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Paper 11
Date: May 6, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NEXTIER OILFIELD SOLUTIONS INC.,
Petitioner,

v.

NEXUS PERFORATING LLC,
Patent Owner.

IPR2021-00082
Patent 10,352,136 B2

Before JAMES A. WORTH, SCOTT C. MOORE, and ERIC C. JESCHKE, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background and Summary

NexTier Oilfield Solutions Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1 and 2 of U.S. Patent No. 10,352,136 B2 ("the '136 patent"). Paper 2 ("Pet."). Nexus Perforating, LLC ("Patent Owner") filed a Preliminary Response. Paper 6 ("Prelim. Resp."). With our authorization, Petitioner filed a Reply In Support of Petition. Paper 10 ("Reply").

An *inter partes* review may not be instituted unless "the information presented in the petition . . . and any response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a) (2018). The Supreme Court has held that we may not institute review of fewer than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu,* 138 S. Ct. 1348, 1359–60 (2018).

For the reasons set forth below, we conclude that there is a reasonable likelihood that Petitioner will prevail in establishing the unpatentability at least one challenged claim. We, therefore, institute *inter partes* review of claims 1 and 2 on all asserted grounds. *See id.*; Patent Trial and Appeal Board Consolidated Trial Practice Guide, 64 (Nov. 2019) (hereinafter, "Consolidated Trial Practice Guide") ("The Board will not institute on fewer than all claims or all challenges in a petition."), *available at* https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf.

Our findings and conclusions at this stage of the proceeding are preliminary and are based on the evidentiary record developed thus far. This

is not a final decision as to the patentability of any claim. Our final decision will be based on the record as fully developed during trial.

B. Real Parties in Interest

Petitioner identifies itself as the only real party in interest. Pet. 2. Patent Owner identifies itself as the only real party in interest. Paper 7, 1.

C. Related Matters

The parties inform us that the '136 patent is the subject of *Nexus Perforating LLC v. NexTier Oilfield Solutions Inc.*, No. 4:20-cv-01539 (S.D. Tex.). Pet. 3; Paper 7, 1. Patent Owner also identifies related U.S. Patent Application No. 16/411,851, filed May 2014, 2019, now abandoned. Paper 7, 1.

D. The '136 Patent

The '136 patent is directed to an "electro-mechanical assembly for connecting a series of [perforating] guns to allow reliable assembly and reliable sequential firing of the guns during the perforation process of production wells." Ex. 1001, 1:24–27.

The '136 patent indicates that, in prior art perforating guns,

> a plastic insulating bottom end cap attaches to the charge carrier, and approximately centers it within the body. The bottom end cap has a central hole through which passes a wire carrying the electrical firing signal. A second wire connects to a grounding pin affixed to the plastic end cap which is routed to brush against the gun body to establish a ground.

Ex. 1001, 2:58–64. The distal end of the charge carrier also includes a plastic insulating end cap, called a top cap, which centers the charge carrier in the body. *Id.* at 2:65–3:1. According to the '136 patent, "[t]he innovation

includes replacing the traditional plastic end caps on each charge carrier with an improved design which is more robust and reliable in the assembly of multiple guns into a single perf assembly." *Id.* at 3:7–10. "The improved gun end caps, in the preferred embodiment, are machined from aluminum and comprise a through hole in the center." *Id.* at 3:13–15. "[T]here is no need for the grounding pin, as the wire may be attached directly to the face of the end cap via a screw. Since the aluminum is conductive, it grounds to the gun body." *Id.* at 3:40–43.

Figure 2 of the '136 patent, reproduced below, depicts a cross section view of a prior art perforating gun joined at each end by a tandem sub. Ex. 1001, 4:18–19.

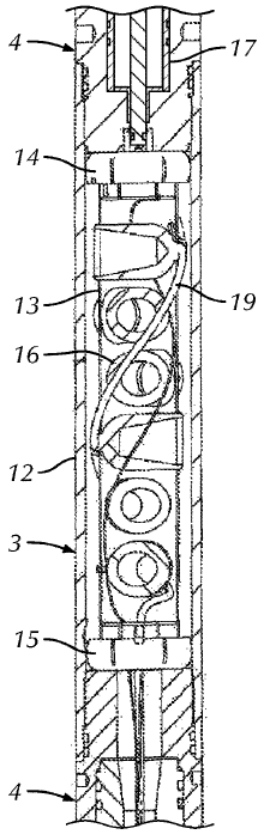


FIG. 2
(Prior Art)

Figure 2 shows gun 3 including charge carrier 13, which includes a plurality of explosive shape charges 16 joined by detonation cord 19. *Id.* at 5:18–20. Charge carrier 13 is supported and centered within body 12 by insulating top end 14 and isolating bottom end 15. *Id.* at 5:20–23.

Figure 2B of the '136 patent, reproduced below, depicts a cross section of a prior art bottom sub assembly mated with a gun. Ex. 1001, 4:22–23.

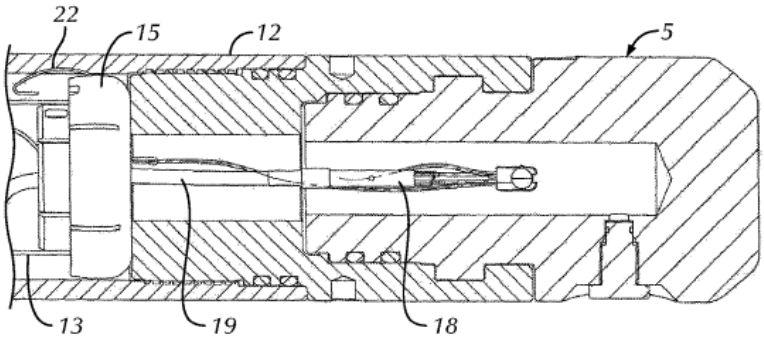


FIG. 2B
(Prior Art)

Figure 2B shows charge carrier 13 attached to insulating end plate 15, which includes a tab for connecting grounding contact 22 to gun body 12, and orifice 23, through which fire and ground wires pass. *Id.* at 5:64–6:4.

Figure 4B of the ’136 patent, reproduced below, depicts a side cross-sectional view an improved end cap according to an exemplary embodiment. Ex. 1001, 6:46–49.

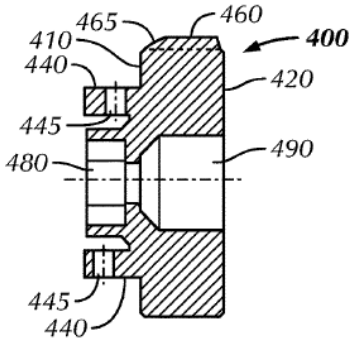


FIG. 4B

Figure 4B depicts end cap 400 manufactured of a durable electrically conductive material, such as aluminum. *Id.* at 6:49–51. End cap 400 includes principle guide pin 460 to ensure grounding with gun body 12. *Id.* at 7:14–18.

