

[SS 1] grounding and arrangement

Results in EPODOC 2

[SS 2] surface and exitation

Results in EPODOC 32

[SS 3] 1

Results in EPODOC 2

[SS 4] ..v

[EPODOC: SS 4] 2

Results in EPODOC 32

[SS 5] ...v

Unknown command or preparation. [More info](#) *ERROR(-104000)*

[SS 5] ..v

[EPODOC: SS 5] (drill or drilling) and earth

Results in EPODOC 9.051

[SS 6] 5 and (well or pit or shaft or hole or pool)

Results in EPODOC 3.669

[SS 7] 6 and arrangement

Results in EPODOC 135

[SS 8] 7 and (EM or electromagnetic)

Results in EPODOC 13

[SS 9] ..v

[EPODOC: SS 9] 8 and energy

Results in EPODOC 1

[SS 10] ..v

[EPODOC: SS 10] 9 and hydrocarbons

Results in EPODOC 0

[SS 11] 10 and oil

Results in EPODOC 0

[SS 12] 8

Results in EPODOC 13

[SS 13] ..li



- 1/13

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PN

- [US2018045034](#) A1 20180215

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- WO2015US22518 20150325

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- US201515555931 20150325

DT

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CCI

- [E21B47/02216](#) ; [E21B7/04](#)

PA

- HALLIBURTON ENERGY SERVICES INC [US]

TI

- Surface Excitation Ranging Methods and Systems Employing a Ground **Well** and a Supplemental Grounding **Arrangement**

AB

- A surface excitation ranging method includes selecting a first **well** with a metal casing as a target **well** and selecting a second **well** with a metal casing as a ground **well**. The method also includes installing a supplemental grounding **arrangement** for a power supply located at **earth**'s surface, wherein the ground **well** and the supplemental grounding **arrangement** fulfill an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along the target **well**. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.
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- [US2018038219](#) A1 20180208

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- WO2015US22536 20150325

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- US201515553111 20150325

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CCI

- [E21B47/02216](#) ; [G01V3/30](#)

CUI

- [E21B47/024](#) ; [E21B47/09](#) ; [G01V3/26](#)

CUA

- [G01V3/083](#)

PA

- HALLIBURTON ENERGY SERVICES INC [US]

TI

- Surface Excitation Ranging Methods and Systems Employing a Customized Grounding **Arrangement**

AB

- A surface excitation ranging method includes installing a customized grounding **arrangement** for a power supply located at **earth**'s surface, wherein the customized grounding **arrangement** fulfills an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along a target **well** with a metal casing. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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PN - [MX2017010185](#) A 20171117

PR - WO2015US22518 20150325

AP - MX20170010185 20150325

DT - I

CCI - [E21B47/02216](#) ; [E21B7/04](#)

PA - HALLIBURTON ENERGY SERVICES INC [US]

TI - SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A GROUND WELL AND A SUPPLEMENTAL GROUNDING ARRANGEMENT.

AB - A surface excitation ranging method includes selecting a first well with a metal casing as a target well and selecting a second well with a metal casing as a ground well. The method also includes installing a supplemental grounding arrangement for a power supply located at earth's surface, wherein the ground well and the supplemental grounding arrangement fulfill an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along the target well. The method also includes sensing electromagnetic (EM) fields emitted from the target well due to the electrical current. The method also includes using distance or direction information obtained from the sensed EM fields to guide drilling of a new well relative to the target well.

