

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DYNAENERGETICS EUROPE GMBH and
DYNAENERGETICS US, INC.,
Petitioner,

v.

SWM INTERNATIONAL, LLC,
Patent Owner.

IPR2022-01372
Patent 11,078,762 B2

Before MITCHELL G. WEATHERLY, ELIZABETH M. ROESEL, and
RICHARD H. MARSCHALL, *Administrative Patent Judges*.

ROESEL, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. *Background and Summary*

DynaEnergetics Europe GmbH and DynaEnergetics US, Inc. (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) seeking an *inter partes* review of claims 1–4, 7, 9, 10, 15–20, 24–26, 29, 30, and 33–36 of U.S. Patent No. 11,078,762 B2 (Ex. 1001, “the ’762 Patent”). SWM International, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With the Preliminary Response, Patent Owner filed a statutory disclaimer of claims 1, 2, 9, 10, 15, 17–20, and 33 of the ’762 Patent. Prelim. Resp. 1; Ex. 2003. Petitioner filed a declaration of John Rodgers, Ph.D. (Ex. 1003), and Patent Owner filed a declaration of Gary R. Wooley, Ph.D. (Ex. 2002).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2022). 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).

Our decision whether to institute an *inter partes* review is based on claims 3, 4, 7, 16, 24–26, 29, 30, and 34–36, which are the challenged claims remaining in the ’762 Patent after Patent Owner’s statutory disclaimer. 37 C.F.R. § 42.107(e); Consolidated Trial Practice Guide November 2019 (“CTPG”)¹ at 52. After considering the information presented in the Petition and the Preliminary Response, we determine that Petitioner has shown a reasonable likelihood that it would prevail in showing

¹ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

that at least one of these claims is unpatentable. Therefore, we grant institution of an *inter partes* review.

Our findings and conclusions below are based on the record developed thus far. This is not a final decision as to the patentability of any challenged claim. Any final decision will be based on the full record developed during trial.

B. Related Matters

The parties identify the following district court case as a related matter: *SWM International, LLC v. DynaEnergetics Europe*, 6:21-cv-00804-ADA (W.D. Tex.). Pet. 1; Paper 5, 1 (Patent Owner's mandatory notices).

C. The '762 Patent (Ex. 1001)

The '762 Patent was issued August 3, 2021 on an application filed March 5, 2019, which is the effective filing date.

The '762 Patent discloses a downhole perforating gun tube for use in oil and gas production. Ex. 1001, codes (54) (57), 1:11–31.

Figure 1 is reproduced below.

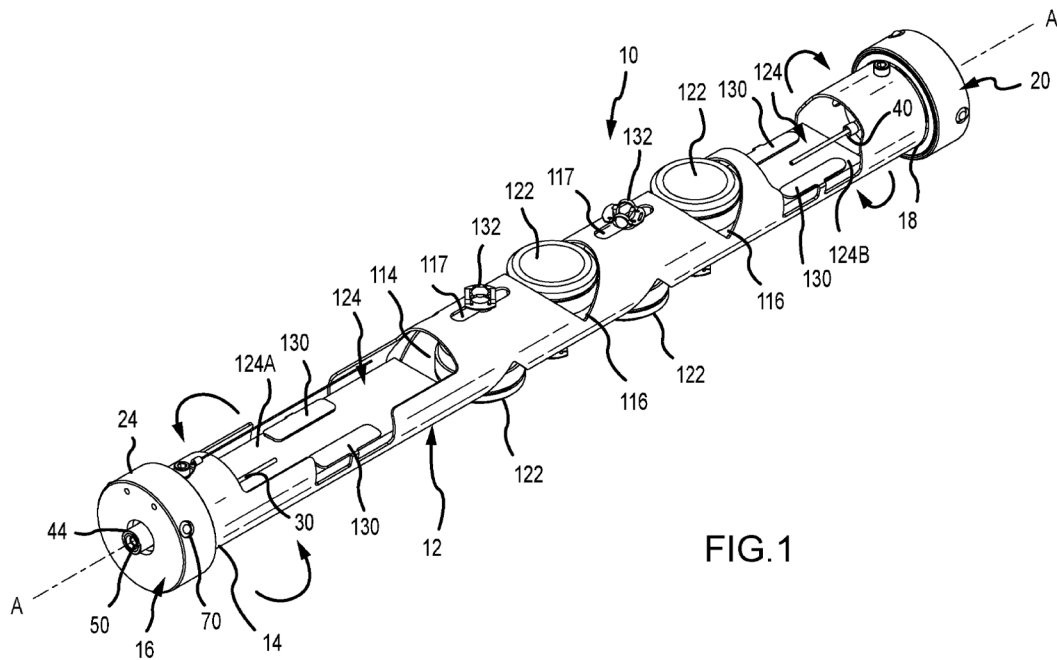
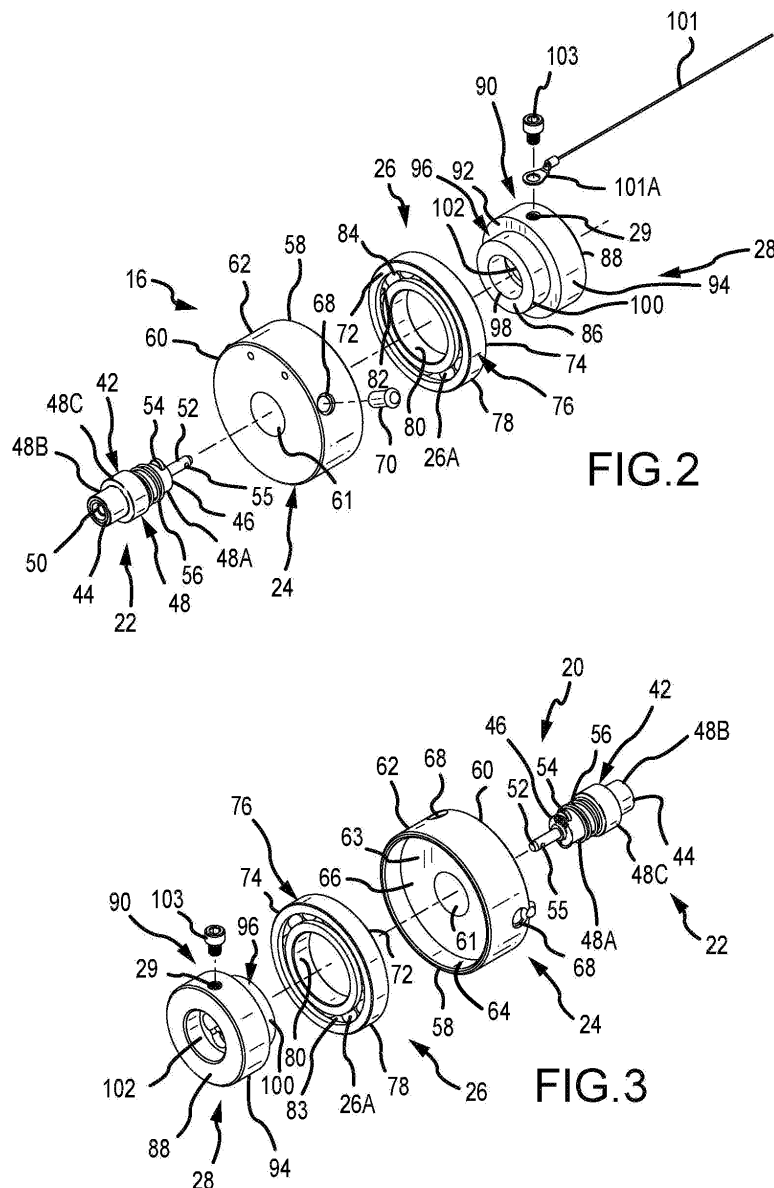