Figure 7, reproduced below, depicts a cross section of an end cap assembled in a gun body according to an exemplary embodiment. Ex. 1001, 4:43–45.

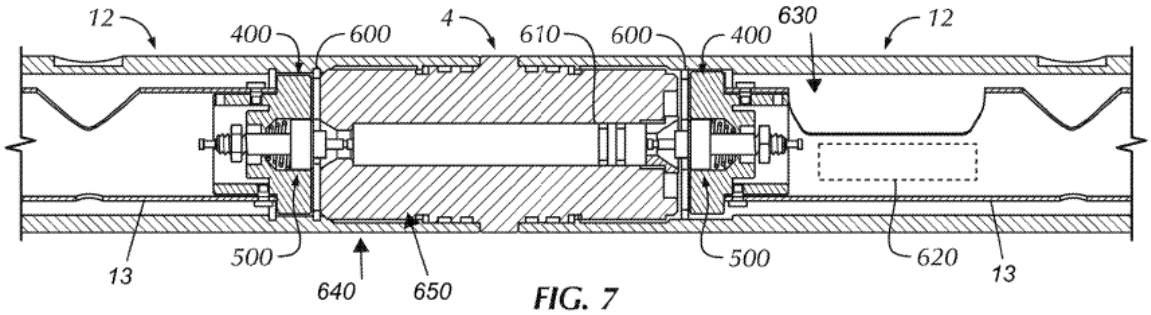


FIG. 7

Figure 7 shows two perforating gun bodies 12 mated to either end of tandem sub 4 via a screwing interface. *Id.* at 7:55–60. End caps 400 of charge carriers 13 are held in position in gun bodies 12 via spring clips 600. *Id.* at 7:66–67. A firing signal is passed between guns through tandem sub 4 to

addressable switch 620. *Id.* at 8:5–8. Wiring for addressable switch 620 and detonators 17 and 18 (not shown) are internal to the charge carrier and accessible via wiring port window 630. *Id.* at 8:8–13.

E. Illustrative Claim

Petitioner challenges claims 1 and 2 of the '136 patent. Of those, claim 1 is independent. Claim 2 depends from claim 1.

Claim 1, reproduced below, is representative.

> 1. A gun assembly for perforating wells comprising:
> at least one gun body casing, the casing being a hollow cylinder, with a box fitting at each end;
> a charge carrier, the carrier being a hollow cylinder, with exterior diameter less than the interior diameter of the casing, and a length shorter than the distance between the box fittings of the casing;
> a plurality of shape charges positioned radially inside the charge carrier and inter connected by a detonator cord;
> a plurality of end caps affixed to the ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein;
> at least one end cap being of a durable material, electrically conductive and electrically connects the charge carrier of the gun body;
> an addressable detonation switch electrically connected between an inner side of at least one end cap and the plurality of shape charges within the charge carrier.

Ex. 1001, 8:36–53.

F. Challenged Claims and Asserted Grounds

Petitioner asserts the following grounds of unpatentability:

Ground	Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1	1, 2	103	Schacherer[1], Perforating Innovations[2]
2	1, 2	103	Schacherer, Black[3]
3	1, 2	103	Schacherer, General Knowledge of a POSITA
4	1, 2	103	Eitschberger[4], Hardesty[5]
5	1, 2	103	Eitschberger, General Knowledge of a POSITA
6	1, 2	103	Perforating Innovations, Hardesty

Pet. 5. Petitioner also relies on the Declaration testimony of Robert A. Parrott. *See* Ex. 1002.

II. ANALYSIS

A. Discretionary Denial of Institution under 35 U.S.C. § 325(d)

Patent Owner asserts we should exercise our discretion under 35 U.S.C. § 325(d) and deny institution because the Office already considered grounds similar to those asserted by Petitioner. Prelim. Resp. 1, 75–79. Petitioner asserts that we should decline to exercise our discretion to deny institution under section 325(d) because asserted "[g]rounds 1–6 are

[1] U.S. Pat. No. 9,689,223 B2, issued June 27, 2017 (Ex. 1003).
[2] Carlos Bauman, et al., *Perforating Innovations—Shooting Holes in Performance Models*, 26 Oilfield Review 14, 2014 (Ex. 1004).
[3] U.S. Pat. Appl. Pub. No. 2012/0247771 A1, published October 4, 2012 (Ex. 1006).
[4] PCT Intl. Pub. No. 2015/028204 A2, published March 5, 2015 (Ex. 1007).
[5] U.S. Pat. No. 9,194,219 B2, issued November 24, 2015 (Ex. 1008).

based on prior art references that were never considered during prosecution." Pet. 6.

We have discretion to deny institution when "the same or substantially the same prior art or arguments previously were presented to the Office." 35 U.S.C. § 325(d). In that respect, section 325(d) provides that the Director may elect not to institute a proceeding if the challenge to the patent is based on matters previously presented to the Office.[6] *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 7 (PTAB Feb. 13, 2020) (precedential) ("*Advanced Bionics*").

In evaluating matters under section 325(d), the Board uses the following two-part framework: (1) determining whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of the first part of the framework is satisfied, determining whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims. *Advanced Bionics*, Paper 6 at 8.

In applying the two-part framework, we weigh the following non-exclusive factors ("the *Becton Dickinson* factors"):

> (a) the similarities and material differences between the asserted art and the prior art involved during examination;
>
> (b) the cumulative nature of the asserted art and the prior art evaluated during examination;

[6] The Board institutes trial on behalf of the Director. 37 C.F.R. § 42.4(a); *Advanced Bionics*, Paper 6 at 7 n.7.

> (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;
>
> (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;
>
> (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art or arguments; and
>
> (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of prior art or arguments.

Becton, Dickinson & Co. v. B. Braun Melsungen AG, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (Decision on Institution) (precedential in relevant part); *see also NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 11–12 (PTAB Sept. 12, 2018) (Decision on Institution) (precedential) (adopting and applying the *Becton, Dickinson* factors).

