

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE PATENT TRIAL AND APPEAL BOARD**

In the Post-Grant Review of U.S. Patent No. 12,110,780

Trial No.: Not Yet Assigned

Issued: October 8, 2024

Filed: August 28, 2023

Inventor: Clinton Moss

Assignee: Gunnar LLLP (“Patent Owner”)

Title: METHOD AND APPARATUS FOR MAGNETIC
RANGING WHILE DRILLING

Mail Stop Patent Board

Commissioner for Patents

P.O. Box 1450

Alexandria, Virginia 22313-1450

PETITION FOR POST-GRANT REVIEW (37 C.F.R. § 42.200)

On behalf of SCIENTIFIC DRILLING INTERNATIONAL, INC. (“SDI” or “Petitioner”) and in accordance with 35 U.S.C. § 321 and 37 C.F.R. § 42.200, Post-Grant Review (“PGR”) is respectfully requested for claims 1-22 of U.S. Patent No. 12,110,780 (“the ’780 Patent”) (EX. 1001). The Commissioner is hereby authorized to charge any fee that has been overlooked to Deposit Account No. 50-5629.

TABLE OF CONTENTS

I.	INTRODUCTION.....	5
II.	MANDATORY NOTICES	5
	a. Real Party-In-Interest.....	5
	b. Related Matters	5
	c. Lead and Back-up Counsel	5
	d. Service Information	5
III.	CERTIFICATION OF GROUNDS FOR STANDING.....	6
IV.	PRIOR ART OVERVIEW OF THE ‘780 PATENT	6
V.	IDENTIFICATION OF CHALLENGE.....	7
	a. Claims	7
	b. Specific Statutory Grounds Under 35 U.S.C. § 112 and § 103	7
	c. Claim Construction	8
VI.	CLAIMS 1-22 OF THE ‘780 PATENT ARE UNPATENTABLE.....	10
	a. Ground 1:	11
	b. Ground 2:	13
	c. Ground 3:	16
	i. Claim 1:	16
	ii. Claim 2:	19
	iii. Claim 3:	20
	iv. Claim 4:	20
	v. Claim 5:	20
	vi. Claim 6:	21

vii.	Claim 8:	21
viii.	Claim 9:	22
ix.	Claim 10:	25
x.	Claim 11:	25
xi.	Claim 12:	26
xii.	Claim 13:	26
xiii.	Claim 14:	27
xiv.	Claim 15:	27
xv.	Claim 17:	27
xvi.	Claim 18:	28
xvii.	Claim 19:	31
xviii.	Claim 20:	34
xix.	Claim 21:	34
xx.	Claim 22:	35
d.	Ground 4:	35
i.	Claim 7:	36
ii.	Claim 16:	36
e.	Ground 5:	37
i.	Claim 1:	38
ii.	Claim 2:	42
iii.	Claim 3:	42
iv.	Claim 4:	43
v.	Claim 5:	43

vi.	Claim 6:	44
vii.	Claim 8:	44
viii.	Claim 9:	44
ix.	Claim 10:	48
x.	Claim 11:	49
xi.	Claim 12:	49
xii.	Claim 13:	49
xiii.	Claim 14:	50
xiv.	Claim 15:	50
xv.	Claim 17:	51
xvi.	Claim 18:	51
xvii.	Claim 19:	55
xviii.	Claim 20:	59
xix.	Claim 21:	59
xx.	Claim 22:	60
f.	Ground 6:	60
i.	Claim 7:	60
ii.	Claim 16:	61
VII.	CONCLUSION	62
VIII.	CERTIFICATION OF WORD COUNT	63
IX.	CERTIFICATION OF SERVICE.....	64
X.	APPENDIX OF EXHIBITS.....	65

I. INTRODUCTION

In accordance with 35 U.S.C. § 321 and 37 C.F.R. § 42.200, SDI requests PGR for claims 1-22 of the '780 Patent.

II. MANDATORY NOTICES

a. Real Party-In-Interest

SDI is the real party-in-interest for the Petitioner.

b. Related Matters

There are no related matters involving the '780 Patent.

c. Lead and Back-up Counsel

Lead Counsel: Mike Locklar (Registration No. 44,878)

Backup Counsel: Chance Hardie (Registration No. 55,247)

d. Service Information

E-mail: mlocklar@ewingjones.com

chardie@ewingjones.com

Postal: EWING & JONES, PLLC

6363 Woodway, Suite 1000

HOUSTON, TEXAS 77057

Telephone: 832-830-8945

A Power of Attorney accompanies this Petition. Petitioner consents to electronic service by email at the email addresses listed above.

III. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies the '780 Patent is available for PGR and Petitioner is not barred or estopped from requesting PGR challenging the patent claims on the grounds identified herein.

IV. PRIOR ART OVERVIEW OF THE '780 PATENT

References Cited in the '780 Patent included several patent documents to Donderici but not U.S. Patent No. 10,429,534 to Donderici ("Donderici '534") (EX. 1002) (or its application publication or a foreign counterpart) and not U.S. Patent No. 10,656,301 to Donderici ("Donderici '301") (EX. 1003) (or its application publication or a foreign counterpart), both assigned to Halliburton Energy Services, Inc. Despite Clinton Moss being the sole inventor of the '780 Patent owned by Gunnar LLLP and subject of this Petition, Clinton Moss is also an inventor of Donderici '534, which was never submitted in an information disclosure statement for consideration in the '780 Patent. Furthermore, both Donderici '534 and Donderici '301 had initial filings respectively over 7 years and over 4 years prior to any priority date of the '780 Patent and were both granted prior to any priority date of the '780 Patent.

With a priority date of at least as early as October 18, 2016, U.S. Patent No. 11,236,551 (“Fredriksen”) (EX. 1004) predates any priority date of the ‘780 Patent. Fredriksen was cited in the ‘780 Patent via its pre-grant publication (US20190119990), which was even identified in the specification of the ‘780 Patent in describing wired pipe subject matter claimed in the ‘780 Patent. (EX. 1001, col.7, ll.60-66). However, the wired pipe subject matter of Fredriksen as shown in this PGR would be obvious to combine with other prior art that was not cited in the ‘780 Patent.

References that were not cited in the ‘780 Patent also include U.S. Patent No. 9,771,791 (“Schulz”) (EX. 1005). Schulz having a filing date of April 22, 2014, predates any priority date of the ‘780 Patent.

V. IDENTIFICATION OF CHALLENGE

a. Claims

Pursuant to Rule 42.204(b)(1), PGR is requested for claims 1-22 of the ‘780 Patent.

b. Specific Statutory Grounds Under 35 U.S.C. § 112 and § 103

Pursuant to Rule 42.204(b)(2), SDI asserts claims 1-22 of the ‘780 Patent are unpatentable as follows:

Ground 1: Claims 1-17 and 19-22 contain new matter that lacks written description prohibited under 35 U.S.C. § 112.

Ground 2: Claims 1-17 and 19-22 are indefinite under 35 U.S.C. § 112.

Ground 3: Claims 1-6, 8-15 and 17-22 are obvious under 35 U.S.C. § 103 based on Donderici ‘534 in view of Fredriksen.

Ground 4: Claims 7 and 16 are obvious under 35 U.S.C. § 103 based on Donderici ‘534 and Fredriksen in view of Schulz.

Ground 5: Claims 1-6, 8-15 and 17-22 are obvious under 35 U.S.C. § 103 based on Donderici ‘301 in view of Fredriksen.