FIG.1

Figure 1 of the '762 Patent shows perforating gun tube 10, including tube body 12, first end fitting or cap 16, second end fitting or cap 20, electrical contact 50, shaped or explosive charges 122, and weights 124A and 124B. Ex. 1001, 2:66–67, 5:50–6:3.

Figures 2 and 3 are reproduced below.



Figures 2 and 3 of the '762 Patent are exploded views of the first and second end caps of the gun tube. Ex. 1001, 3:1–4. Each end cap includes end contact 22, outer collar 24, bearing assembly 26, support 28, and electrical contact 50. *Id.* at 6:56–7:1. Outer collar 24 is positioned over end contact 22, bearing assembly 26, and support 28, so that electrical contact 50 extends through an opening 61 of outer collar 24. *Id.* at 8:50–53, Fig. 2.

The '762 Patent discloses that weights 124 “cause gun tube 10 to rotate relative to bearing assemblies 26 so the portion of gun tube 10 that retains one or more weights 124 is at the bottom of the wellbore (i.e., closest to the Earth’s center) when gun tube 10 is positioned horizontally in a wellbore.” Ex. 1001, 6:5–10. Rotation of the gun tube, coupled with the location and angle of the weights in the gun tube, allows the shape charges to be oriented in a desired direction prior to the shape charges being fired. *Id.* at code (57), 6:37–52.

D. Illustrative Claim

Claims 3, 4, 7, 16, 24–26, 29, 30, 34–36 are the challenged claims that remain in the '762 Patent after Patent Owner’s statutory disclaimer. Claims 24 and 29 are independent, and claim 24 is illustrative of the claimed subject matter.

24. A downhole perforating gun system, comprising: an outer casing having a longitudinal center axis;

a gun body having a longitudinal center axis, wherein the gun body is concentrically disposed in the outer casing such that the longitudinal center axis of the gun body is aligned with the longitudinal center axis of the outer casing;

one or more explosive charges coupled to the gun body;

a collar;

a support member;

a bearing assembly at least partially disposed between the collar and the support member such that the gun body is rotatable relative to the outer casing; and

one or more weights, wherein the gun body is rotatable by the weights via the bearing assembly based on gravity acting on the one or more weights.

Ex. 1001, 27:55–28:3.

E. Asserted Challenges to Patentability

Petitioner asserts the following challenges to patentability:

Claims Challenged ²	35 U.S.C. §	Reference(s)/Basis
3, 7, 24–26, 29, 30, 34–36	102(a)(1)	Yonghong ³
4, 16	103	Yonghong, Schacherer, ⁴ Eitschberger ⁵
3, 7, 24–26, 29, 30, 34–36	102(a)(1)	Hardesty ⁶
4, 16	103	Hardesty, Schacherer, Eitschberger
3, 7, 24–26, 29, 30, 34–36	103	Hardesty, Yonghong

Pet. 4.

II. ANALYSIS

A. Legal Standards

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how the challenged

² Here and throughout the Decision, we list only the challenged claims remaining in the ’762 Patent after Patent Owner’s statutory disclaimer.