Factors (a), (b), and (d) of *Becton, Dickinson* relate to whether the art or arguments presented in the Petition are the same or substantially the same as those previously presented to the Office. *Advanced Bionics*, Paper 6 at 10. Factors (c), (e), and (f) "relate to whether the petitioner has demonstrated a material error by the Office" in its prior consideration of that art or arguments. *Id.* Only if the same or substantially the same art or arguments were previously presented to the Office do we then consider whether petitioner has demonstrated a material error by the Office. *Id.*

Patent Owner contends that the prior art cited in the Petition is similar to the Barlow, Tassaroli, Bradford, and Langford references cited during prosecution. Prelim. Resp. 76–77. In particular, Patent Owner contends that each of Petitioner's grounds combines "a prior art perf gun with an unprotected detonation switch[] vulnerably spotted in the pinhead of the gun

body" with "another prior art perf gun with an unprotected detonation switch put far outside of [the] gun." *Id*. at 76. Patent Owner asserts that the Examiner allowed the challenged claims after they were amended to require a detonation switch positioned in the manner claimed, i.e., "electrically connected between an inner side of at least one end cap and the plurality of shape charges." *See id*. at 78.

Petitioner argues in response that the prior art before the Examiner did not disclose electrically conductive end caps, and that the Examiner focused on this deficiency—rather than the positions of the detonation switches—when allowing the claims. Reply 2–3. Petitioner further asserts that the cited prior art references each disclose a detonation switch that is "electrically connected between an inner side of at least one end cap and the plurality of shape charges." Reply 3.

In the Notice of Allowance, the Examiner indicated that the claims were allowable because "the prior art of record fails to disclose or teach a gun assembly with a durable and electrically conductive end cap with an addressable detonation switch comprising the limitations as claimed." Ex. 1011, 25. Petitioner has presented evidence that several of the cited references teach electrically conductive end caps made of durable materials. *See, e.g.*, Reply 2–3; Pet. 26–28 (citing Ex. 1003, 6:18–22), 63–66 (citing Ex. 1007 ¶¶ 32, 37), 99–100 (citing Ex. 1004, 31). The references cited in the Petition do not appear to be cumulative of those considered by the Examiner with respect to the claim limitation requiring a durable and electrically conductive end cap.

Petitioner also has identified several references that appear to teach positioning a detonation switch between the inner side of an end cap and the

shape charges within a charge carrier. *See, e.g.*, Pet. 34 (citing Ex. 1004, 21, "Addressable Switch and Detonator"), 39 (citing Ex. 1006, Fig. 7, Reference Numeral 30), 70 (citing Ex. 1007, Fig. 2, Reference Numeral 10). Accordingly, the references cited in the Petition do not appear to be cumulative of those considered by the Examiner with respect to the claim limitation specifying the position of the detonation switch.

For the foregoing reasons, we are persuaded that the prior art cited in this proceeding is materially different than, and therefore not cumulative of, the art that was cited during examination. Petitioner's present arguments concerning these references thus, do not substantially overlap with arguments that previously were before the Examiner. Accordingly, *Beckon, Dickinson* factors (a), (b), and (d) all weigh against a determination that the art or arguments presented in the Petition are the same or substantially the same as those previously presented to the Office. *See Advanced Bionics*, Paper 6 at 10. In this situation, a discretionary denial of institution under Section 325(d) is inappropriate, and it is unnecessary for us to consider the remaining *Beckon, Dickinson* factors. *See id*.

For the foregoing reasons, we decline to invoke our discretion under 35 U.S.C. § 325(d) to deny institution of an *inter partes* review.

B. Claim Construction

We generally give the words of a claim their ordinary and customary meaning. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1313. The person of ordinary skill in the art is deemed to read the claim term not only in the context of the

particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. *Id*.

"[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Claim 1 recites "at least one end cap being of a durable material, electrically conductive and electrically connects the charge carrier of the gun body." Ex. 1001, 8:48–50. Petitioner asserts that one of ordinary skill in the art "would understand that the body of the end cap itself—as opposed to a separate conductive piece, such as a metal centering clip or a grounding pin—must be electrically conductive." Pet. 13 (citing Ex. 1002 ¶¶ 130–135). Petitioner also indicates that "[t]his dispute is not relevant for purposes of this Petition because each reference cited for the above limitation uses end caps with metallic, conductive bodies." *Id.* Patent Owner argues that a non-conductive end cap with a separate, conductive piece could satisfy claim 1. *See* Prelim. Resp. 37–44. The Petition relies on references that allegedly teach end caps made of conductive materials. *See* Reply 2–3; Pet. 26–28 (citing Ex. 1003, 6:18–22), 63–66 (citing Ex. 1007 ¶¶ 32, 37), 99–100 (citing Ex. 1004, 31). Accordingly, none of the issues in this proceeding turns on the resolution of this claim construction dispute. We, therefore, need not address this dispute.

Patent Owner also makes a generalized argument that Petitioner's expert is not qualified to offer claim construction-related opinions. *See* Prelim. Resp. 26–48. Patent Owner specifically argues that Petitioner's

expert overlooked a restriction requirement in the file history of the '136 patent. *Id*. at 29. According to Patent Owner, this restriction requirement makes clear that the "gun assembly" of claim 1 "does not include the separate device called an 'intermediate sub for connecting two gun assemblies.'" *Id*. Patent Owner's argument is not persuasive.

During prosecution, the Examiner required the patent applicant to restrict the application to either a group of claims directed to a gun assembly, or a claim drawn to an intermediate sub; and that the applicant elected to pursue the gun assembly claims. *See* Ex. 1011, 10, 25. But a restriction requirement is merely a procedure that is used to streamline prosecution. Our reviewing court has held that an election made in response to a restriction requirement does not operate to limit claim scope unless the applicant clearly and unmistakably disavows claim scope. *See, e.g., Plantronics, Inc. v. Aliph, Inc.*, 724 F.3d 1343, 1350–51 (Fed. Cir. 2013). Patent Owner has not identified any such disavowal of claim scope, or cited any legal authority to support its position that the patent applicant's election somehow otherwise operated to limit the scope of the challenged claims. Moreover, the specification of the '136 patent indicates that a "gun assembly" may include an intermediate (i.e., tandem) sub. *See* Ex. 1001, 4:27–29 ("FIG. 3B, is another detailed view of a tandem sub, showing the end cap of the gun and pressure switch of the tandem sub in their respective positions in the gun assembly"), 5:38–39 (using the terms "intermediate sub" and "tandem sub" interchangeably). On this record, we are not persuaded that the term "gun assembly" of claim 1 excludes intermediate subs.

Patent Owner additionally argues that Petitioner's infringement contentions in related district court litigation are part of the record of this

proceeding. *See* Prelim. Resp. 48–52. Patent Owner, however, does not clearly identify any claim construction disputes raised by these infringement contentions that would bear on the issues presently in dispute. *See id*. at 26–52. Accordingly, we do not address Petitioner's infringement contentions.

We decline to further construe any claim terms because we find that doing so is not necessary in order to resolve the issues presently in dispute. *See Nidec*, 868 F.3d at 1017.