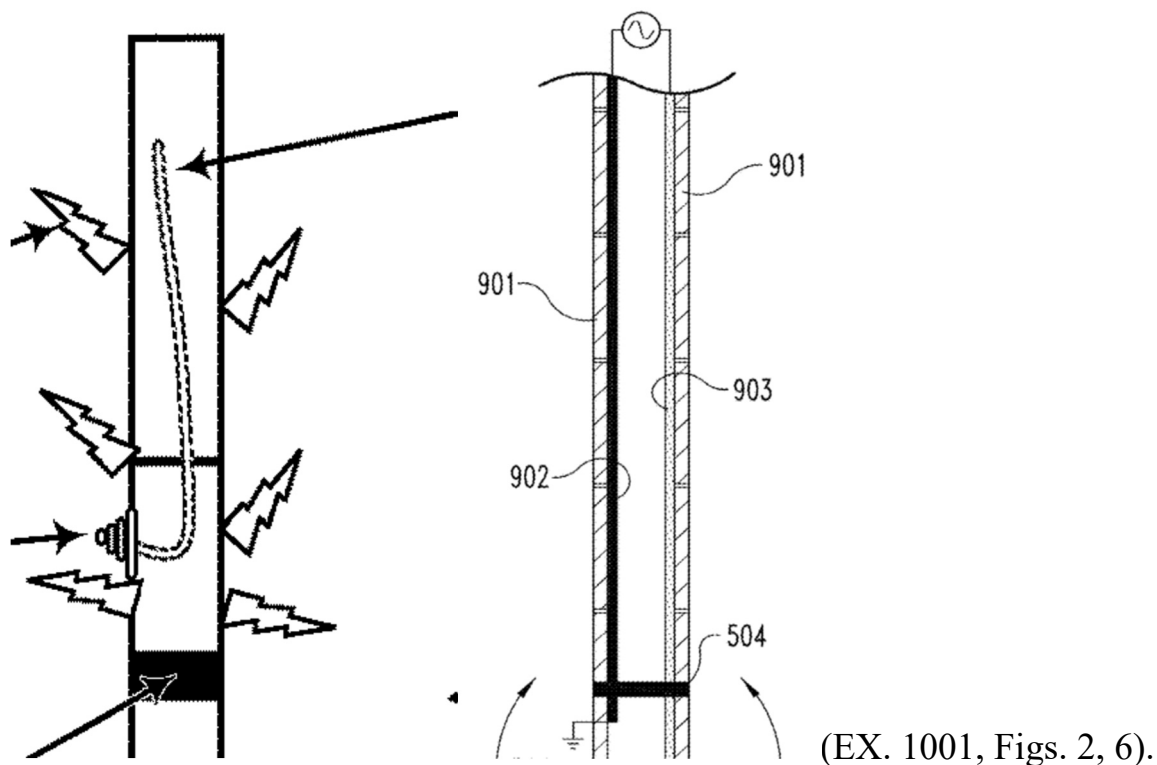
Ground 6: Claims 7 and 16 are obvious under 35 U.S.C. § 103 based on Donderici ‘301 and Fredriksen in view of Schulz.

c. Claim Construction

A claim in PGR shall be construed “in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. §42.200(b). Petitioner interprets the claims accordingly. Even if the bounds of the claims are not reasonably certain, the Board should nevertheless determine if the challenged claims are unpatentable over prior art unless the indefiniteness renders it logically impossible. *See, Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 812-14 (Fed. Cir.

2021). While Petitioner asserts in Grounds 1 and 2 that claims including “a rigid connection” contain new matter lacking written description and are indefinite, Petitioner thus acknowledges an attempt to provide a claim construction to the best extent possible for this limitation is nevertheless required in order to cancel the claims for obviousness under Grounds 3-6 and at the same time cancel the claims based on Grounds 1 and 2. Accordingly, Petitioner submits a claim construction for the limitation in challenged claims 1-17 and 19-22 of “wherein the connection between the wire and the drill pipe is a rigid connection” for the reasons described below. (EX. 1001, col10:1134-35, 10:65-66, 12:15-17).

The specification for the ‘780 Patent does not recite a “rigid connection” except for in the claims. The ‘780 Patent includes two possible options for connecting to power depicted in Fig. 2 and Fig. 6 merely schematically showing respectively a connection from a wire to tubing and wired pipe as follows:



In the Reply to Non-Final Office Action of September 28, 2022 (EX. 1006) from US 11,781,421 (“the ‘421 parent patent”) that is the priority continuation claim for the ‘780 Patent, the Patent Owner distinguished the “rigid connection” being claimed therein from “a spring loaded contacting mechanism” associated with a wireline application. (EX. 1006, pp. 4 and 7). While thus still ambiguous, wired pipe used for drill pipe is not a wireline application and is at least one example of a “rigid connection.” (EX. 1009, ¶6).

VI. CLAIMS 1-22 OF THE ‘780 PATENT ARE UNPATENTABLE

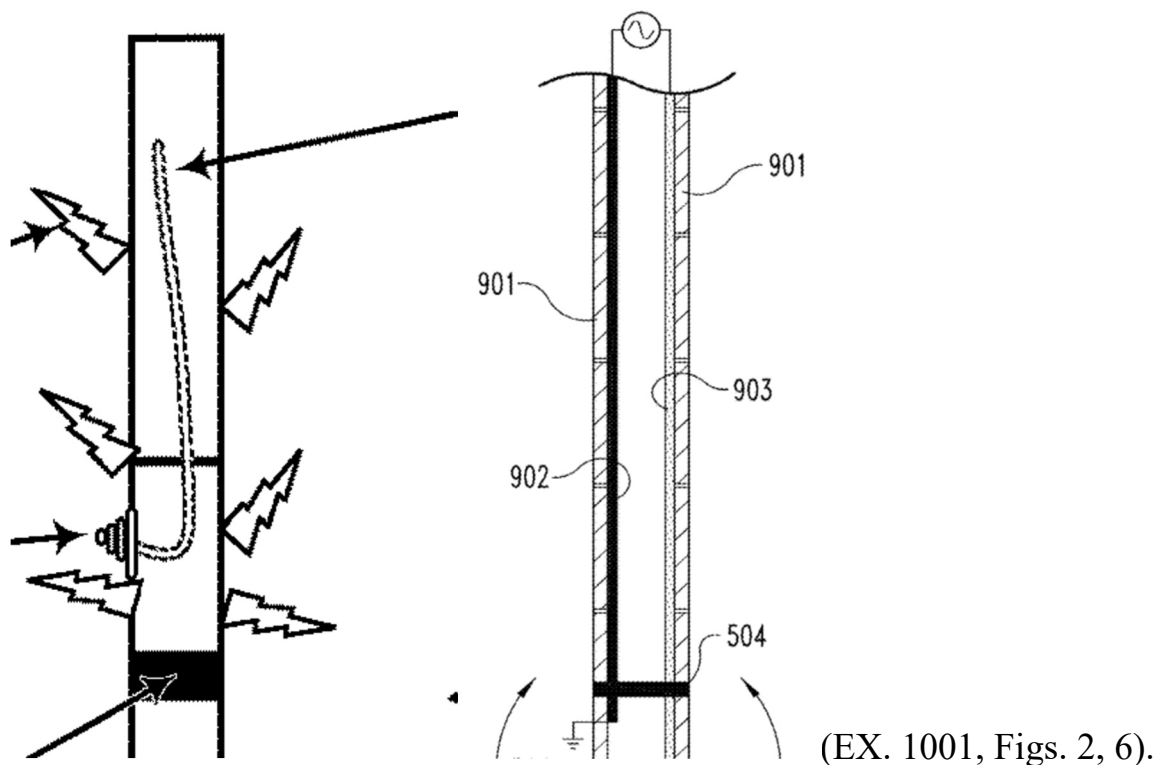
Pursuant to Rule 42.204(b)(4-5), the following subsections demonstrate how the claims 1-17 and 19-22 of the ‘780 Patent are unpatentable under 35 U.S.C. § 112

and/or how the prior art discloses every limitation of claims 1-22 of the '780 Patent, and how the claims are rendered obvious by the prior art.

a. Ground 1:

Claims 1-17 and 19-22 contain new matter that lacks written description that is prohibited under 35 U.S.C. § 112.

Independent claims 1, 9 and 19 describe a connection between a wire and drill pipe as a “rigid connection.” (EX. 1001, 10:35, 10:66, 12:17). However, the specification only refers to a connection between a wire and coiled tubing as either “temporarily” or “permanently” connected without ever reciting the word “rigid,” which was introduced into the claims after the effective filing date of the '780 Patent. (EX. 1001, 5:6-8). The '780 Patent includes two possible options for connecting to power depicted in Fig. 2 and Fig. 6 merely schematically showing respectively a connection from a wire to tubing and wired pipe as follows:



No structural description or depicted structures in the ‘780 Patent support amendment of the claims to include the “rigid connection.” Therefore, the disclosure does not “describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.” *Ariad Pharmaceuticals, Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010).