³ Ex. 1004, CN2698970Y, granted May 11, 2005, with English Translation (“Yonghong”).

⁴ Ex. 1006, US 9,689,223 B2, issued June 27, 2017 (“Schacherer”).

⁵ Ex. 1007, US 9,784,549 B2, issued October 10, 2017 (“Eitschberger”).

⁶ Ex. 1005, US 9,115,572 B1, issued August 25, 2015 (“Hardesty”).

claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied upon).

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter 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. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved based on 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 ordinary skill in the art; and (4) when presented, objective evidence of nonobviousness, i.e., secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

Additionally, the obviousness inquiry typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)). Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements,” but “must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

B. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art (“POSITA”) would have had “a Bachelor of Science in mechanical or electrical engineering and 2–5 years of experience designing perforating gun systems.” Pet. 25. According to Petitioner, “the individual should be familiar with prior art methods of using gravity to orient the shaped charges in a rotatable charge tube.” *Id.* Petitioner further contends that “[p]ersons with different degrees may also have ordinary skill in the art, and increased education or experience could compensate for shortcomings in other areas.” *Id.* (citing Ex. 1003 ¶ 51).

For purposes of the preliminary response, Patent Owner does not dispute Petitioner’s definition of a POSA. Prelim. Resp. 7–8.

For purposes of this Decision, we apply Petitioner’s articulation of the level of ordinary skill in the art, which is consistent with the level of skill in the art at the time of the invention as reflected in the asserted prior art.

C. Claim Construction

In an *inter partes* review, we apply the same claim construction standard as would be used by a district court to construe a claim in a civil action involving the validity or infringement of a patent. 37 C.F.R. § 42.100(b). Under that standard, claim terms are given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history of record. *Id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–19 (Fed. Cir. 2005) (en banc); *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365–66 (Fed. Cir. 2012). “The Board is required to construe ‘only those terms . . . that are in

controversy, and only to the extent necessary to resolve the controversy.”
Realtime Data, LLC v. Iancu, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (quoting
Vivid Techs., Inc. v. Am. Sci. Eng’g, Inc., 200 F.3d 795, 803 (Fed. Cir.
1999))).

In the related litigation, the district court ruled that the term “collar” has its “[p]lain and ordinary meaning” and “does not inherently require or restrict rotation.” Ex. 1008.⁷ Petitioner states that it does not contest this construction. Patent Owner asserts that, in the related litigation, the parties and their respective experts agreed that “a collar is an annular or ring-shaped structure.” Prelim. Resp. 8 (citing Ex. 1009, 2–3; Ex. 2001 ¶¶ 38–42).

After reviewing the cited evidence and the ’762 Patent’s description of “outer collar 24” as having “annular side wall 62” (Ex. 1001, 7:59–63, Fig. 3), we agree with Patent Owner’s proposed construction for the term “collar” and apply it for purposes of this Decision.

Next, Patent Owner argues that “the claimed ‘gun body,’ ‘collar,’ ‘support member,’ and ‘one or more weights’ are required to be separate from each other and also from the other elements of the remaining claims.” Prelim. Resp. 8 (citing Ex. 2001 ¶ 43). As evidentiary support for this argument, Patent Owner relies on the language of the claims, descriptions in the Specification, the district court’s construction for the term “collar,” and Dr. Wooley’s testimony. *Id.* at 8–12 (citing Ex. 1001, 1:49–54, 1:65–2:6, 8:9–36, 8:63–66, Figs. 4, 13A–13J; Ex. 1008; Ex. 2001 ¶¶ 38–50).

⁷ The district court also ruled that the term “predefined orientation” has its “[p]lain and ordinary meaning” and is “[n]ot indefinite. Ex. 1008. In the meantime, however, Patent Owner disclaimed claim 20, the only claim in which this term appears.

Patent Owner is correct that, “[w]here a claim lists elements separately, the clear implication of the claim language is that those elements are distinct components of the patented invention.” *Becton, Dickinson & Co. v. Tyco Healthcare Group, LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010). The Court held that “[b]ecause the unequivocal language of the asserted claims . . . requires both a hinged arm and a spring means, there can be no literal infringement by [the] accused products which . . . do not contain a spring means that is a separate structural element from the hinged arm and its hinges.” *Id.* at 1255–56.