C. Obviousness under 35 U.S.C. § 103

1. Principles of Law

An invention is not patentable under 35 U.S.C. § 103 "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and, (4) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17−18 (1966).

When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR Int'l Co. v. Teleflex Inc.*, 550

U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

2. Level of Ordinary Skill in the Art

The level of skill in the art is "a prism or lens" through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) ("the level of skill in the art is a prism or lens through which a judge, jury, or the Board views the prior art and the claimed invention"). Petitioner asserts the person of ordinary skill "would have a bachelor's or equivalent degree in mechanical or electrical engineering or a related field and at least 2 to 5 years of experience in perforating gun systems." Pet. 12. Patent Owner does not propose any particular skill level in its Preliminary Response. *See generally* Prelim. Resp.

For purposes of this Decision, we accept and apply Petitioner's formulation regarding the level of ordinary skill in the art.

3. Secondary Considerations

Patent Owner argues that Petitioner worked with the inventor of the '136 patent to incorporate the claimed invention into a product, and then branded that product the "GameChanger™." Prelim. Resp. 51. According to Patent Owner, Petitioner's choice of the trade name GameChanger is an admission that the claimed subject matter is novel, and thus, constitutes secondary evidence of non-obviousness. *Id*. at 51–52.

"[T]o be accorded substantial weight in the obviousness analysis, the evidence of secondary considerations must have a 'nexus' to the claims, *i.e.*, there must be 'a legally and factually sufficient connection' between the evidence and the patented invention." *Henny Penny Corp. v. Frymaster*

LLC, 938 F.3d 1324, 1332 (Fed. Cir. 2019). "The burden of proof as to this connection or nexus resides with the patentee." *Demaco Corp. v. F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1392 (Fed. Cir. 1988).

Here, Patent Owner argues that "[t]he nexus between Petitioner's admission and patentability of the claimed subject matter is evident by comparing Petitioner's brochures (e.g., [Ex. 2021], pg. 32) to the properly construed claims." Prelim. Resp. 51. But Patent Owner never actually compares the GameChanger product to any challenged claim, much less demonstrates that this product and a challenged claim are coextensive. *See id.*; *Polaris Indus., Inc. v. Arctic Cat, Inc.*, 882 F.3d 1056, 1072 (Fed. Cir. 2018) (A presumption of nexus applies "when the patentee shows that the asserted objective evidence is tied to a specific product and that the product embodies the claimed features, and is coextensive with them.") (citation and internal quotation omitted). Accordingly, Patent Owner has not met its burden to demonstrate a nexus, and its secondary considerations evidence is not entitled to substantial weight in our obviousness analysis.

4. Scope and Content of the Prior Art; Differences between Claimed Subject Matter and Prior Art; Obviousness

a) Summary of the Prior Art

(1) Schacherer

Schacherer is directed to "selectable, internally oriented and/or integrally transportable explosive assemblies." Ex. 1003, 1:9–10. Figure 2, reproduced below, shows a cross-sectional view of an explosive assembly. *Id.* at 2:1–4.

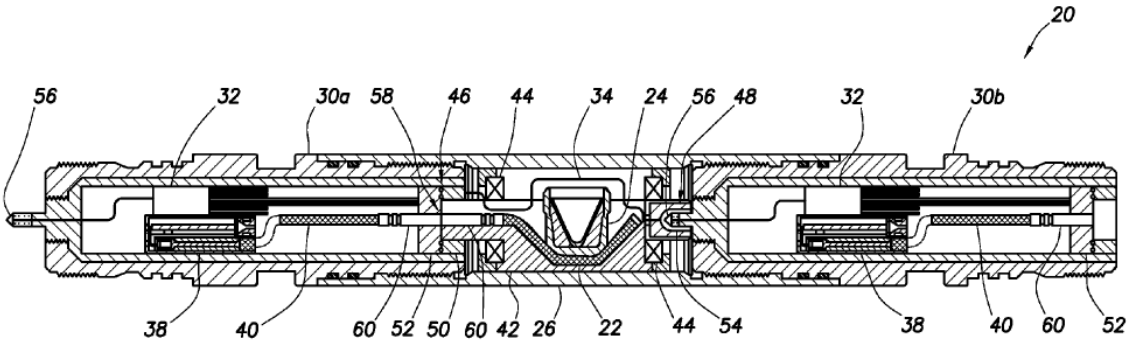


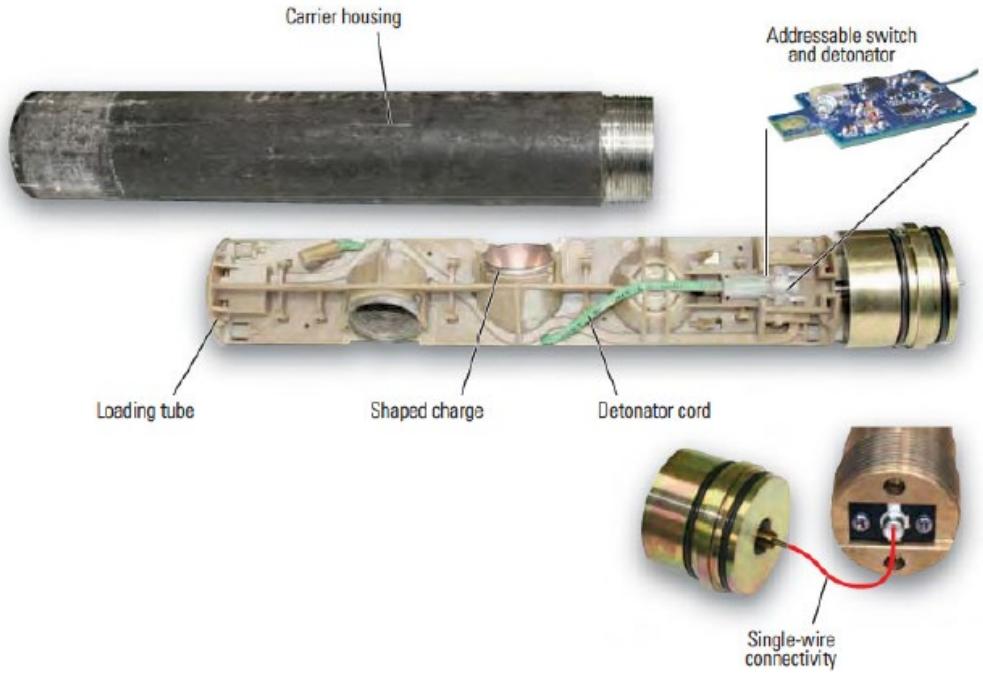
FIG.2

Figure 2 depicts explosive assembly 20 comprising explosive components 22 and 24 positioned in outer housing 26 between connectors 30*a* and 30*b*, which are threaded into respective ends of housing 26. *Id.* at 3:66–4:4. Connectors 30*a* and 30*b* include selective firing modules 32 electrically connected to electrical conductor 34 via rotary electrical connections 46 and 48. *Id.* at 4:5–7. Explosive components 22 and 24 can be selectively and individually detonated by transmitting signals to respective selective firing modules 32. *Id.* at 4:61–67. Housing 26 and connectors 28 and 30 may be made of electrically conductive material for grounding purposes. *Id.* at 6:18–22.