The disclosure for the ‘780 Patent thus at most described a “connection.” The claim term “rigid connection” derives no benefit to only disclosure of “connection” for purposes of written description and introduction of new matter. Specifically, “rigid connections” are “not within the invention described in the application.” *Ariad* at 1345-46 (citing *Schriber-Schroth Co. v. Cleveland Trust Co.*, 305 U.S. 47 (1938))

where “the Court held that a patent directed to pistons for a gas engine with "extremely rigid" (emphasis added) webs did not adequately describe amended claims that recited flexible (emphasis added) webs.”).

Accordingly, the written description as filed for the ‘780 Patent provides no support for the “rigid connection,” as recited in claims 1, 9 and 19. All claims dependent on claims 1, 9 and 19 thereby also include the “rigid connection” due to the dependency. Claims 1-17 and 19-22 hence introduce new matter and lack written description required under 35 U.S.C. §112 with respect to the “rigid connection.”

b. Ground 2:

Claims 1-17 and 19-22 are indefinite under 35 U.S.C. § 112.

As described *supra* at section VI(a) regarding the “rigid connection” lacking written description, the specification provides no certainty or clarity about the scope of the invention defined by the claims reciting the term “rigid connection.” The prosecution history with respect to the “rigid connection” does not inform with reasonable certainty the scope of the invention. In the Reply to Non-Final Office Action of September 28, 2022, from the ‘421 parent patent that is the priority continuation claim for the ‘780 Patent, the Patent Owner distinguished the “rigid connection” being claimed therein from “a spring loaded contacting mechanism” associated with a wireline application. (EX. 1006, pp. 4 and 7). Further, the Patent Owner stated that “a rigidly connected wire would twist” if the drill pipe where the

wire is rigidly connected is rotating. *Id.* The Examiner in the Office Action of March 20, 2024, attempted to address the “rigid connection” in applying the prior art by stating spring loaded contacts “are broadly read as a ‘rigid connection’ since they maintain connection between the wire 90 and the pipe 57... as it would maintain contact.” (EX. 1007, p4).

The Examiner’s attempted interpretation is not consistent with the Patent Owner’s arguments from the ‘421 parent patent prosecution history regarding Patent Owner’s desired meaning of “rigid connection.” The confusion between the Examiner’s broadest reasonable interpretation and the Patent Owner’s intent regarding meaning of “rigid connection” in the prosecution history evidences the indefiniteness of the claims that recite “rigid connection.”

Claim 9 further adds to the confusion by reciting that the connection “is a rigid connection and (emphasis added) is not spring loaded.” (EX. 1001, 10:66-67). Despite the Patent Owner arguing that the “rigid connection” is differentiated from a spring loaded connection in the prosecution history, the Patent Owner drafted claim 9 in a way that implies the “rigid connection” may be spring loaded if not for explicit disclaiming of the “rigid connection” being spring loaded. Even the Patent Owner thus cannot “provide objective boundaries” when it comes to connection characteristics for the “rigid connection” recited in the claims “when read in light of the specification and the prosecution history.” *Interval Licensing LLC v. AOL, Inc.*,

766 F.3d 1364, 1371 (Fed. Cir. 2014), and *see, Iridescent Networks, Inc. v. AT&T Mobility, LLC*, 933 F.3d 1345, 1353 (Fed. Cir. 2019).

Given the total absence of written description and useful intrinsic evidence to provide a more specific structure for the “rigid connection,” a generalized example of a standard 110V plug and outlet further illustrates how it is impossible to determine what the claimed invention is because of reciting the “rigid connection.” One could presume that a feed wire into the outlet clamped down by a screw might be a “rigid connection” since the feed wire is secured in place unlike a plug connection that is slidable into and out of the outlet. An alternative view though would consider the feed wire into the outlet not being stiffened (*i.e.*, a flexible connection) to be in contrast with hard prongs and a stiffened end (*i.e.*, the plug connection being a rigid connection) made where an appliance wire connects with the outlet at the plug. The “rigid connection” potential to mean several different interpretations without providing delineating guidance among the contending definitions establishes the indefiniteness of the claims. *See, Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 911 n.8 (2014).

Accordingly, reciting the “rigid connection” in claims 1, 9 and 19 fails to inform about the scope of the invention with reasonable certainty. All claims dependent on claims 1, 9 and 19 also include the “rigid connection” due to the

- *“a power supply;”*

Donderici ‘534 discloses that “current injection system 50 includes either a voltage controlled or current controlled transmitter 38, and it preferably alternates as very low frequencies in the order of 0.02-250 Hz to generate the current injected by emitter electrode E.” (EX. 1002, 7:31-35).

- *“at least one section of drill pipe configured to be operatively connected to the power supply;”*

Donderici ‘534 discloses that:

With ongoing reference to FIGS. 1 and 2, there is shown a second wellbore 28 shown in the process of being drilled. A drilling system 30 is generally shown associated therewith. Drilling system 30 may include a drilling platform 32 positioned over formation 12, and a wellhead installation 34, including blowout preventers 36. Platform 32 may be disposed for raising and lowering a conveyance mechanism 48 within second wellbore 28.

(Ex. 1002, 3:42-49). Donderici ‘534 further discloses that “conveyance mechanism 48 may be a tubing string or drill string.” (EX. 1002, 4:5-6). Donderici ‘534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part

of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38).

- *“at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the wire and the drill pipe is a rigid connection that maintains its rigid connection as the at least one section of drill pipe is drilling;”*

Donderici ‘534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38). Fredriksen discloses that wired pipe that may be used for drill pipe, casing, tubing, risers, and line pipe. (EX. 1004, 3:10-14). Wired pipe is a rigid connection as that term is defined above that maintains its rigid connection as the at least one section of drill pipe is drilling. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici ‘534 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶7).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and*

that is capable of causing electrical energy to exit a section of drill pipe; and”

Donderici ‘534 discloses that “current injection system 50 (emitter E and return R electrodes) that injects alternating currents (AC) into formation 12” with “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 4:65-67 and 5:30-31). For example, FIG. 3C of Donderici ‘534 discloses an emitter electrode E and a first gap sub G₁. (EX. 1002, 5:59-64). Donderici ‘534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002, 4:18-21).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici ‘534 discloses that “EM sensor 51 includes at least a magnetic gradient sensor or magnetic gradiometer (receiver)” to “form a tool for EM ranging.” (EX. 1002, 3:60-65).

ii. Claim 2:

“The apparatus of claim 1 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Donderici '534 discloses that “one or more of the emitter electrode E” as illustrated in FIG. 5A. (EX. 1002, 5:31 and FIG. 5A). For example, FIG. 3C of Donderici '534 discloses a second gap sub G₂ located further downhole from G₁. (EX. 1002, 5:64-67).

iii. Claim 3:

“The apparatus of claim 1 wherein the sensor is part of the bottom hole assembly.”

Donderici '534 discloses that “EM sensor 51 may be part of the bottom-hole-assembly (BHA) 52.” (EX. 1002, 4:3-4).

iv. Claim 4:

“The apparatus of claim 1 wherein the sensor is part of the drill pipe.”

Donderici '534 discloses that “current injection system 50 and EM sensor 51 are attached to, or a part of, a drill string 48.” (EX. 1002, 5:5-7).

v. Claim 5:

“The apparatus of claim 1 wherein the drill pipe is coiled tubing.”

Donderici '534 discloses that “conveyance mechanism 48 may be a tubing string or drill string,” which terms are thereby differentiated from one another. (EX.

1002, 4:5-6). One skilled in the art knew that drill pipe/string “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). Thus, the “tubing string” disclosed in Donderici ‘534 is known to be “coiled tubing” in contrast to segments or joints of tubulars threaded together. (EX. 1009, ¶8).

vi. Claim 6:

“The apparatus of claim 1 wherein the drill pipe is a section of threaded drill pipe.”