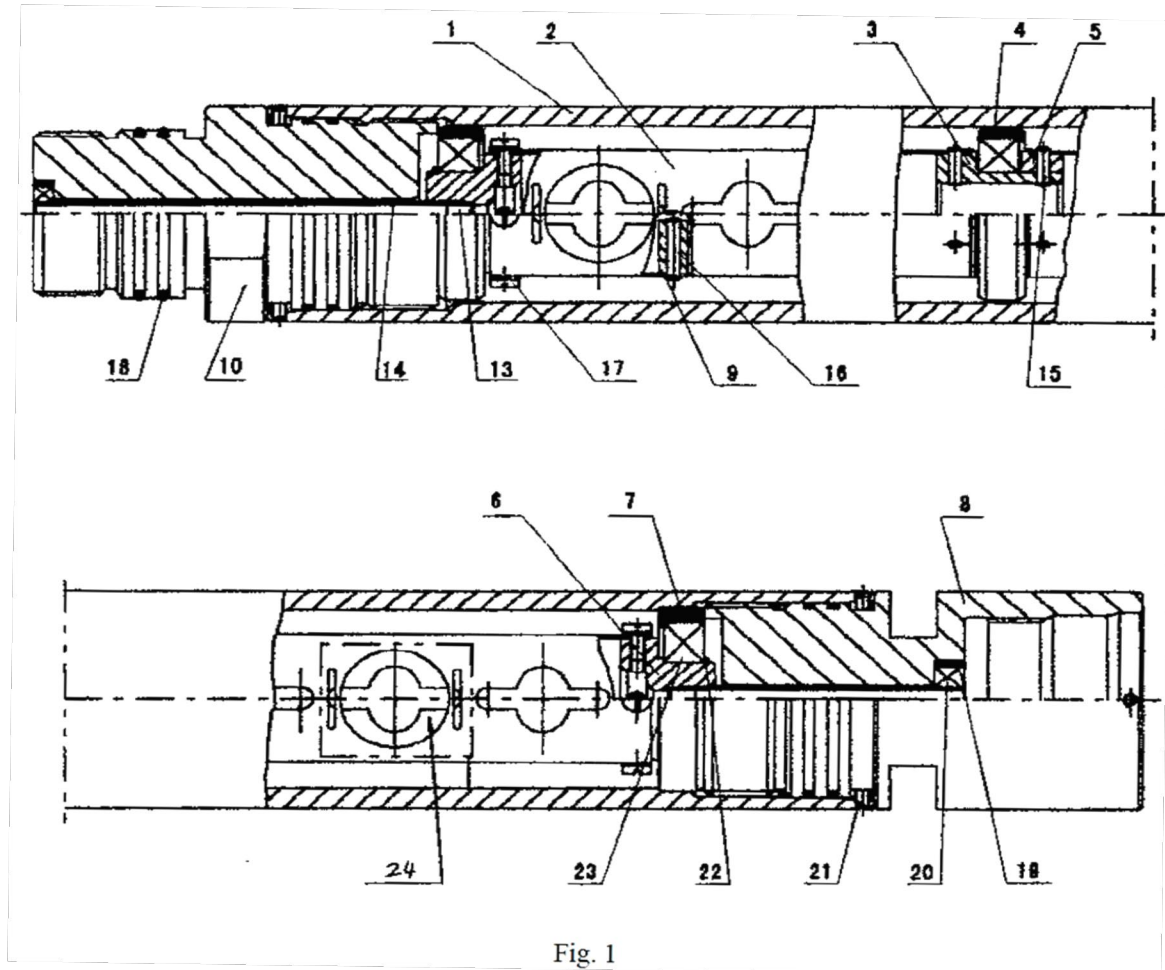
After considering Patent Owner’s claim construction argument, we determine that it is best addressed in the context of considering whether the asserted prior art anticipates the challenged claims.

D. Alleged Anticipation by Yonghong

Petitioner challenges claims 3, 7, 24–26, 29, 30, and 34–36 as anticipated by Yonghong. Pet. 26–47. Patent Owner opposes. Prelim. Resp. 16–20. We provide an overview of Yonghong before turning to our analysis, which focuses on the disputed issue.

1. *Yonghong (Ex. 1004)*

Yonghong is a utility model titled “Perforating Gun for Horizontal Well.” Ex. 1004, code (54). Figure 1 is reproduced below.



Yonghong Figure 1 shows a gun body of a perforating gun, including gun tube 1, upper connector 8, and lower connector 10. Ex. 1004, 6–8.⁸ With reference to Figure 1, Yonghong discloses:

The charge tube assembly has an internal directional rotation structure which uses an eccentric weight principle to determine the perforation direction of the charge tube assembly; the three charge tubes sections (2) are connected by means of a

⁸ We refer to the page numbers added by Petitioner in the bottom right corner of each page of Exhibit 1004.

shaft (3), a sleeve (5), and a self-plugging rivet (15); a charge tube shaft (6) is connected to the charge tube (2) by means of a screw (17); a counterweight (9) is mounted at the bottom of the charge tube (2) by means of a self-plugging rivet (16); a bearing (23), a bushing (4), a bearing seat (7), and a retaining ring (22) are respectively mounted at the connection of the shaft (3) and the sleeve (5) and at the charge tube shafts (6) at both ends.

The safe detonation propagation mechanism has a structure enabling the detonating cord to rotate together with the charge tube assembly; after the detonating cord penetrates through the inner holes of the charge tube shafts (6) at the two ends of the charge tubes (2), first, a backstop tube (13) is used to close the hole, and then one end of the detonating cord protection tube (14) is connected to the charge tube shaft (6), and the other end penetrates through the small bearings (20) and a retaining ring (19) mounted in an upper and lower connector (8, 10), after which it is intermediately abutted with one end of the detonating cord protection tube (14) at the other end.

Id. at 6 (excerpt from “summary” section of Yonghong); *see also id.* at 8–9 (essentially the same text in “detailed description of the embodiments”).