(2) Perforating Innovations

Perforating Innovations pertains to explosive shaped charges used in oil and gas wells, and software for computing penetration depth, perforation effectiveness, and system dynamic responses. Ex. 1004, 1.[7] Reproduced below is a figure appearing on page 18 of Exhibit 1004.

[7] We refer and cite to the page numbers added to the document in the lower right side of each page.



This figure from page 18 of Exhibit 1004 depicts components of a perforating gun system including a carrier housing, a loading tube, shaped charges, and a detonator cord. *Id.* at 18. The system uses detonators and addressable switches that are connected by a single-wire system, such that each gun can be fired in sequence via commands to the addressable switches. *Id.*

(3) Black

Black is directed to a "perforating gun and methods of arming a perforating gun." Ex. 1006, Abstract. Figure 7, reproduced below, depicts an exemplary perforating gun. *Id.* ¶ 17.

FIG. 7

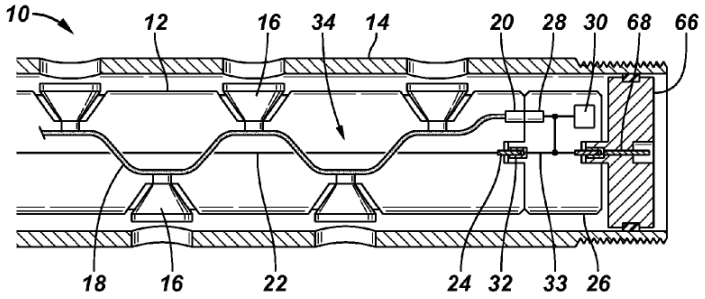


Figure 7 depicts perforating gun 10 comprising arming device 26, which is physically, electrically, and ballistically connected to loading tube 12. *Id.* ¶ 34. Ballistic train 34 includes explosive charges 16 connected to detonating cord 18, which is connected to detonator 28. *Id.* Pressure bulkhead 66 is installed in carrier 14 adjacent to arming device 26. *Id.* Pressure bulkhead 66 includes electrical feed-through conductor 68 connected to electrical conductor 22 of loading tube 12 via electrical conductor 33 of arming device 26 in order to provide electrical continuity between the well surface and the perforating gun string. *Id.*

(4) Eitschberger

Eitschberger is directed to "devices and methods for selective arming of a detonator assembly of a perforating gun assembly." Ex. 1007 ¶ 1. Figure 4, reproduced below, depicts a cross-section view of a perforating gun assembly. *Id.* ¶ 13.

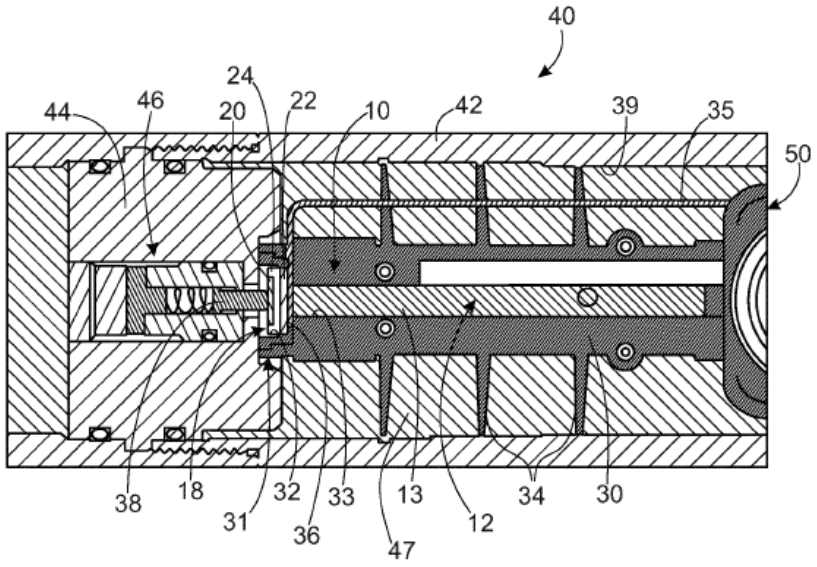


FIG. 4

Figure 4 shows perforating gun assembly 40 with detonator positioning assembly 30, which receives detonator assembly 10 and holds it in place. *Id.* ¶ 31. Detonator positioning assembly 30 also provides electrical contacting components for wirelessly connecting to detonator assembly 10 (*id.*), and further provides a grounding connection to housing 42 (*id.* ¶ 32). Tandem seal adapter 44 seals inner components from the outside environment, and also seals adjacent perforating gun assemblies from each other. *Id.* ¶ 32.

(5) Hardesty

Hardesty is directed "to pre-wir[ing] and connect[ing] plural perforating guns to pre-wired switch subs without manual wiring and connections." Ex. 1008, 1:36–38. Figure 2, reproduced below, depicts a prior art perforating gun assembly. *Id.* at 5:48–49.