Donderici ‘534 discloses that “conveyance mechanism 48 may be a tubing string or drill string,” which are thus two different types of string that may form the conveyance mechanism. (EX. 1002, 4:5-6). One skilled in the art knew that drill pipe/string “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). Thus, the “drill string” disclosed in Donderici ‘534 is known to be “a section of threaded drill pipe” in contrast to coiled tubing. (EX. 1009, ¶9).

vii. Claim 8:

“The apparatus of claim 1 wherein the power supply is connected to the drill pipe using one or more conductors.”

Donderici '534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002, 4:18-21). Further, Donderici '534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38). The electrical connection of the power supply to the drillstring in Donderici '534 inherently uses a conductor (*i.e.*, as part of the conductive wiring).

viii. Claim 9:

- “*An apparatus for magnetic ranging comprising:*”

Donderici '534 discloses that “a wellbore ranging tool for electromagnetic ranging between first and second wellbores.” (EX. 1002, 16:57-58).

- “*a power supply;*”

Donderici '534 discloses that “current injection system 50 includes either a voltage controlled or current controlled transmitter 38, and it preferably alternates as very low frequencies in the order of 0.02-250 Hz to generate the current injected by emitter electrode E.” (EX. 1002, 7:31-35).

- *“at least one section of drill pipe operatively connected to the power supply;”*

Donderici ‘534 discloses that:

With ongoing reference to FIGS. 1 and 2, there is shown a second wellbore 28 shown in the process of being drilled.

A drilling system 30 is generally shown associated therewith. Drilling system 30 may include a drilling platform 32 positioned over formation 12, and a wellhead installation 34, including blowout preventers 36. Platform 32 may be disposed for raising and lowering a conveyance mechanism 48 within second wellbore 28.

(Ex. 1002, 3:42-49). Donderici ‘534 further discloses that “conveyance mechanism 48 may be a tubing string or drill string.” (EX. 1002, 4:5-6). Donderici ‘534 discloses “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38).

- *“at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the*

wire and the drill pipe is a rigid connection and is not spring loaded;”

Donderici ‘534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38). Fredriksen discloses that wired pipe that may be used for drill pipe, casing, tubing, risers, and line pipe. (EX. 1004, 3:10-14). Wired pipe is a rigid connection that is not spring loaded, as “rigid connection” is defined above. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici ‘534 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶7).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and that is capable of causing electrical energy to exit a section of drill pipe; and”*

Donderici ‘534 discloses that “current injection system 50 (emitter E and return R electrodes) that injects alternating currents (AC) into formation 12” with “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 4:65-67 and 5:30-31). For example, FIG. 3C of Donderici ‘534 discloses an emitter electrode E and a first gap sub G₁.

(EX. 1002, 5:59-64). Donderici '534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002, 4:18-21).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici '534 discloses that “EM sensor 51 includes at least a magnetic gradient sensor or magnetic gradiometer (receiver)” to “form a tool for EM ranging.” (EX. 1002, 3:60-65).

ix. Claim 10:

“The apparatus of claim 9 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Donderici '534 discloses “one or more of the emitter electrode E” as illustrated in FIG. 5A. (EX. 1002, 5:31 and FIG. 5A). For example, FIG. 3C of Donderici '534 discloses a second gap sub G₂ located further downhole from G₁. (EX. 1002, 5:64-67).

x. Claim 11:

“The apparatus of claim 9 wherein the sensor is part of the bottom hole assembly.”

Donderici '534 discloses that “EM sensor 51 may be part of the bottom-hole-assembly (BHA) 52.” (EX. 1002, 4:3-4).

xi. Claim 12:

“The apparatus of claim 9 wherein the sensor is part of the drill pipe.”

Donderici '534 discloses that “current injection system 50 and EM sensor 51 are attached to, or a part of, a drill string 48.” (EX. 1002, 5:5-7).

xii. Claim 13:

“The apparatus of claim 9 wherein the drill pipe is coiled tubing.”

Donderici '534 discloses that “conveyance mechanism 48 may be a tubing string or drill string,” which are thus two different types of string that may form the conveyance mechanism. (EX. 1002, 4:5-6). One skilled in the art knew that drill pipe/string “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (*see*, EX. 1008, 5:39-41 and 23:27-28). Thus, the “tubing string” disclosed in Donderici '534 is known to be “coiled tubing” in contrast to segments or joints of tubulars threaded together. (EX. 1009, ¶8).

xiii. Claim 14:

“The apparatus of claim 9 wherein the drill pipe is a section of threaded drill pipe.”

Donderici ‘534 discloses that “conveyance mechanism 48 may be a tubing string or drill string,” which terms are thereby differentiated from one another. (EX. 1002, 4:5-6). One skilled in the art knew that drill pipe/string “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). Thus, the “drill string” disclosed in Donderici ‘534 is known to be “a section of threaded drill pipe” in contrast to coiled tubing. (EX. 1009, ¶9).

xiv. Claim 15:

“The apparatus of claim 9 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Since claim 15 is a duplicate of claim 10, Donderici ‘534 and Fredriksen render obvious claim 15 for the same reasons as discussed regarding claim 10.

xv. Claim 17:

“The apparatus of claim 9 wherein the power supply is connected to the drill pipe using one or more conductors.”

Donderici '534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002, 4:18-21). The electrical connection of the power supply to the drillstring in Donderici '534 inherently uses a conductor.

xvi. Claim 18:

- *“An apparatus for magnetic ranging comprising:”*

Donderici '534 discloses that “a wellbore ranging tool for electromagnetic ranging between first and second wellbores has been described.” (EX. 1002, 16:57-58).

- *“a power supply;”*

Donderici '534 discloses that “current injection system 50 includes either a voltage controlled or current controlled transmitter 38, and it preferably alternates as very low frequencies in the order of 0.02-250 Hz to generate the current injected by emitter electrode E.” (EX. 1002, 7:31-35).

- *“at least one section of drill pipe configured to be operatively connected to the power supply;”*

Donderici '534 discloses that:

With ongoing reference to FIGS. 1 and 2, there is shown a second wellbore 28 shown in the process of being drilled. A drilling system 30 is generally shown associated therewith. Drilling system 30 may include a drilling platform 32 positioned over formation 12, and a wellhead installation 34, including blowout preventers 36. Platform 32 may be disposed for raising and lowering a conveyance mechanism 48 within second wellbore 28.

(Ex. 1002, 3:42-49). Donderici '534 further discloses that "conveyance mechanism 48 may be a tubing string or drill string." (EX. 1002, 4:5-6). Donderici '534 discloses that "[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1." (EX. 1002, 7:35-38).

- *"at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the wire and the drill pipe maintains a continuous electrical connection while the at least one section of drill pipe is drilling;"*

Donderici '534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38). Fredriksen discloses wired pipe that may be used for drill pipe, casing, tubing, risers, and line pipe. (EX. 1004, 3:10-14). Wired pipe maintains a continuous electrical connection while the at least one section of drill pipe is drilling. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici '534 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶7).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and that is capable of causing electrical energy to exit a section of drill pipe; and”*

Donderici '534 discloses that “current injection system 50 (emitter E and return R electrodes) that injects alternating currents (AC) into formation 12” with “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 4:65-67 and 5:30-31). For example, FIG. 3C of Donderici '534 discloses an emitter electrode E and a first gap sub G₁. (EX. 1002, 5:59-64). Donderici '534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules

56-62 or may be transmitted via conveyance system 48,” which is the drill string.
(EX. 1002, 4:18-21).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici ‘534 discloses that “EM sensor 51 includes at least a magnetic gradient sensor or magnetic gradiometer (receiver)” to “form a tool for EM ranging.”
(EX. 1002, 3:60-65).

xvii. Claim 19:

- *“A method of magnetic ranging comprising:”*

Donderici ‘534 discloses that “a wellbore ranging tool for electromagnetic ranging between first and second wellbores has been described.” (EX. 1002, 16:57-58).

- *“installing a sensor that senses a magnetic ranging signal
in a wellbore;”*

Donderici ‘534 discloses that “EM sensor 51 includes at least a magnetic gradient sensor or magnetic gradiometer (receiver)” to “form a tool for EM ranging.”
(EX. 1002, 3:60-65).

- *“installing a first electrically insulative gap sub in a
wellbore;”*

Donderici '534 discloses “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 5:30-31).