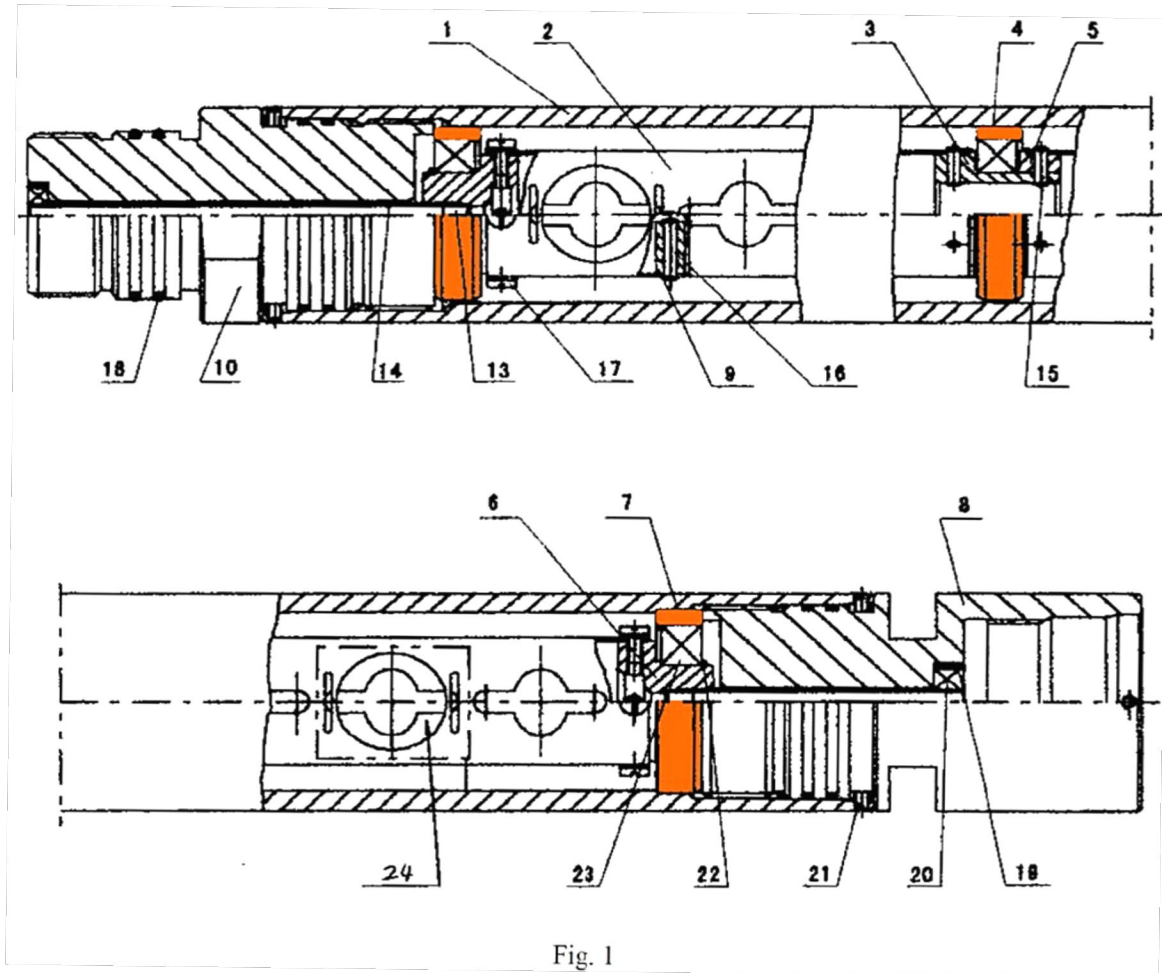
Yonghong discloses that, with this design, “the charge tube assembly in each perforating gun can rotate continuously to adjust with the change of well bore trajectory” and “the detonating cord can rotate together with the charge tube assembly,” which “produces more reliable detonation propagation and better alignment.” *Id.* at 9.

2. *Whether Yonghong discloses a collar*

Challenged claims 3, 24, and 29 each recites a collar. Claim 24, for example, recites “a collar; a support member; a bearing assembly at least partially disposed between the collar and the support member such that the gun body is rotatable relative to the outer casing.”

Petitioner maps the recited “collar” to Yonghong’s “bushing (4)” and directs us to Yonghong’s disclosure that “bushing (4)” is “mounted . . . at the

charge tube shafts (6) at both ends.” Pet. 30 (citing Ex. 1004, 6, 8, Fig. 1, claim 5; Ex. 1003 ¶¶ 62, 63). Petitioner illustrates its contention with the following annotated version of Yonghong Figure 1, with the alleged “collar” colored orange:



Pet. 31. Yonghong Figure 1 shows a gun body of a perforating gun.

Patent Owner argues that “Yonghong contains no explicit disclosure of any component that could constitute a collar within the meaning of the ’762 Patent.” Prelim. Resp. 16 (citing Ex. 2001 ¶ 55). Patent Owner argues that Petitioner’s colorization of Yonghong Figure 1 is misleading, that Yonghong’s bushing 4 is not annular, and that “Yonghong’s depiction of the bushing is ambiguous at best.” *Id.* at 16–20.

After considering the parties' arguments and evidence, we determine that, for purposes of institution, Petitioner makes a sufficient showing for the "collar" element of the claims. Petitioner identifies Yonghong's bushing 4 as the recited "collar." Based on the current record, we understand Yonghong as disclosing a charge tube assembly having a total of four bushings 4: two "at the connection of the shaft (3) and the sleeve (5)" between the charge tubes sections (of which there are three) and two more "at the charge tube shafts (6) at both ends." Ex. 1004, 6, 8. Three of these bushings are shown in Yonghong Figure 1, even though only one of them is labeled with a reference numeral. The same is true for bearing seat 7. Furthermore, Yonghong Figure 1 appears to show annular structures, including bushing 4, with one quarter of the annular structure cut away to show a longitudinal cross section on the upper half of each of the upper and lower parts of the drawing. Accordingly, on this record, we do not find that Petitioner's colorization of Yonghong Figure 1 is misleading. Although the figure does not clearly delineate between bushing 4 and bearing seat 7, Patent Owner does not rely on this lack of clarity in the drawing, nor do we view it as a reason to deny institution.