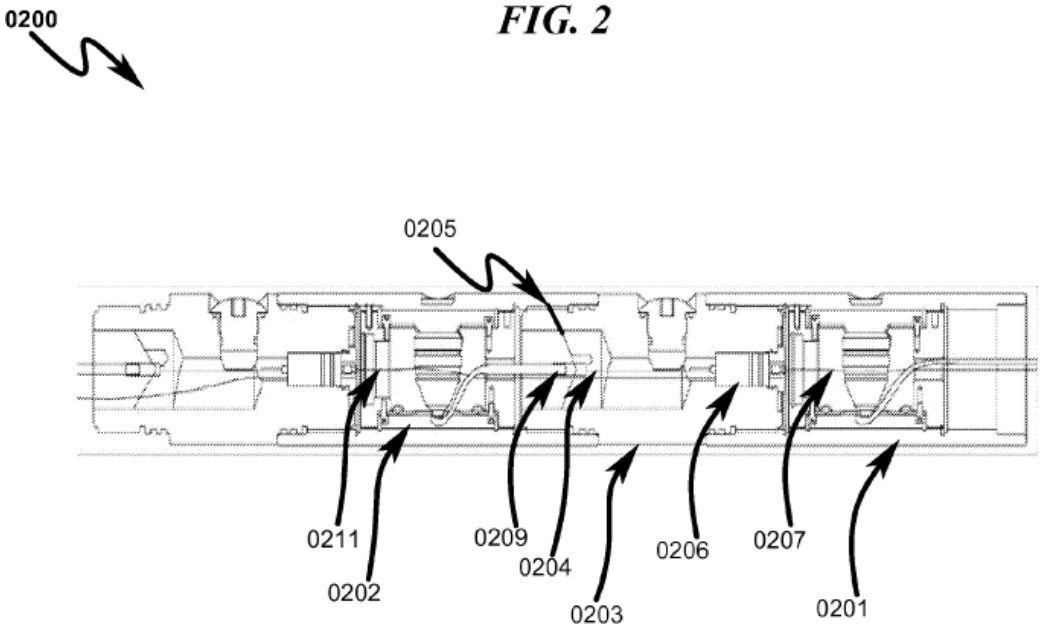


Figure 2 shows perforating gun assembly 0200 comprising perforating guns 0201 and 0202 connected by switch sub 0203. *Id.* at 2:54–56, 2:60–61. Switch sub 0203 includes switch 0206 that connects through line 0211 to input/fire line 0204 of detonator 0209. *Id.* at 2:63–65. Ground line 0205 is grounded to the body of switch sub 0203. *Id.* at 2:65–67.

b) Ground 1: Obviousness of Claims 1 and 2 over Schacherer and Perforating Innovations

(1) Analysis of Claim 1

(a) "A gun assembly for perforating wells"

Petitioner contends that Schacherer's well tool system 12, which includes interconnected explosive assemblies 20, is a gun assembly for perforating wells. Pet. 15. Petitioner supports this contention with declaration testimony and citations to Schacherer. *See id*. (citing Ex. 1002

¶¶ 23–27; Ex. 1003, 2:30–38). Patent Owner responds by repeating its claim construction argument that Petitioner misconstrued the claim limitation "gun assembly." *See* Prelim. Resp. 53–54. Patent Owner's argument is unpersuasive for the reasons discussed above. *See supra* § II.B.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches the preamble of claim 1.

(b) "at least one gun body casing, the casing being a hollow cylinder, with a box fitting at each end"

Petitioner contends that outer housing 26 of Schacherer's explosive assembly 20 is a gun body casing of the type recited in claim 1. Pet. 15–16. Petitioner further contends that the ends of outer housing 26 are box fittings because they are configured to receive the threaded ends of connectors 30*a* and 30*b*. *Id*. at 16. Petitioner supports its contention with declaration testimony and citations to Schacherer. *See id*. at 15–18 (citing Ex. 1002 ¶¶ 23–27; Ex. 1003, 2:30–38, 3:66–4:4, Figs. 1, 2, 5). Patent Owner does not presently dispute that Schacherer teaches these claim limitations. *See* Prelim. Resp. 53–60.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches a gun body casing of the type recited in claim 1.

(c) "a charge carrier, the carrier being a hollow cylinder, with exterior diameter less than the interior diameter of the casing, and a length shorter than the distance between the box fittings of the casing"

Petitioner contends that Figure 5 of Schacherer depicts structures a person of ordinary skill in the art would recognize as charge carriers comprising hollow cylinders with exterior diameters less than the interior diameter of outer housing 26 (i.e., the gun body casing) and lengths shorter than the distance between the threaded ends that receive connectors 30a and 30b (i.e., the box fittings). Pet. 18–22. Petitioner supports this contention with declaration testimony and citations to Schacherer and a publication that Schacherer incorporates by reference. *See id*. (citing Ex. 1002 ¶¶ 54–58; Ex. 1003, 3:22–26, Fig. 5). Patent Owner does not presently dispute that Schacherer teaches these claim limitations. *See* Prelim. Resp. 53–60.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches a charge carrier of the type recited in claim 1.

(d) "a plurality of shape charges positioned radially inside the charge carrier and inter connected by a detonator cord"

Petitioner contends that Schacherer's explosive components 22 and 24 are detonating cords and perforating charges, respectively, and that Schacherer teaches positioning multiple perforating (i.e., shape) charges that are connected by a detonation cord radially inside a charge carrier. Pet. 22–23. Petitioner supports this contention with declaration testimony and citations to Schacherer and a publication that is incorporated by reference into Schacherer's specification. *See id*. (citing Ex. 1002 ¶¶ 89–90, Ex. 1003,

2:35–38, 3:16–21, Fig. 1). Patent Owner does not presently dispute that Schacherer teaches these claim limitations. *See* Prelim. Resp. 53–60.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches a plurality of shape charges positioned and connected in the manner recited in claim 1.

> *(e) "a plurality of end caps affixed to the ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein"*

Petitioner contends that Figure 5 of Schacherer depicts end caps affixed to the ends of the charge carriers that function to axially align and secure the charge carriers within the casing between the box fitting ends. Pet. 24–26. In particular, Petitioner contends that rotary electrical connection 80 and the similar "lower rotary connection" (apparently a reference to rotary detonation coupling 58) are end caps. *See id*. Petitioner supports this contention with declaration testimony and citations to Schacherer. *See id*. (citing Ex. 1002 ¶¶ 104–108; Ex. 1003, 2:33–34, 5:43–47, 5:57–59, 6:6–8, Fig. 5).

Patent Owner argues that the components that Petitioner identifies as end caps are actually part of intermediate subs, and thus, cannot be considered part of the claimed "gun assembly." *See* Prelim. Resp. 56–57. This argument is not persuasive because it is based on a claim construction argument that we reject. *See supra* § II.B. Patent Owner does not otherwise dispute that Schacherer teaches the above claim limitations. *See* Prelim. Resp. 53–60.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches a plurality of end caps of the type recited in claim 1.

> *(f) "at least one end cap being of a durable material, electrically conductive and electrically connects the charge carrier of the gun body"*

Petitioner contends that Schacherer teaches that the disclosed end caps may be constructed of durable and conductive materials such as steel, creating an electrical connection between the charge carrier and outer housing 26 of the gun body. Pet. 26–30. Petitioner points to an embodiment in Schacherer in which outer housing 26 and connectors 28 and 30 are made of a conductive material, and the charge carrier is grounded by way of an electrical connection between these conductive components. Pet. 26–28; Ex. 1002 ¶¶ 138–140; Ex. 1003, 6:18–22. Petitioner contends that in such an embodiment, the connection between the charge carrier and outer housing 26 would necessarily be accomplished "through the body of the end cap—i.e., 'electrical connector 84.'" Pet. 27; Ex. 1002 ¶ 139. Petitioner alternatively contends that Performing Innovations teaches a durable and conductive end cap of the type recited in claim 1, and that incorporating such an end cap into Schacherer's device would have been a simple and predictable substitution. Pet. 28–30.