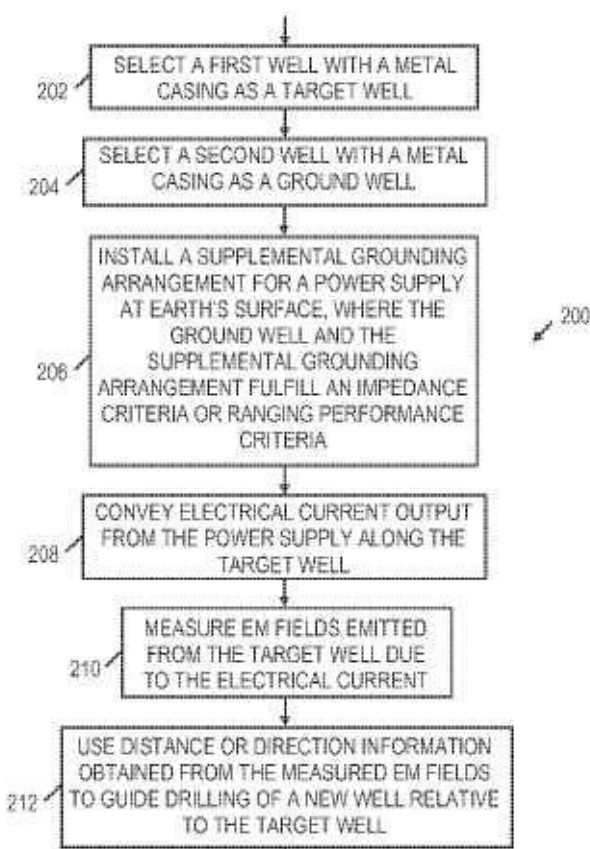


FIG. 6

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PN - [MX2017010190](#) A 20171117

PR - WO2015US22536 20150325

AP - MX20170010190 20150325

DT - I

CCI - [E21B47/02216](#) ; [G01V3/30](#)

CUI - [E21B47/024](#) ; [E21B47/09](#) ; [G01V3/26](#)

CUA - [G01V3/083](#)

PA - HALLIBURTON ENERGY SERVICES INC [US]

TI - SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A CUSTOMIZED GROUNDING ARRANGEMENT.

AB - A surface excitation ranging method includes installing a customized grounding arrangement for a power supply located at earth's surface, wherein the customized grounding arrangement fulfills an impedance criteria or ranging

performance criteria. The method also includes conveying an electrical current output from the power supply along a target **well** with a metal casing. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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- [CA2977216](#) A1 20160929

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- WO2015US22518 20150325

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- CA20152977216 20150325

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- [E21B47/02216](#) ; [E21B7/04](#)

PA

- HALLIBURTON ENERGY SERVICES INC [US]