3. Remaining Elements of Challenged Claims

At this stage of the proceeding, Patent Owner does not contest Petitioner's showing for the remaining limitations of claims 3, 7, 24–26, 29, 30, and 34–36. We determine that, for purposes of institution, Petitioner shows sufficiently that at least claim 24 is anticipated by Yonghong.

E. Alleged Anticipation by Hardesty

Petitioner challenges claims 3, 7, 24–26, 29, 30, and 34–36 as anticipated by Hardesty. Pet. 60–80. Patent Owner opposes. Prelim.

Resp. 20–24. We provide an overview of Hardesty before turning to our analysis, which focuses on the disputed issue.

1. *Hardesty (Ex. 1005)*

Hardesty discloses a system and method for orienting a perforating gun in a wellbore. Ex. 1005, 1:37–41. The system includes a gun string assembly (“GSA”) with an external protuberance member (“EPM”) and an internal pivot support (“IPS”). *Id.* at code (57), 4:27–30. The EPM orients the GSA within a coarse angular range, and the IPS corrects the orientation within a fine angular range. *Id.* at 4:44–56. According to Hardesty, “[t]he external orientation of the EPM along with limited internal swing about the IPS provide for an accurate orientation of the charges for perforating through a hydrocarbon formation.” *Id.* at 4:37–40.

Figure 4 is reproduced below.

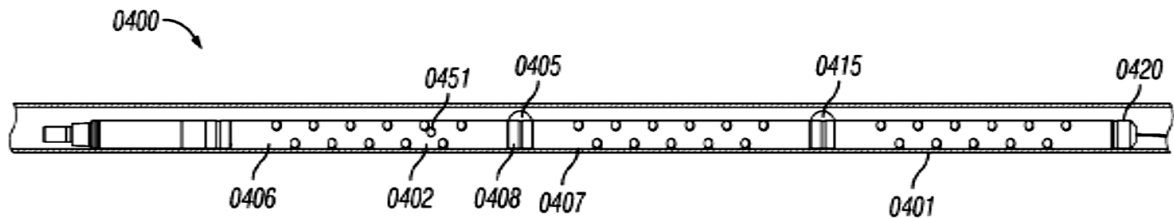


FIG. 4

Hardesty Figure 4 shows GSA 20 deployed inside wellbore casing 1.⁹ Ex. 1005, 6:39–48. GSA 20 includes a string of perforating guns 6 connected by finned subs 8, to which EPM 5 is attached. *Id.* at 6:50–61. According to Hardesty, EPM 5 externally orients GSA 20 in the well casing such that the charges inside a charge holder tube (“CHT”) “are coarsely

⁹ For simplicity, we omit the first two or three digits of Hardesty’s reference numerals, for example, “20” instead of “0420” and “1” instead of “0401.”

aligned within ± 20 degrees (coarse angular range) of the desired perforating orientation.” *Id.* at 6:57–7:2.

Figure 7 is reproduced below.

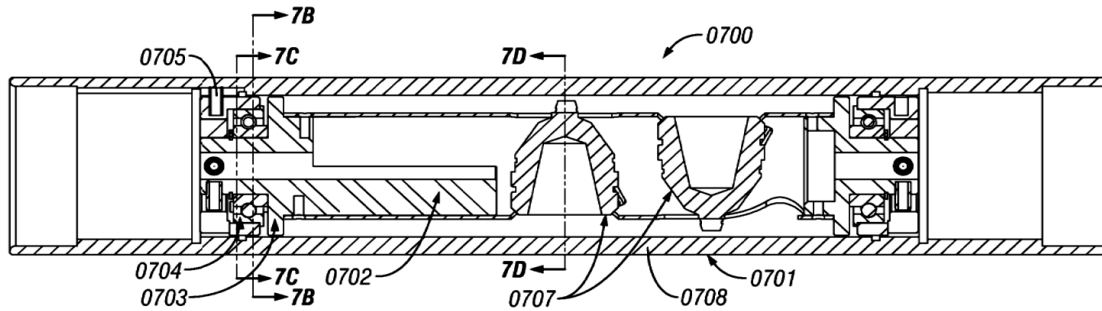
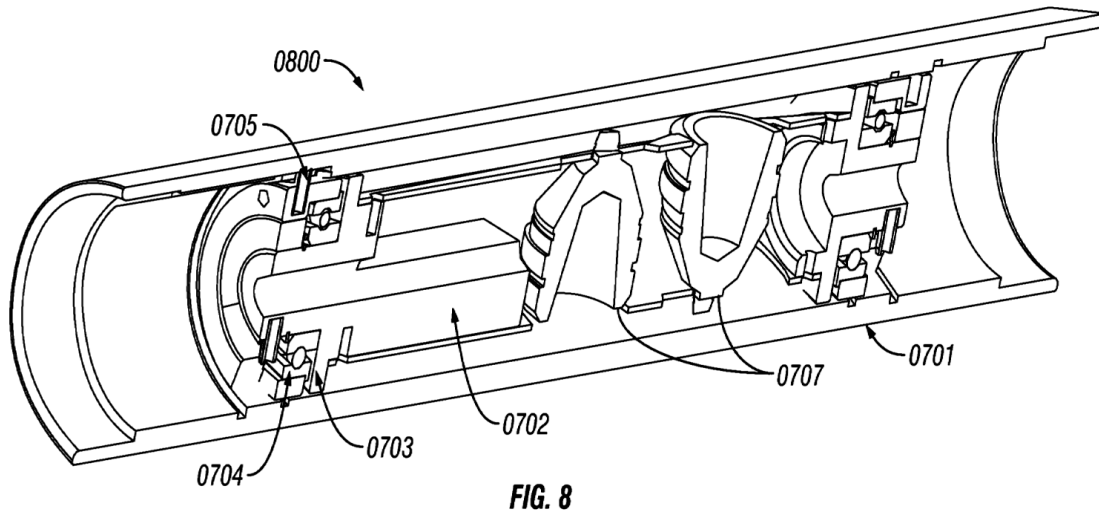