Regarding Schacherer, we observe that electrical connector 84 is a component of rotary electrical connector 80 (i.e., the end cap). *See* Ex. 1003, 5:57–63. Electrical connector 84 appears to be in direct contact with outer housing 26. *See* Ex. 1003, Fig. 5. It is not immediately apparent why the entirety of rotary electrical connector 80 (the end cap), rather than just

electrical connector 84, would need to be made of conductive material in order to establish a connection between the charge carrier and outer housing 26. The parties may wish to address this issue in further briefing.

At this stage of the proceeding, however, Patent Owner has not directly disputed Petitioner's contention that Schacherer teaches, or at least suggests, that rotary electrical connector 80 could be made of a durable and conductive material. *See* Prelim. Resp. 53–60. Patent Owner also has not yet provided any testimonial evidence to rebut the opinions of Petitioner's declarant. On this record and at this stage of the proceeding, Petitioner has made a sufficient showing that Schacherer teaches, or at least suggests, constructing rotary electrical connector 80 of a durable and conductive material.

Patent Owner argues that Schacherer does not teach an electrical connection between the end cap and the charge carrier of the gun body. *See* Prelim. Resp. 55–56. This argument is unpersuasive because it is not adequately developed or explained, and because it is based on a comparison between Schacherer and a preferred embodiment rather than a comparison between Schacherer and claim 1. *See id*.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches, or at least suggests, an end cap that electrically connects the charge carrier of the gun body.

Regarding Performing Innovations, Patent Owner argues that the component Petitioner identifies as an end cap "does not cap anything." Prelim. Resp. 57. But claim 1 merely requires that the recited end caps be "affixed to the ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein." Patent Owner

does not directly dispute that the components identified by Petitioner satisfy these limitations in the Performing Innovations system, or that they would do so if incorporated into Schacherer's system in the manner proposed by Petitioner. *See id*. Accordingly, this argument is unpersuasive.

Patent Owner also argues that the end caps of Schacherer and Performing Innovations cannot be swapped "because they are not the same part." Prelim. Resp. 58. This argument is unpersuasive because "it is not necessary that the inventions of the references be physically combinable to render obvious the invention under review." *In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983).

Petitioner has made a sufficient showing on this record that Performing Innovations teaches an end cap made of a durable and electrically conductive material, and that one of ordinary skill in the art would have had reason to incorporate such an end cap into Schacherer's device.

(g) "an addressable detonation switch electrically connected between an inner side of at least one end cap and the plurality of shape charges within the charge carrier"

Petitioner contends that Schacherer's selective firing module 32 is an addressable detonation switch that is connected to Schacherer's explosive components (which include shape charges). Pet. 30–32 (citing Ex. 1003, 2:57–64, 4:58–61); Ex. 1002 ¶¶ 164–165. Petitioner concedes that selective firing module 32 is not connected between an inner side of the end cap and the plurality of shape charges. *See* Pet. 33. But Petitioner contends that Perforating Innovations teaches an addressable detonation switch located in the manner recited in claim 1, and that the teachings of Perforating

Innovations would have motivated an ordinarily skilled artisan to move Schacherer's selective firing module to the inner side of Schacherer's end cap. Pet. 34–35 (citing Ex. 1002 ¶¶ 166–170). Petitioner contends that this modification would have been a simple design choice that could have been easily accomplished and would have yielded predictable results. Pet. 35.

Patent Owner repeats its argument that Perforating Innovations is cumulative of prior art that was before the Examiner, but does not offer any persuasive responses to the substance of Petitioner's contentions. *See id*. at 58–59.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches an addressable detonation switch electrically connected to a plurality of shape charges within a charge carrier, and that one of ordinary skill would have been motivated by the teachings of Perforating Innovations to move Schacherer's addressable detonation switch to the inner side of the adjacent end cap.

(2) Analysis of Claim 2

Petitioner asserts that Figure 5 of Schacherer illustrates an unnumbered guide pin of the type recited in claim 2. Pet. 34–35 (citing Ex. 1002 ¶¶ 186–190; 1003, Fig. 5). Patent Owner does not presently dispute that Schacherer teaches the additional limitations recited in claim 2. *See* Prelim. Resp. 53–60.

Petitioner has made a sufficient showing at this stage of the proceeding that Schacherer teaches all limitations recited in claim 2.

(3) Conclusion

For the foregoing reasons, and based on the totality of the evidence before us at this stage of the proceeding, Petitioner has demonstrated a reasonable likelihood of prevailing in demonstrating that claims 1 and 2 would have been unpatentable pursuant to 35 U.S.C. § 103 in view of Schacherer and Perforating Innovations. We, therefore, will institute an *inter partes* review as to all grounds and all challenged claims. *See* 35 U.S.C. § 314(a); Consolidated Trial Practice Guide, 64.

In order to provide additional guidance to the parties, we now address the parties' disputes regarding the remaining grounds.

c) Ground 2: Obviousness of Claims 1 and 2 over Schacherer and Black

Petitioner identifies portions of Schacherer and Black that allegedly teach or suggest each limitation of claims 1 and 2 (*see* Pet. 37–40), and these contentions are supported by declaration testimony (*see* Ex. 1002 ¶¶ 23–27, 54–58, 89–90, 104–108, 138–140, 171–173, 186–190). Petitioner also identifies a rationale for why one of ordinary skill in the art would have combined the teachings of Schacherer and Black to arrive at the claimed subject matter. *See* Pet. 39–40 (citing Ex. 1002 ¶¶ 166–170).

Patent Owner asserts that its arguments regarding Schacherer from Ground 1 all apply equally to Ground 2. Prelim. Resp. 60–61. These arguments are unpersuasive for the reasons discussed above. *See supra* § II.C.4.b.

Patent Owner also argues that the "so-called" end cap of Black "does not cap anything." Prelim. Resp. 61. This argument is not persuasive because claim 1 merely requires that the recited end caps be "affixed to the

ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein."