- *“installing at least one section of drill pipe in a wellbore that is connected to the electrically insulative gap sub;”*

Donderici '534 discloses “current injection system 50 (emitter E and return R electrodes) that injects alternating currents (AC) into formation 12” with “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 4:65-67 and 5:30-31).

- *“connecting a power supply to at least one section of drill pipe using at least one wire that is located inside the at least one section of drill pipe, wherein the connection from the at least one wire to the at least one section of drill pipe is made at surface and is a rigid connection;”*

Donderici '534 discloses that “[t]ransmitter 38 may be locally carried on drill string 48, such as part of power module 56, or positioned at the surface with conductive wiring extending down to emitter electrode E, such as shown in FIG. 1.” (EX. 1002, 7:35-38). Fredriksen discloses wired pipe that may be used for drill pipe, casing, tubing, risers, and line pipe. (EX. 1004, 3:10-14). Wired pipe is a rigid

connection that is made at surface, as that term is defined above. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici '534 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶7).

- *“energizing the power supply to cause current to flow down the drill pipe and inject into a wellbore formation and travel to a target well to create a magnetic ranging signal;”*

Donderici '534 discloses that “current injection system 50 (emitter E and return R electrodes) that injects alternating currents (AC) into formation 12 which currents travel to and then along conductive member 14 in first wellbore 10, and (ii) an EM sensor 51, namely a magnetic gradient sensor or magnetic gradiometer (receiver), that sense the gradient magnetic fields due to these AC currents on the conductive member 14.” (EX. 1002, 4:65-5:5).

- *“sampling the magnetic ranging signal; and”*

Donderici '534 discloses that “EM sensor 51 includes at least a magnetic gradient sensor or magnetic gradiometer (receiver)” to “form a tool for EM ranging.” (EX. 1002, 3:60-65).

- *“adjusting the drilling operations to alter a characteristic of the drilling operations.”*

Donderici ‘534 discloses that “adjust the drilling parameters for the second wellbore, such as the trajectory of the wellbore path, after which, in step J, a geo steering system carried by the drill string may be accordingly adjusted in order to steer the drill bit based on the magnetic ranging.” (EX. 1002, 16:33-37).

xviii. Claim 20:

“The method of claim 19 further comprising adjusting the drilling operations to alter a second characteristic of the drilling operations.”

Donderici ‘534 discloses that “adjust the drilling parameters (emphasis added) for the second wellbore, such as the trajectory of the wellbore path, after which, in step J, a geo steering system carried by the drill string may be accordingly adjusted in order to steer the drill bit based on the magnetic ranging.” (EX. 1002, 16:33-37).

xix. Claim 21:

“The method of claim 19 further comprising installing a second electrically insulative gap sub downhole from the first electrically insulative gap sub.”

Donderici '534 discloses “one or more insulators or gap subs G deployed along the string to insulate one or more of the emitter electrode E.” (EX. 1002, 5:30-31 and FIG. 3C-E). For example, FIG. 3C of Donderici '534 discloses a second gap sub G₂ located further downhole from G₁. (EX. 1002, 5:64-67).

xx. Claim 22:

“The method of claim 19 wherein the step of sampling the magnetic ranging signal occurs while drilling is taking place.”

Donderici '534 discloses being merely “preferable, as at step D, to interrupt drilling during wellbore ranging in order to minimize noise levels that could interfere with ranging measurements.” (EX. 1002, 15:19-21). While identified as preferable for noise reasons, Donderici '534 clearly contemplates sampling while drilling. Accordingly, “FIG. 1 may be a measurement-while-drilling or logging-while-drilling system in which passive ranging can be utilized to guide drill bit 54 while a drill string is deployed in wellbore 28.” (EX. 1002, 4:11-15).

d. Ground 4:

Claims 7 and 16 are obvious based on Donderici '534 and Fredriksen in view of Shulz.

i. Claim 7:

“The apparatus of claim 1 wherein the power supply is connected to the drill pipe using at least one wire of a multiribbon wire.”

Donderici ‘534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002, 4:18-21). Schultz discloses transmissions lines for communicating an electrical signal downhole “include a coaxial cable, a triaxial cable, a multiaxial cable, a twisted pair cable, a ribbon cable, and insulated conductors. (EX. 1005, 3:37-41). One of ordinary skill in the art would be motivated to combine Schultz with Donderici ‘534 to transmit both electrical power and signals through drill pipe. (EX. 1005, Abstract and 4:42-45 and EX. 1009, ¶10).

ii. Claim 16:

“The apparatus of claim 9 wherein the power supply is connected to the drill pipe using at least one wire of a multiribbon wire.”

Donderici ‘534 discloses that “[p]ower and communications to current injection system 50, if any, may be carried locally by appropriate modules 56-62 or may be transmitted via conveyance system 48,” which is the drill string. (EX. 1002,

4:18-21). Schultz discloses transmissions lines for communicating an electrical signal downhole “include a coaxial cable, a triaxial cable, a multiaxial cable, a twisted pair cable, a ribbon cable, and insulated conductors. (EX. 1005, 3:37-41). One of ordinary skill in the art would be motivated to combine Schultz with Donderici ‘534 to transmit both electrical power and signals through drill pipe. (EX. 1005, Abstract and 4:42-45 and EX. 1009, ¶10).

e. Ground 5:

Claims 1-6, 8-15 and 17-22 are obvious based on Donderici ‘301 in view of Fredriksen.

For reference with the specification citations below in Donderici ‘301 disclosing the claim limitations, FIG. 1 in Donderici ‘301 shows:

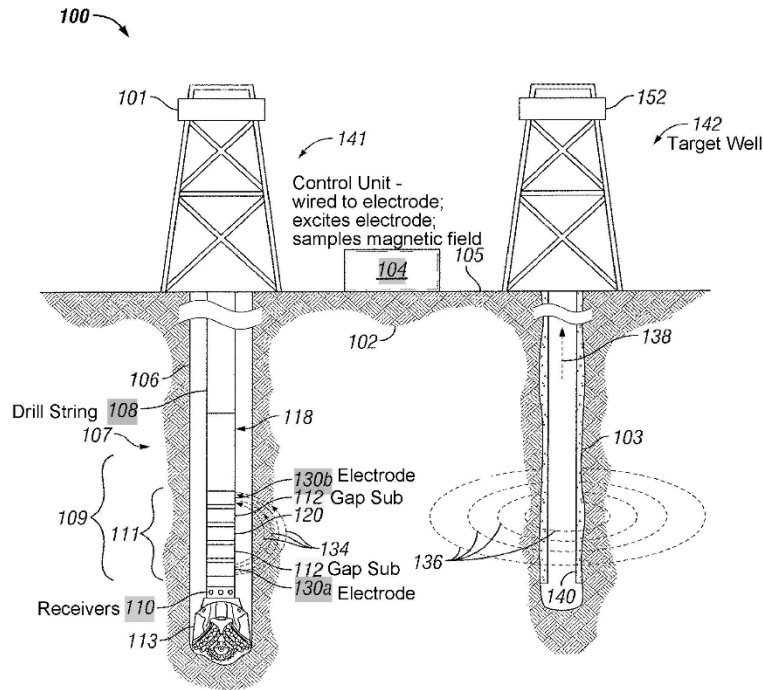


FIG. 1

(EX. 1003, FIG. 1).

i. **Claim 1:**

- “An apparatus for magnetic ranging comprising:”

Donderici ‘301 discloses that “a galvanic tool may comprise any tool, such as downhole tool 111, with electrodes or a toroidal coil through which current is injected into a subterranean formation and a voltage response of the formation to the injected current is measured.” (EX. 1003, 4:27 - 34).

- “a power supply;”

Donderici ‘301 discloses that “the source of excitation may be located downhole or at the surface.” (EX. 1003, 6:22-24).

- *“at least one section of drill pipe configured to be operatively connected to the power supply;”*

Donderici ‘301 discloses “rig 101 at the surface 105 associated with a well 141 and positioned above borehole 106” and “a drilling assembly 107, comprising drill string 108 and bottom hole assembly (BHA) 109.” (EX. 1003, 4:6-8). The “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28).