FIG. 7

Hardesty Figure 7 shows perforating gun 1 comprising CHT 3, which carries energetic charges 7, 8 and is coupled to the gun via bearing race system 4 and aligned to the gun barrel with alignment pin 5. Ex. 1005, 8:54–63.

According to Hardesty, a pin in bearing race system 4 limits the rotation of CHT 3 within a limited arc and orients energetic charges 7, 8 within a fine angular range, for example, within ± 5 degrees. *Id.* at 8:63–9:5, 9:9–12, Fig. 7C (cross-section showing restriction pin 31). Eccentric weight 2 “may also be used to orient the energetic charges in a preferred perforating direction.” *Id.* at 9:12–14.

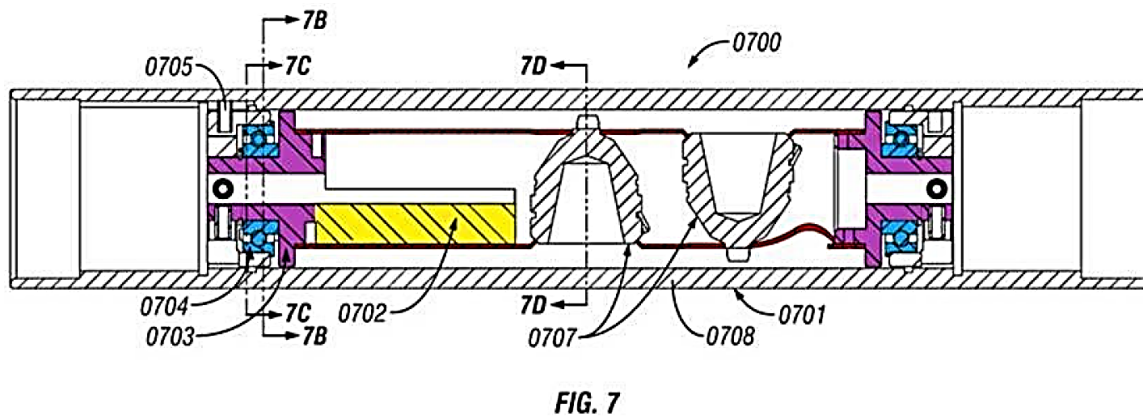
Figure 8 is reproduced below.

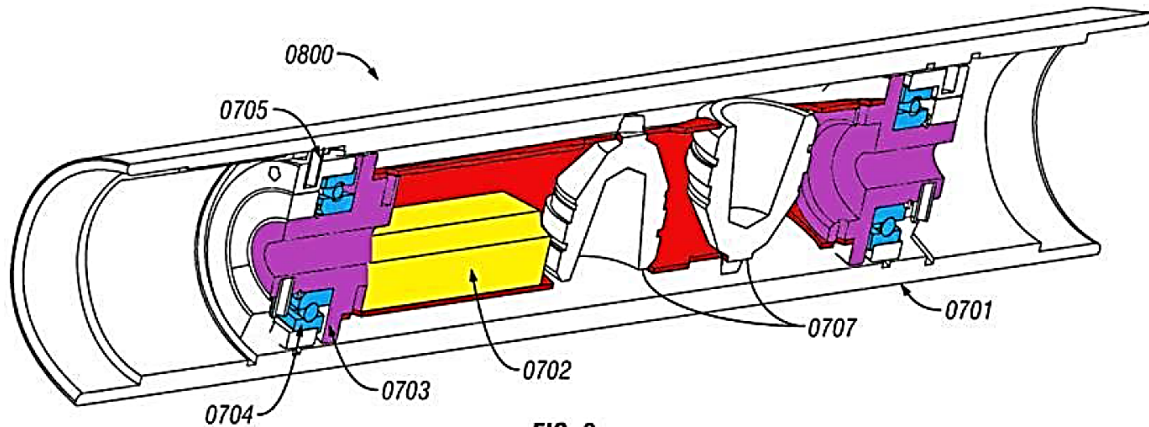


Hardesty Figure 8 is a perspective view of perforating gun 1 with internal bearing race system 4 that rotates within a limited arc due to restriction pin 31 (not shown in Figure 8). Ex. 1005, 9:21–24, Fig. 7C.

2. *Whether Hardesty discloses a gun body, a support member, and a weight*

Petitioner contends that Hardesty discloses a gun body, a support member, and a weight, as recited in the challenged claims, and provides the following colored versions of Hardesty Figures 7 and 8 to illustrate its contentions.





Pet. 71. Hardesty Figures 7 and 8 show a perforating gun. Petitioner contends that Hardesty's perforating gun includes a gun body (red), a support member (purple), a bearing assembly (blue), and a weight (yellow).
Pet. 60–70.