Patent Owner additionally argues that Schacherer and Black cannot be combined in a way that would yield the invention of claim 1. Prelim. Resp. 62. This argument is unpersuasive because it is not adequately developed, and because references need not be physically combinable in order to render an invention obvious. *See id.*; *In re Sneed*, 710 F.2d at 1550.

d) Ground 3: Obviousness of Claims 1 and 2 over Schacherer

Petitioner identifies portions of Schacherer that allegedly teach or suggest all limitations of claim 1 and 2 except for the requirement for an addressable detonation switch "electrically connected between an inner side of at least one end cap and the plurality of shape charges within the charge carrier." *See* Pet. 37–40. These contentions are supported by declaration testimony. *See* Ex. 1002 ¶¶ 23–27, 54–58, 89–90, 104–108, 138–140, 186–190. Petitioner also contends that a person of ordinary skill would have had reason to place Schacherer's addressable detonation switch between the inner side of an end cap because this would have been a simple design choice that solved a problem with a finite number of solutions. Pet. 46–47 (citing Ex. 1002 ¶¶ 166–170).

Patent Owner asserts that its arguments regarding Schacherer from Ground 1 all apply equally to Ground 3. Prelim. Resp. 63–64. These arguments are unpersuasive for the reasons discussed above. *See supra* § II.C.4.b.

Patent Owner also argues that Patent Owner improperly identifies components as end caps that "do not cap anything" and that are part of tandem subs. Prelim. Resp. 64–65. These arguments are not persuasive

because they are based on a claim construction argument that we reject (*see supra* § II.B), and because claim 1 merely requires that the recited end caps be "affixed to the ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein."

Patent Owner additionally argues that Schacherer cannot be combined with the knowledge of one of ordinary skill in the art in a way that would yield the invention of claim 1. Prelim. Resp. 65–66. This argument is unpersuasive because it is not adequately developed, and because references need not be physically combinable in order to render an invention obvious. *See id*.; *In re Sneed*, 710 F.2d at 1550.

e) Ground 4: Obviousness of Claims 1 and 2 over Eitschberger and Hardesty

Petitioner identifies portions of Eitschberger and Hardesty that allegedly teach or suggest each limitation of claims 1 and 2 (*see* Pet. 47–71), and these contentions are supported by declaration testimony (*see* Ex. 1002 ¶¶ 28–30, 40–41, 73–75, 96–98, 121–128, 148–154, 177–182, 191–195). Petitioner also identifies a rationale for why one of ordinary skill in the art would have combined the teachings of Eitschberger and Hardesty to arrive at the claimed subject matter. Pet. 52, 56 (citing Ex. 1002 ¶¶ 42–45, 76–84).

Patent Owner argues that Patent Owner improperly identifies components as end caps that "do not cap anything" and that are part of tandem subs. Prelim. Resp. 67–68. These arguments are not persuasive because they are based on a claim construction argument that we rejected (*see supra* § II.B), and because claim 1 merely requires that the recited end caps be "affixed to the ends of the carrier and axially aligning the carrier within the casing between the box fitting ends, and secured therein."

Patent Owner also argues that Eitschberger does not teach an electrical connection between the end cap and the charge carrier of the gun body. *See* Prelim. Resp. 68–69. This argument unpersuasive because it is not adequately developed or explained, and because it is based on a comparison between Schacherer and a preferred embodiment rather than a comparison between Schacherer and claim 1. *See id*.

Patent Owner additionally argues that Eitschberger cannot be combined with Hardesty in a way that would yield the invention of claim 1. Prelim. Resp. 70. This argument is unpersuasive because it is not adequately developed, and because references need not be physically combinable in order to render an invention obvious. *See id*.; *In re Sneed*, 710 F.2d at 1550.

f) Ground 5: Obviousness of Claims 1 and 2 over Eitschberger

Petitioner identifies portions of Eitschberger that allegedly teach of suggest each limitation of claims 1 and 2, except for the limitations reciting a gun body casing "with a box fitting at each end," and a charge carrier "being a hollow cylinder, with exterior diameter less than the interior diameter of the casing, and a length shorter than the distance between the box fittings of the casing." *See* Pet. 75–82. Petitioner's contentions are supported by declaration testimony. *See* Ex. 1002 ¶¶ 40–41, 73–75, 96–98, 121–128, 148–154, 177–182, 191–195. Petitioner also contends that a person of ordinary skill would have had reason to employ a box fitting on each end of Eitschberger's gun body, and a cylindrical charge carrier with the claimed dimensions inside of Eitschberger's gun body. *See* Pet. 75–82. Petitioner contends that these were common aspects of perforating guns known to persons of ordinary skill in the art, and employing them would

have merely required making simple substitutions of one known element for another in a situation where there were a finite number or predictable solutions. Pet. 75–82 (citing Ex. 1002 ¶¶ 46–49, 81–85).

Patent Owner asserts that its arguments regarding Schacherer from Ground 4 all apply equally to Ground 5. Prelim. Resp. 71–72. These arguments are unpersuasive for the reasons discussed above. *See supra* § II.C.4.e.

Patent Owner also argues that Eitschberger cannot be combined with the knowledge of one of ordinary skill in the art in a way that would yield the invention of claim 1. Prelim. Resp. 72–73. This argument is unpersuasive because it is not adequately developed, and because references need not be physically combinable in order to render an invention obvious. *See id*.; *In re Sneed*, 710 F.2d at 1550.

g) Ground 6: Obviousness of Claims 1 and 2 over Perforating Innovations and Hardesty

Petitioner identifies portions of Perforating Innovations and Hardesty that allegedly teach or suggest each limitation of claims 1 and 2 (*see* Pet. 86–103), and these contentions are supported by declaration testimony (*see* Ex. 1002 ¶¶ 34–35, 66–67, 94–95, 109–118, 142–147, 191). Petitioner also identifies a rationale for why one of ordinary skill in the art would have combined the teachings of Perforating Innovations and Hardesty to arrive at the claimed subject matter. Pet. 88–90, 93–94, 98–99, 103 (citing Ex. 1002 ¶¶ 36–39, 68–72, 119–120, 197–198).

Patent Owner argues that Perforating Innovations and Hardesty cannot be combined in a way that would yield the invention of claim 1. Prelim. Resp. 74–75. This argument is unpersuasive because it is not adequately

developed, and because references need not be physically combinable in order to render an invention obvious. *See id*.; *In re Sneed*, 710 F.2d at 1550.

D. Conclusion

For the reasons discussed above, Petitioner has shown a reasonable likelihood it will succeed in demonstrating that claims 1 and 2 are unpatentable under 35 U.S.C. § 103. We, therefore, institute an *inter partes* review as to all claims and grounds set forth in the Petition. *See* 35 U.S.C. § 314(a); Consolidated Trial Practice Guide, 64.

III. ORDER

In consideration of the foregoing, it is hereby:

ORDERED, pursuant to 35 U.S.C. § 314(a), that an *inter partes* review of claims 1 and 2 of U.S. Patent No. 10,352,136 B2 is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), that this *inter partes* review shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

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