Based on the foregoing, Donderici ‘301 explicitly teaches the control unit at the surface with the power source and connected to the survey electrodes making up the drill pipe. Donderici ‘301 further discloses “the system control unit 104 may excite the survey electrode 130a” in certain embodiments, but for “other embodiments, the survey electrode 130a is excited by a downhole source located at or associated with the downhole tool 111.” (EX. 1003, 6:15-22).

- *“at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the wire and the drill pipe is a rigid connection that maintains*

its rigid connection as the at least one section of drill pipe is drilling;”

Donderici ‘301 discloses that the “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). The term “communicatively coupled” is defined “to mean either a direct or an indirect communication connection” and “may be a wired or wireless connection,” which Donderici ‘301 further states “are well known to those of ordinary skill in the art and will therefore not be discussed in detail.” (EX. 1003, 3:29-36).

Fredriksen discloses wired pipe including a section of drill pipe that is partially lined with at least one conductive material. (EX. 1004, 3:38-52). The conductive material of Fredriksen is electrically connected to the power supply. (EX. 1004 1:30-33, 1:57-60). Wired pipe is a rigid connection, as that term is defined above, that maintains its rigid connection as the at least one section of drill pipe is drilling. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici ‘301 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶11).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and*

that is capable of causing electrical energy to exit a section of drill pipe; and”

Donderici ‘301 discloses that “gap sub 112 is located between the electrodes 130 (for example, survey electrode 130a and return electrode 130b to electrically insulate two portions of the BHA 109 and to prevent shorting.” (EX. 1003, 9:20-24). Donderici ‘301 also discloses that “current 134 may be induced within the formation 102 by energizing the survey electrode 130a of the drilling assembly 107.” (EX. 1003, 4:65-5:1).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici ‘301 discloses that:

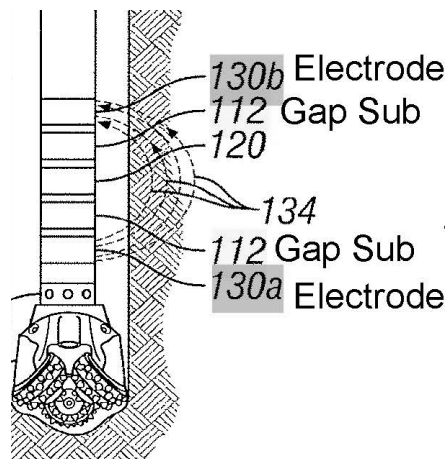
In certain embodiments, the system control unit 104 may further send commands to a receiver, for example, receiver 110, to cause any one or more receivers 110 to measure the induced magnetic field 136 on the second borehole 103. The receiver 110 may be a magnetometer, a collection of magnetometers, a solenoidal coil wrapped around the downhole tool 111 (for example, with a tilt between 0 degrees and 45 degrees), a solenoidal coil placed on the side of the downhole tool 111, or a collection of solenoidal coils.

(EX. 1003, 6:39-47).

ii. Claim 2:

“The apparatus of claim 1 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Donderici ‘301 discloses two gap subs and two electrodes in FIG. 1:



(EX. 1003, FIG. 1).

iii. Claim 3:

“The apparatus of claim 1 wherein the sensor is part of the bottom hole assembly.”

Donderici ‘301 discloses a bottom hole assembly (BHA), in which “BHA 109 may comprise a drill bit 113 and a downhole tool 111.” (EX. 1003, 4:11-12). In Donderici ‘301, the sensor providing “the receiver 110 may be a magnetometer, a

collection of magnetometers, a solenoidal coil wrapped around the downhole tool 111.” (EX. 1003, 6:42-45).

iv. Claim 4:

“The apparatus of claim 1 wherein the sensor is part of the drill pipe.”

Donderici ‘301 discloses “a drilling assembly 107, comprising drill string 108” with the receivers 110 that provide the sensor shown in FIG. 1 as part of that drill string since directly behind a drill bit along pipe going back to surface. (EX. 1003, 4:9-10 and FIG. 1).

v. Claim 5:

“The apparatus of claim 1 wherein the drill pipe is coiled tubing.”

Donderici ‘301 as discussed with claim 1 discloses use of drill string. One skilled in the art knew that drillstring “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). It would be obvious to try coiled tubing by choosing from a finite number of identified, predictable solutions for drill pipe for active ranging while drilling apparatuses, with a reasonable expectation of success. (EX. 1009, ¶12).

vi. Claim 6:

“The apparatus of claim 1 wherein the drill pipe is a section of threaded drill pipe.”

Donderici ‘301 as discussed with claim 1 discloses use of drill string. One skilled in the art knew that drillstring “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (*see*, EX. 1008, 5:39-41 and 23:27-28). It would be obvious to try threaded drill pipe by choosing from a finite number of identified, predictable solutions for drill pipe for active ranging while drilling apparatuses, with a reasonable expectation of success. (EX. 1009, ¶12).

vii. Claim 8:

“The apparatus of claim 1 wherein the power supply is connected to the drill pipe using one or more conductors.”

Donderici ‘301 discloses that “if a first device couples to a second device, that connection may be through a direct connection or through an indirect mechanical or electrical connection.” (EX. 1003, 3:26-28). The electrical connection of the power supply to the drillstring in Donderici ‘301 inherently uses a conductor.

viii. Claim 9:

- *“An apparatus for magnetic ranging comprising:”*

Donderici '301 discloses that “a galvanic tool may comprise any tool, such as downhole tool 111, with electrodes or a toroidal coil through which current is injected into a subterranean formation and a voltage response of the formation to the injected current is measured.” (EX. 1003, 4:27 - 34).

- *“a power supply;”*

Donderici '301 discloses that “the source of excitation may be located downhole or at the surface.” (EX. 1003, 6:22-24).

- *“at least one section of drill pipe operatively connected to the power supply;”*

Donderici '301 discloses “rig 101 at the surface 105 associated with a well 141 and positioned above borehole 106” and “a drilling assembly 107, comprising drill string 108 and bottom hole assembly (BHA) 109.” (EX. 1003, 4:6-8). The “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28).

Based on the foregoing, Donderici '301 explicitly teaches the control unit at the surface with the power source and connected to the survey electrodes making up the drill pipe. Donderici '301 further discloses “the system control unit 104 may

excite the survey electrode 130a” in certain embodiments, but for “other embodiments, the survey electrode 130a is excited by a downhole source located at or associated with the downhole tool 111.” (EX. 1003, 6:15-22).

- *“at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the wire and the drill pipe is a rigid connection and is not spring loaded;”*

Donderici ‘301 discloses that the “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). The term “communicatively coupled” is defined “to mean either a direct or an indirect communication connection” and “may be a wired or wireless connection,” which Donderici ‘301 further states “are well known to those of ordinary skill in the art and will therefore not be discussed in detail.” (EX. 1003, 3:29-36).

Fredriksen discloses wired pipe including a section of drill pipe that is partially lined with at least one conductive material. (EX. 1004, 3:38-52). The conductive material of Fredriksen is electrically connected to the power supply. (EX. 1004 1:30-33, 1:57-60). Wired pipe is a rigid connection, as that term is defined

above, that is not spring loaded. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici '301 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶11).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and that is capable of causing electrical energy to exit a section of drill pipe; and”*

Donderici '301 discloses that “gap sub 112 is located between the electrodes 130 (for example, survey electrode 130a and return electrode 130b to electrically insulate two portions of the BHA 109 and to prevent shorting.” (EX. 1003, 9:20-24). Donderici '301 also discloses that “current 134 may be induced within the formation 102 by energizing the survey electrode 130a of the drilling assembly 107.” (EX. 1003, 4:65-5:1).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici '301 discloses that:

In certain embodiments, the system control unit 104 may further send commands to a receiver, for example, receiver 110, to cause any one or more receivers 110 to measure the induced magnetic field 136 on the second borehole 103. The

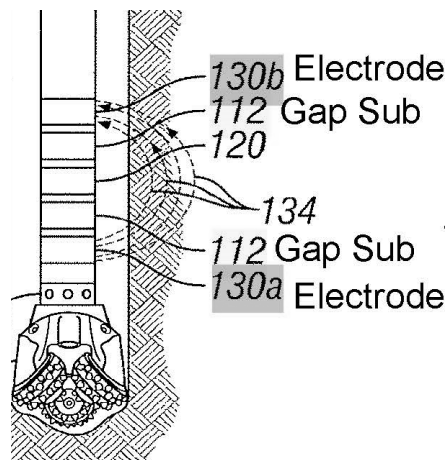
receiver 110 may be a magnetometer, a collection of magnetometers, a solenoidal coil wrapped around the downhole tool 111 (for example, with a tilt between 0 degrees and 45 degrees), a solenoidal coil placed on the side of the downhole tool 111, or a collection of solenoidal coils.

