40:3-17 (gas temperatures); <i>id.</i> , 48:21-49:12 (valve statuses); <i>id.</i> , 52:2-15, 53:7-18, 54:14-22 (filter bypass status).
	42	Pet. Opp. to RMTA §1.C.1; EX1052, ¶¶297-302; EX1023, 31:7-9 ([42[a]]).
13B	43	Pet. Opp. to RMTA §1.C.2; EX1052, ¶¶316-321; EX1023, 52:16-53:5 (43[d]).
14B	45	Pet. Opp. to RMTA §1.C.3; EX1052, ¶¶349-359; EX1053, 72:6-73:8 (45[c]).
	46	Pet. Opp. to RMTA §1.C.3; EX1052, ¶¶360-369; EX1053, 96:4-8 (46[c]).

Examples of Dr. Nikolaou’s Admissions:

SC 41 (water separator status):

Q. Why would a POSITA want to monitor water separator status?

A. ...to ensure that there is proper operation ... no compromise in performance.

Q. Was it known to monitor water separator status in 2015?

A. The technology for monitoring water separator status was available and known. A POSITA would know that technology.

EX1053, 21:1-8, 22:20-23:2

SC [46c] (signal transmitted over armored shielded CAT5E cabling):

Q. Was it common in 2015 for signals to switchgears to be transmitted over armored shielded Cat5e cabling?

A. The technology was definitely available at the time, yes.

EX1053, 96:4-8

Petitioners’ Unchallenged Grounds 12B-21B

Ground	SC	Evidence of What Was Otherwise Available to the Public and a POSITA’s Motivations
15B	47, 56	Pet. Opp. to RMTA §1.C.4; EX1052, ¶¶454-461 (SC 47-48), 473-465 (SC 56); EX1053, 79:12-16 (47[i], 56[i]); EX1023, 39:13-17 (same).
	48, 59	Pet. Opp. to RMTA §1.C.4; Ground 12B (42[a]).
	49, 57	Pet. Opp. to RMTA §1.C.4; Ground 13B (43[c], 43[d]).
	52	Pet. Opp. to RMTA §1.C.4; EX1052, ¶¶463-471; EX1023, 81:9-15 (gas fuel main discharge pressure transmitter failure); <i>id.</i> , 82:11-16 (backup system relay failure).
	54	Pet. Opp. to RMTA §1.C.4; Ground 14B (45[c]).
16B	50	Pet. Opp. to RMTA §1.C.5; EX1052, ¶¶494-496; Ground 20B (50[d]).
17B	51	Pet. Opp. to RMTA §1.C.6; EX1052, ¶¶524-546; EX1023, 35:14-21 (fuel system air supply pressure transmitter failure); <i>id.</i> , 36:20-37:3 (thermocouple input module thermistor failure); <i>id.</i> , 37:22-38:7 (start VFD configuration failure); <i>id.</i> , 40:15-41:1 (generator circuit breaker failure to open); <i>id.</i> , 42:4-9 (gas fuel supply pressure transmitter failure); <i>id.</i> , 43:10-15 (gas fuel control pressure transmitter failure); <i>id.</i> , 44:13-19 (utility circuit breaker closed); <i>id.</i> , 45:17-46:3 (generator frequency); <i>id.</i> , 48:3-8 (engine serial number).

Examples of Dr. Nikolaou’s Admissions:

SC [47i]/[56i] (turbine air inlet filter transmitter failure):

Q. Was it common to monitor for a failure of a turbine air inlet filter transmitter in 2015?

A. For -- for turbines, yes. In general, yes.

EX1053, 79:12-16

SC [52c] (gas fuel main discharge pressure transmitter failure):

Q. As of the time of the 992 patent application in 2015, was it known to monitor for failure of a turbine generator's gas fuel main valve discharge pressure transmitter?

A. The technology for doing that was available at the time, that is correct.

EX1023, 81:9-15

SC [51c] (gas fuel control pressure transmitter failure):

Q. As of the time of the 992 patent application in 2015, was it known to monitor for failure of a gas fuel control pressure transmitter?

A. The technology for how to monitor this was available at the time.

Petitioners’ Unchallenged Grounds 12B-21B

Ground	SC	Evidence of What Was Otherwise Available to the Public and a POSITA’s Motivations
18B	53	Pet. Opp. to RMTA §1.C.7; EX1052, ¶¶563-577; EX1023, 83:19-84:6 (motor winding temperatures); <i>id.</i> , 84:17-20 (motor RPM); <i>id.</i> , 85:7-11 (voltage); <i>id.</i> , 85:21-86:3 (torque); <i>id.</i> , 86:12-87:2 (current (amperage)).
19B	55	Pet. Opp. to RMTA §1.C.8; EX1052, ¶¶587-591; Ground 14B (55[b]).
20B	44	Pet. Opp. to RMTA §1.C.9; EX1052, ¶¶622-636; EX1023, 58:7-13 (system pressure); <i>id.</i> , 59:5-11 (charge pressure); <i>id.</i> , 59:21-60:15 (temperature); <i>id.</i> , 61:6-11 (hydraulic oil level); <i>id.</i> , 61:22-62:13 (filter status).
21B	58	Pet. Opp. to RMTA §1.C.10; EX1052, ¶¶652-653; see Ground 15B.

Examples of Dr. Nikolaou’s Admissions:

SC [53c] (torque):

Q. As of the time of the 992 patent application in 2015, was it known to monitor a VFD's torque?

A. The technology for doing this was available at the time.

EX1023, 85:21-86:3

SC [44d] (system pressure):

Q. As of the time of the 992 patent application in 2015, was it known to monitor the system pressure of a hydraulic system?

A. The technology or monitoring the pressure of a hydraulic system was known at the time, yes.

EX1023, 58:7-13

SC [44d] (charge pressure):

Q. As of the time of the 992 patent application in 2015, was it known to monitor the charge pressure of a hydraulic system?

A. The technology for monitoring charge pressure in a hydraulic system was known at the time, yes.