TI

- SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A GROUND **WELL** AND A SUPPLEMENTAL GROUNDING **ARRANGEMENT**

AB

- A surface excitation ranging method includes selecting a first **well** with a metal casing as a target **well** and selecting a second **well** with a metal casing as a ground **well**. The method also includes installing a supplemental grounding **arrangement** for a power supply located at **earth's** surface, wherein the ground **well** and the supplemental grounding **arrangement** fulfill an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along the target **well**. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

```
graph TD; 202[SELECT A FIRST WELL WITH A METAL CASING AS A TARGET WELL] --> 204[SELECT A SECOND WELL WITH A METAL CASING AS A GROUND WELL]; 204 --> 206[INSTALL A SUPPLEMENTAL GROUNDING ARRANGEMENT FOR A POWER SUPPLY AT EARTH'S SURFACE, WHERE THE GROUND WELL AND THE SUPPLEMENTAL GROUNDING ARRANGEMENT FULFILL AN IMPEDANCE CRITERIA OR RANGING PERFORMANCE CRITERIA]; 206 --> 208[CONVEY ELECTRICAL CURRENT OUTPUT FROM THE POWER SUPPLY ALONG THE TARGET WELL]; 208 --> 210[MEASURE EM FIELDS EMITTED FROM THE TARGET WELL DUE TO THE ELECTRICAL CURRENT]; 210 --> 212[USE DISTANCE OR DIRECTION INFORMATION OBTAINED FROM THE MEASURED EM FIELDS TO GUIDE DRILLING OF A NEW WELL RELATIVE TO THE TARGET WELL];
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FIG. 6

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- WO2015US22536 20150325

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- CA20152976352 20150325

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CCI

- [E21B47/02216](#) ; [G01V3/30](#)

CUI

- [E21B47/024](#) ; [E21B47/09](#) ; [G01V3/26](#)

CUA - [G01V3/083](#)

PA - HALLIBURTON ENERGY SERVICES INC [US]

TI - SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A CUSTOMIZED GROUNDING **ARRANGEMENT**

AB - A surface excitation ranging method includes installing a customized grounding **arrangement** for a power supply located at **earth**'s surface, wherein the customized grounding **arrangement** fulfills an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along a target **well** with a metal casing. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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PN - [AU2015387499](#) A1 20170831

PR - WO2015US22536 20150325

AP - AU20150387499 20150325

DT - I

CCI - [E21B47/02216](#) ; [G01V3/30](#)

CUI - [E21B47/024](#) ; [E21B47/09](#) ; [G01V3/26](#)

CUA - [G01V3/083](#)

PA - HALLIBURTON ENERGY SERV INC

TI - Surface excitation ranging methods and systems employing a customized grounding **arrangement**

AB - A surface excitation ranging method includes installing a customized grounding **arrangement** for a power supply located at **earth**'s surface, wherein the customized grounding **arrangement** fulfills an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along a target **well** with a metal casing. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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PN - [AU2015387496](#) A1 20170817

PR - WO2015US22518 20150325

AP - AU20150387496 20150325

DT - I

CCI - [E21B47/02216](#) ; [E21B7/04](#)

PA - HALLIBURTON ENERGY SERV INC

TI - Surface excitation ranging methods and systems employing a ground **well** and a supplemental grounding **arrangement**

AB - A surface excitation ranging method includes selecting a first **well** with a metal casing as a target **well** and selecting a second **well** with a metal casing as a ground **well**. The method also includes installing a supplemental grounding **arrangement** for a power supply located at **earth**'s surface, wherein the ground **well** and the supplemental grounding **arrangement** fulfill an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along the target **well**. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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- PN - [WO2016153504](#) A1 20160929
- PR - WO2015US22518 20150325
- AP - WO2015US22518 20150325
- DT - *; Rep
- CT - |KR| ISR (A1)
[US5218301](#) A 19930608 [XY] (KUCKES ARTHUR F [US])
[X] 1-8, 11-19
* See column 5, lines 40-64, column 6, line 31-column 7, line 28 and figure 1. *
[Y] 9-10, 20;
[US2012326723](#) A1 20121227 [Y] (BLOEMENKAMP RICHARD [FR], et al)
[Y] 9-10, 20
* See abstract and claim 1. *;
[US2007278008](#) A1 20071206 [A] (KUCKES ARTHUR F [US], et al)
[A] 1-20
* See paragraphs [0024]-[0058] and figures 1-10. *;
[US5343152](#) A 19940830 [A] (KUCKES ARTHUR F [US])
[A] 1-20
* See column 6, line 65-column 11, line 39 and figure 1. *;
[US7812610](#) B2 20101012 [A] (CLARK BRIAN [US], et al)
[A] 1-20
* See column 3, line 18-column 16, line 67 and figures 1-15. *
- CCI - [E21B47/02216](#) ; [E21B7/04](#)
- PA - HALLIBURTON ENERGY SERVICES INC [US]