(EX. 1003, 6:39-47).

ix. Claim 10:

“The apparatus of claim 9 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Donderici ‘301 discloses two gap subs and two electrodes in FIG. 1:



(EX. 1003, FIG. 1).

x. Claim 11:

“The apparatus of claim 9 wherein the sensor is part of the bottom hole assembly.”

Donderici ‘301 discloses a bottom hole assembly (BHA), in which “BHA 109 may comprise a drill bit 113 and a downhole tool 111.” (EX. 1003, 4:11-12). In Donderici ‘301, the sensor providing “the receiver 110 may be... a solenoidal coil wrapped around the downhole tool 111.” (EX. 1003, 6:42-45).

xi. Claim 12:

“The apparatus of claim 9 wherein the sensor is part of the drill pipe.”

Donderici ‘301 discloses “a drilling assembly 107, comprising drill string 108” with the receivers 110 that provide the sensor shown in FIG. 1 as part of that drill string since directly behind a drill bit along pipe going back to surface. (EX. 1003, 4:9-10 and FIG. 1).

xii. Claim 13:

“The apparatus of claim 9 wherein the drill pipe is coiled tubing.”

Donderici ‘301 as discussed with claim 9 discloses use of drill string. One skilled in the art knew that drillstring “may be made up of segments or joints of

tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). It would be obvious to try coiled tubing by choosing from a finite number of identified, predictable solutions for drill pipe for active ranging while drilling apparatuses, with a reasonable expectation of success. (EX. 1009, ¶12).

xiii. Claim 14:

“The apparatus of claim 9 wherein the drill pipe is a section of threaded drill pipe.”

Donderici ‘301 as discussed with claim 9 discloses use of drill string. One skilled in the art knew that drillstring “may be made up of segments or joints of tubulars threaded together or coiled tubing.” (see, EX. 1008, 5:39-41 and 23:27-28). It would be obvious to try threaded drill pipe by choosing from a finite number of identified, predictable solutions for drill pipe for active ranging while drilling apparatuses, with a reasonable expectation of success. (EX. 1009, ¶12).

xiv. Claim 15:

“The apparatus of claim 9 further comprising a second electrically insulated member located further downhole from the first electrically insulated member.”

Since claim 15 is a duplicate of claim 10, Donderici ‘301 and Fredriksen render obvious claim 15 for the same reasons as discussed regarding claim 10.

xv. **Claim 17:**

“The apparatus of claim 9 wherein the power supply is connected to the drill pipe using one or more conductors.”

Donderici ‘301 discloses that “if a first device couples to a second device, that connection may be through a direct connection or through an indirect mechanical or electrical connection.” (EX. 1003, 3:26-28). The electrical connection of the power supply to the drillstring in Donderici ‘301 inherently uses a conductor.

xvi. **Claim 18:**

- *“An apparatus for magnetic ranging comprising:”*

Donderici ‘301 discloses that “a galvanic tool may comprise any tool, such as downhole tool 111, with electrodes or a toroidal coil through which current is injected into a subterranean formation and a voltage response of the formation to the injected current is measured.” (EX. 1003, 4:27 - 34).

- *“a power supply;”*

Donderici ‘301 discloses that “the source of excitation may be located downhole or at the surface.” (EX. 1003, 6:22-24).

- *“at least one section of drill pipe configured to be operatively connected to the power supply;”*

Donderici '301 discloses “rig 101 at the surface 105 associated with a well 141 and positioned above borehole 106” and “a drilling assembly 107, comprising drill string 108 and bottom hole assembly (BHA) 109.” (EX. 1003, 4:6-8). The “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28).

Based on the foregoing, Donderici '301 explicitly teaches the control unit at the surface with the power source and connected to the survey electrodes making up the drill pipe. Donderici '301 further discloses “the system control unit 104 may excite the survey electrode 130a” in certain embodiments, but for “other embodiments, the survey electrode 130a is excited by a downhole source located at or associated with the downhole tool 111.” (EX. 1003, 6:15-22).

- *“at least one wire inside the at least one section of drill pipe that connects the power supply and the at least one section of drill pipe, wherein the connection between the wire and the drill pipe maintains a continuous electrical connection while the at least one section of drill pipe is drilling;”*

Donderici '301 discloses that the “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). The term “communicatively coupled” is defined “to mean either a direct or an indirect communication connection” and “may be a wired or wireless connection,” which Donderici '301 further states “are well known to those of ordinary skill in the art and will therefore not be discussed in detail.” (EX. 1003, 3:29-36).

Fredriksen discloses wired pipe including a section of drill pipe that is partially lined with at least one conductive material. (EX. 1004, 3:38-52). The conductive material of Fredriksen is electrically connected to the power supply. (EX. 1004 1:30-33, 1:57-60). Wired pipe is a rigid connection, as that term is defined above, that maintains a continuous electrical connection while the at least one section of drill pipe is drilling. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici '301 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶11).

- *“a first electrically insulated member electrically connected with the at least one section of drill pipe and that is capable of causing electrical energy to exit a section of drill pipe; and”*

Donderici '301 discloses that “gap sub 112 is located between the electrodes 130 (for example, survey electrode 130a and return electrode 130b to electrically insulate two portions of the BHA 109 and to prevent shorting.” (EX. 1003, 9:20-24). Donderici '301 also discloses that “current 134 may be induced within the formation 102 by energizing the survey electrode 130a of the drilling assembly 107.” (EX. 1003, 4:65-5:1).

- *“a sensor for detecting a magnetic ranging signal.”*

Donderici '301 discloses that:

In certain embodiments, the system control unit 104 may further send commands to a receiver, for example, receiver 110, to cause any one or more receivers 110 to measure the induced magnetic field 136 on the second borehole 103. The receiver 110 may be a magnetometer, a collection of magnetometers, a solenoidal coil wrapped around the downhole tool 111 (for example, with a tilt between 0 degrees and 45 degrees), a solenoidal coil placed on the side of the downhole tool 111, or a collection of solenoidal coils.

(EX. 1003, 6:39-47).

xvii. **Claim 19:**

- *“A method of magnetic ranging comprising:”*

Donderici ‘301 discloses that “a galvanic tool may comprise any tool, such as downhole tool 111, with electrodes or a toroidal coil through which current is injected into a subterranean formation and a voltage response of the formation to the injected current is measured.” (EX. 1003, 4:27 - 34).

- *“installing a sensor that senses a magnetic ranging signal in a wellbore;”*

Donderici ‘301 discloses “one or more receivers 110 to measure the induced magnetic field 136 on the second borehole 103.” (EX. 1003, 6:41-42).

- *“installing a first electrically insulative gap sub in a wellbore;”*

Donderici ‘301 discloses that “gap sub 112 is located between the electrodes 130 (for example, survey electrode 130a and return electrode 130b to electrically insulate two portions of the BHA 109 and to prevent shorting.” (EX. 1003, 9:20-24).

- *“installing at least one section of drill pipe in a wellbore that is connected to the electrically insulative gap sub;”*

Donderici ‘301 discloses that “rig 101 at the surface 105 associated with a well 141 and positioned above borehole 106” and “a drilling assembly 107,

comprising drill string 108 and bottom hole assembly (BHA) 109.” (EX. 1003, 4:6-8). FIG. 1 shows the gap sub 112 and drill string 108 connected and in the borehole 106. (EX. 1003, Fig. 1).