- TI - SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A GROUND **WELL**
AND A SUPPLEMENTAL GROUNDING **ARRANGEMENT**
- AB - A surface excitation ranging method includes selecting a first **well** with a metal casing as a target **well** and selecting a second **well** with a metal casing as a ground **well**. The method also includes installing a supplemental grounding **arrangement** for a power supply located at **earth**'s surface, wherein the ground **well** and the supplemental grounding **arrangement** fulfill an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along the target **well**. The method also includes sensing **electromagnetic (EM)** fields emitted from the target **well** due to the electrical current. The method also includes using distance or direction information obtained from the sensed **EM** fields to guide **drilling** of a new **well** relative to the target **well**.

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- PN - [WO2016153507](#) A1 20160929
- PNFP - WO2016153507 A8 20170831
- PR - WO2015US22536 20150325
- AP - WO2015US22536 20150325
- DT - *; Rep
- CT - |KR| ISR (A1)
[US5218301](#) A 19930608 [XY] (KUCKES ARTHUR F [US])
[X] 1-8, 11-19
* See column 5, lines 40-64, column 6, line 31-column 7, line 28 and figure 1. *
[Y] 9-10, 20;
[US2012326723](#) A1 20121227 [Y] (BLOEMENKAMP RICHARD [FR], et al)
[Y] 9-10, 20
* See abstract and claim 1. *;
[US2007278008](#) A1 20071206 [A] (KUCKES ARTHUR F [US], et al)
[A] 1-20
* See paragraphs [0024]-[0058] and figures 1-10. *;
[US5343152](#) A 19940830 [A] (KUCKES ARTHUR F [US])
[A] 1-20

* See column 6, line 65-column 11, line 39 and figure 1. *;
[US7812610](#) B2 20101012 [A] (CLARK BRIAN [US], et al)
[A] 1-20
* See column 3, line 18-column 16, line 67 and figures 1-15. *

CCI	- E21B47/02216 ; G01V3/30
CUI	- E21B47/024 ; E21B47/09 ; G01V3/26
CUA	- G01V3/083
PA	- (A1) HALLIBURTON ENERGY SERV INC [US] - (A8) HALLIBURTON ENERGY SERVICES INC [US]
TI	- (A1 A8) SURFACE EXCITATION RANGING METHODS AND SYSTEMS EMPLOYING A CUSTOMIZED GROUNDING ARRANGEMENT
AB	- (A1 A8) A surface excitation ranging method includes installing a customized grounding arrangement for a power supply located at earth 's surface, wherein the customized grounding arrangement fulfills an impedance criteria or ranging performance criteria. The method also includes conveying an electrical current output from the power supply along a target well with a metal casing. The method also includes sensing electromagnetic (EM) fields emitted from the target well due to the electrical current. The method also includes using distance or direction information obtained from the sensed EM fields to guide drilling of a new well relative to the target well .

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PN	- US5241273 A 19930831	
PNFP	- US5241273 B1 19960220	
PR	- US19910719798 19910624	
AP	- US19910719798 19910624	
DT	- *	
CT	- (A) US4786874 A []; US4899112 A []; US5045795 A []	
CTNP	- (A) [] Advertisement of Teleco Oilfield Services Inc. (one sheet) entitled Teleco MWD Gives You The In s And Out s Of Horizontal Drilling , 1990 [] Anderson, B. et al., Effects of Dipping Beds on the Response of Induction Tools , SPE 61st Annual Technical Conference, New Orleans, La., Paper SPE 15488 (Oct. 5 8, 1986) [] Barber, T. D., and Howard, A. Q., Correcting the Induction Log for Dip Effect , SPE 64th Annual Technical Conference, San Antonio, Tex., Paper SPE 19607, (Oct. 8 11, 1989) [] Howard, A. Q., and Chew, W. C., A Variational Model of Induction Logging in a	

	Dipping Bed Environment , presented at the IGARSS Symposium, Vancouver, Session F8, Paper 5, (Jul. 10 14, 1989) [] Anderson, B. et al., Response of 2 MHz LWD Resistivity and Wireline Induction Tools in Dipping Beds and Laminated Formations , SPWLA 31st Annual Logging Symposium, Lafayette, La., (Jun. 24 27, 1990) [] Wu, J. Q. et al, Bed Boundary Detection Using Resistivity Sensor in Drilling Horizontal Wells , SPWLA 32nd Annual Logging Symposium (Jun. 16 19, 1991)
CCI	- G01V3/30 ; E21B7/06
PA	- (A B1) SCHLUMBERGER TECHNOLOGY CORP [US]
TI	- (A) Method for controlling directional drilling in response to horns detected by electromagnetic energy propagation resistivity measurements
	- (B1) Method for controlling directional drilling in response to horns detected by electromagnetic energy progagation resistivity measurements
AB	- (A) The disclosed method is applicable for use in conjunction with an earth borehole drilling apparatus that typically includes: a drilling rig; and a drill string operating from said drilling rig for drilling an earth borehole, the drill string including a bottom hole arrangement comprising a drill bit and a downhole resistivity measuring subsystem for measuring downhole formation resistivity near the bit by propagating electromagnetic energy into earth formations near the bit, receiving electromagnetic energy that has propagated through the formations and producing measurement signals that

depend on the received signals. A method is set forth for directing the **drilling** of a **well** bore with respect to a geological bed boundary in the **earth** formations, including the steps of: producing from the measurement signals a recording of downhole formation resistivity as a function of position; determining the presence of a horn in the resistivity recording; and implementing a change in the **drilling** direction of the **drill** bit in response to said determination of the presence of a horn.

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PN	- GB2056691 A 19810318	
PNFP	- GB2056691 B 19840516	
PR	- GB19800026597 19800814; GB19790028804 19790817	
AP	- GB19800026597 19800814	
DT	- *	
CCI	- G01F1/58	
PA	- (A B) SANDERSON M; GRAY J	
TI	- (A) Differential electromagnetic flowmeters	
	- (B) DIFFERENTIAL ELECTROMAGNETIC FLOWMETERS	
AB	- (A) A flowmeter head is in the form of side-by-side channels FC1, FC2 of non- magnetic, electrically insulating material with the channels of very similar size. Sufficient precision of channel size is attained by boring the channels or by using drawn tube of closely controlled size. A radial measuring electrode EC1, EC2 is provided in each channel, e.g. by drilling a fine hole in the channel wall and sealing a wire in. The electrode arrangement permits an applied magnetic flux to pass through first one channel, then the other. Earth electrodes EE11, EE12, EE21, EE22 are provided at the ends of each channel outside the flux path. An earth -loop free	

connection to a differential amplifier of a flowmeter apparatus is possible with the electrode configuration (Figure 3). The precision of the channel size improves common-mode accuracy and the **earth**-loop free connection reduces drift and noise. The flowmeter head may be used to control the mixing of two components (Figure 4).
<IMAGE>

13/13	© EPODOC / EPO
PN	- GB861606 A 19610222
PR	- DEX861606 19561112
AP	- GB19570034872 19571108
DT	- *
CCI	- E21B44/005 ; E21B4/04 ; E21B19/08
PA	- LICENTIA GMBH
TI	- Arrangement for controlling the progress of deep- well drilling
AB	- 861,606. Boring earth . LICENTIA PATENTVERWALTUNGS-G.m.b.H. Nov. 8, 1957 [Nov. 12, 1956], No. 34872/57. Class 85. Deep well drilling rig, in which the drill bit 4 is driven by an electric motor 3 mounted at the lower end of a drill pipe 2 suspended from a winch 7, is controlled by circuits so interlinked that the rate of drilling is automatically adjusted to an optimum value. Liquid to wash out the cuttings is supplied to the pipe 2 by a hose and pump 8. Preferably the winch 7 is electrically driven. The difference between the desired torque and the actual torque at any given moment is fed through a circuit a to a regulator 15 which automatically controls the drive of the winch 7 to change the pressure of the pipe 2 on the drill and so restore the torque to the optimum value. A circuit b includes a regulator 17 responsive to the rate of drilling to vary the output of the pump 8 supplying water to the pipe 2. When the pump reaches its maximum output, the circuit b is put into reverse and used to regulate the rate of drilling . The optimum torque of the motor,



which depends on the characteristics of the motor, is fed to an adjusting device 10 while the actual torque at any given time is fed to a converter 11, the difference between the two torques being determined by a device 14 in circuit with the regulator 15, which, if the working torque is too great, increases the torque on the winch to relieve the load on the **drill** bit and vice versa. The devices 10, 11, 14 and 15 maybe operated by D.C. The speed v at which the **drill** descends is recorded by a converter 12 and compared in a device 171 with the quantity of liquid fed by the pump 8, this quantity being measured and conveyed by a device 13, which feeds the device 17<SP>1</SP>. The difference recorded by the device 171 is fed to the regulator 17 to change the output of the pump. When the output reaches its maximum a contact 8 closes and the rate of **drilling** is then controlled by the pump output. Variation in the output takes effect at the **drilling** bit with a time lag dependent on the length of pipe. This is compensated through a connection e from the regulator 17 to the servo-motor of the winch 7. A circuit d feeds the torque adjustment from the regulator 17 to the adjusting device 10. The liquid output is connected through a regulator 16 and a circuit f to the drive for the winch. The system may be operated using D.C. voltages as measuring means and to control values. The rate of **drilling** is determined by coupling a tachometer to the pulleys carrying the cable

5. **Electromagnetic**, hydraulic, electro-hydraulic or electro-pneumatic regulating systems may also be used.