- *“connecting a power supply to at least one section of drill pipe using at least one wire that is located inside the at least one section of drill pipe, wherein the connection from the at least one wire to the at least one section of drill pipe is made at surface and is a rigid connection;”*

Donderici ‘301 discloses connecting surface power supply to a drill pipe using a wire, stating “the source of excitation may be located downhole or at the surface.” (EX. 1003, 6:22-24). The “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). The term “communicatively coupled” is defined “to mean either a direct or an indirect communication connection” and “may be a wired or wireless connection,” which Donderici ‘301 further states “are well known to those of ordinary skill in the art and will therefore not be discussed in detail.” (EX. 1003, 3:29-36).

Based on the foregoing, Donderici ‘301 explicitly teaches the control unit at the surface with the power source and connected by wire to the survey electrodes

making up the drill pipe. Donderici '301 further discloses “the system control unit 104 may excite the survey electrode 130a” in certain embodiments, but for “other embodiments, the survey electrode 130a is excited by a downhole source located at or associated with the downhole tool 111.” (EX. 1003, 6:15-22).

Fredriksen discloses wired pipe including a section of drill pipe that is partially lined with at least one conductive material. (EX. 1004, 3:38-52). The conductive material of Fredriksen is electrically connected to the power supply. (EX. 1004 1:30-33, 1:57-60). Wired pipe is a rigid connection, as that term is defined above, that is made at surface. One of ordinary skill in the art would be motivated to combine Fredriksen with Donderici '301 to transmit both electrical power and signals through drill pipe. (EX. 1004, 1:57-60 and EX. 1009, ¶11).

- *“energizing the power supply to cause current to flow down the drill pipe and inject into a wellbore formation and travel to a target well to create a magnetic ranging signal;”*

Donderici '301 discloses that “current 134 may be induced within the formation 102 by energizing the survey electrode 130a of the drilling assembly 107.” (EX. 1003, 4:65-5:1). “Part of the formation current 134 may be received and concentrated at the casing 140 within the conductive target (target well 142), shown

as current 138, and the current 138 on the casing 140 may induce a magnetic field 136.” (EX. 1003, 5:7-12).

- *“sampling the magnetic ranging signal; and”*

Donderici ‘301 discloses that:

In certain embodiments, the system control unit 104 may further send commands to a receiver, for example, receiver 110, to cause any one or more receivers 110 to measure the induced magnetic field 136 on the second borehole 103. The receiver 110 may be a magnetometer, a collection of magnetometers, a solenoidal coil wrapped around the downhole tool 111 (for example, with a tilt between 0 degrees and 45 degrees), a solenoidal coil placed on the side of the downhole tool 111, or a collection of solenoidal coils.

(EX. 1003, 6:39-47).

- *“adjusting the drilling operations to alter a characteristic of the drilling operations.”*

Donderici ‘301 discloses that “one or more drilling parameters are adjusted based, at least in part, on the determined one or more ranging parameters.” (EX. 1003, 11:28-30).

xviii. Claim 20:

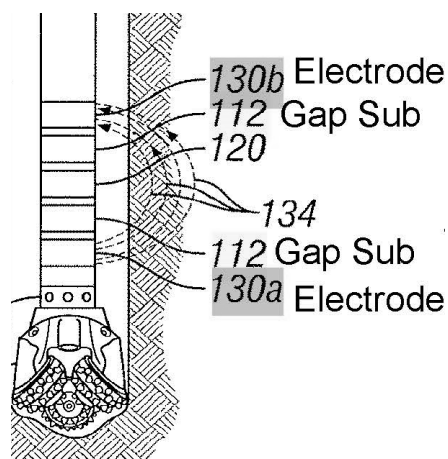
“The method of claim 19 further comprising adjusting the drilling operations to alter a second characteristic of the drilling operations.”

Donderici ‘301 discloses that “one or more drilling parameters are adjusted based, at least in part, on the determined one or more ranging parameters.” (EX. 1003, 11:28-30).

xix. Claim 21:

“The method of claim 19 further comprising installing a second electrically insulative gap sub downhole from the first electrically insulative gap sub.”

Donderici ‘301 discloses two gap subs in FIG. 1:



(EX. 1003, FIG. 1).

xx. Claim 22:

“The method of claim 19 wherein the step of sampling the magnetic ranging signal occurs while drilling is taking place.”

Donderici ‘301 discloses that “FIG. 1 is a diagram showing an illustrative logging while drilling environment.” (EX. 1003, 1:51-53). “In LWD, data is typically collected during the drilling process.” (EX. 1003, 3:43-44).

f. Ground 6:

Claims 7 and 16 are obvious based on Donderici ‘301 and Fredriksen in view of Shulz.

i. Claim 7:

“The apparatus of claim 1 wherein the power supply is connected to the drill pipe using at least one wire of a multiribbon wire.”

Donderici ‘301 discloses that “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). Schultz discloses transmissions lines for communicating an electrical signal downhole “include a

coaxial cable, a triaxial cable, a multiaxial cable, a twisted pair cable, a ribbon cable, and insulated conductors. (EX. 1005, 3:37-41). One of ordinary skill in the art would be motivated to combine Schultz with Donderici ‘301 to transmit both electrical power and signals through drill pipe. (EX. 1005, Abstract and 4:42-45 and EX. 1009, ¶13).

ii. Claim 16:

“The apparatus of claim 9 wherein the power supply is connected to the drill pipe using at least one wire of a multiribbon wire.”

Donderici ‘301 discloses that “system control unit 104 may be positioned at the surface 105 as depicted in FIG. 1 and may be communicably or communicatively coupled to downhole elements including, but not limited to, drilling assembly 107, telemetry system 118, downhole tool 111.” (EX. 1003, 5:24-28). Schultz discloses transmissions lines for communicating an electrical signal downhole “include a coaxial cable, a triaxial cable, a multiaxial cable, a twisted pair cable, a ribbon cable, and insulated conductors. (EX. 1005, 3:37-41). One of ordinary skill in the art would be motivated to combine Schultz with Donderici ‘301 to transmit both electrical power and signals through drill pipe. (EX. 1005, Abstract and 4:42-45 and EX. 1009, ¶13).

VII. CONCLUSION

Based on the foregoing, claims 1-22 of the '780 Patent are unpatentable. The Petitioner requests PGR to cancel the claims of the '780 Patent. The Commissioner is hereby authorized to charge any fee that has been overlooked to Deposit Account No. 50-5629.

Date: July 1, 2025

/Michael Locklar/
Michael Locklar
Reg. 44,878
EWING & JONES, PLLC
6363 Woodway, Suite 1000
HOUSTON, TEXAS 77057
832-830-8945 Direct Dial
Attorney for Petitioner

VIII. CERTIFICATION OF WORD COUNT

I hereby certify that the foregoing, Petition for Post-Grant Review of U.S. Patent No. 12,110,780, contains 10817 words as measured by the word processing software used to prepare the document, in compliance with 37 C.F.R. §42.24 (d).

Date: July 1, 2025

/Michael Locklar/
Michael Locklar
Reg. 44,878

IX. CERTIFICATION OF SERVICE

I hereby certify that the foregoing, Petition for Post-Grant Review of U.S. Patent No. 12,110,780, including all Exhibits, was served on July 1, 2025, via Express Mail delivery directed to the attorney of record for the patent at the following address:

Buss & Benefield PLLC

1298 West Main Street

Greenwood, IN 46142

Date: July 1, 2025

/Michael Locklar/

Michael Locklar

Reg. 44,878

X. APPENDIX OF EXHIBITS

Exhibit No.	Title
1001	U.S. Patent No. 12,110,780 (“the ‘780 Patent”)
1002	U.S. Patent No. 10,429,534 (“Donderici ‘534”)
1003	U.S. Patent No. 10,656,301 (“Donderici ‘301”)
1004	US. Patent No. 11,236,551 (“Fredriksen”)
1005	U.S. Patent No. 9,771,791 (“Schulz”)
1006	Reply to Non-Final Office Action of September 28, 2022, in Prosecution History of US Patent No. 11,781,421.
1007	Office Action of March 20, 2024, in Prosecution History of the ‘780 Patent.
1008	U.S. Patent No. 8,881,843
1009	Declaration of Jamie Dorey