Patent Owner argues that Hardesty does not disclose a support member separate from the alleged gun body and weight. Prelim.
Resp. 20–24.

After considering the parties' arguments and evidence, we determine that, for purposes of institution, Petitioner makes a sufficient showing for the support member, gun body, and weight elements of the challenged claims. Referring to colored versions of Hardesty Figures 7 and 8, Petitioner contends:

The “charge holder tube” (0703) would be understood to refer to the red charge holder (gun body) and the purple support members collectively, where each purple support member further would be understood to be a distinct structure from the red charge holder because, e.g., it has boundary lines and opposite cross-hatching from the red charge holder.

Pet. 65 (citing Ex. 1003 ¶¶ 124, 125; Ex. 1005, Figs. 7, 8; 37 C.F.R. § 1.84(h)(3)). Petitioner further contends:

The weight (yellow) and the left support member (purple) appear to be distinct structural portions of an integral structure. Notably, the weight (0702) is labeled separately from the charge holder tube (0703), which is made up of the support members (purple) and the gun body (red).

Pet. 70 (citing Ex. 1003 ¶ 129).

The parties agree that the structure Petitioner identifies as a support member (purple) is part of Hardesty's charge holder tube 3. Pet. 65, 70; Prelim. Resp. 21–22; Ex. 1005, 8:57–65, Figs. 7, 8. There is also no dispute that the structure Petitioner identifies as a support member (purple) is part of an integral structure with Hardesty's weight 2. Pet. 70; Prelim. Resp. 22–23; Ex. 1005, 9:12–14, Figs. 7, 8. In our preliminary view, however, Petitioner provides sufficient support for its contention that the purple structure in Petitioner's colored versions of Hardesty Figures 7 and 8 is a “distinct structure” from the rest of Hardesty's charge holder tube 3 and a “distinct structural portion[] of an integral structure” that includes weight 2. Pet. 65, 70 (citing Ex. 1003 ¶¶ 124, 125, 129; Ex. 1005, Figs. 7, 8; 37 C.F.R. § 1.84(h)(3)).

3. Remaining Elements of Challenged Claims

At this stage of the proceeding, Patent Owner does not contest Petitioner's showing for the remaining limitations of claims 3, 7, 24–26, 29, 30, and 34–36. We determine that, for purposes of institution, Petitioner shows sufficiently that at least claim 24 is anticipated by Hardesty.

F. Petitioner's Yonghong-led Obviousness Challenge

Petitioner challenges claims 4 and 16 as obvious based on Yonghong in view of Schacherer or Eitschberger. Pet. 48–60. Patent Owner opposes.

Prelim. Resp. 20–24. We provide an overview of Schacherer and Eitschberger before turning to our analysis.

1. Schacherer (Ex. 1006)

Schacherer discloses a well tool system including multiple explosive assemblies, where each assembly includes an outer housing, at least one explosive component that rotates relative to the outer housing, and a selective firing module that causes detonation of the explosive component. Ex. 1006, 1:30–37. Figure 2 is reproduced below.

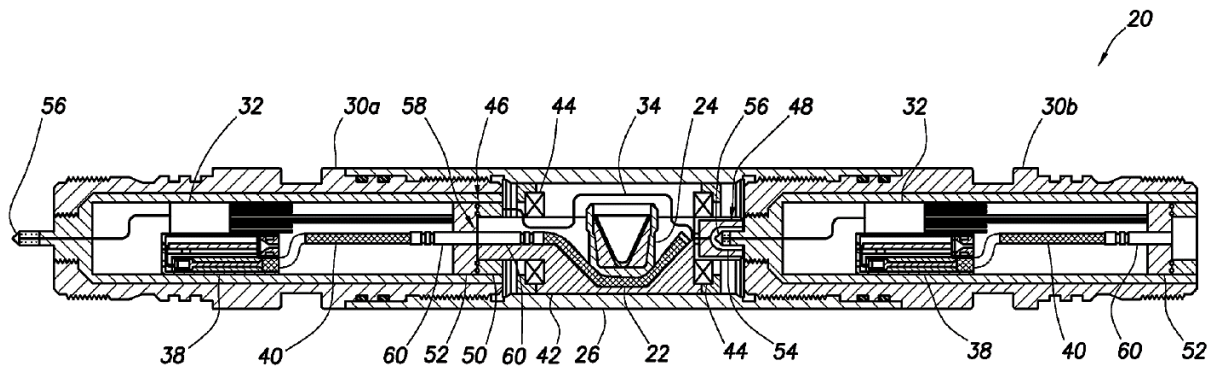


FIG. 2

Schacherer Figure 2 shows explosive assembly 20, including explosive components 22, 24 (also referred to as detonating cord 22 and perforating charges 24, respectively); outer housing 26; connectors 30a, b; selective firing modules 32; electrical conductor 34; electrical detonator 38; explosive components 40 (also referred to as detonating cords 40); eccentric weight 42; bearings 44; rotary electrical connections 46, 48; rotary detonation coupling 58; and boosters 60. Ex. 1006, 2:1–4, 2:35–40, 3:51–4:55. Outer housing 26 is positioned between two threaded connectors 30a, b and houses explosive components 22, 24 and eccentric weight 42, which are supported on bearings 44. *Id.* at 3:60–4:4. Electrical conductor 34 passes through outer housing 26 and is electrically connected

to selective firing modules 32 in connectors 30a, b via rotary electrical connections 46, 48, which allow electrical conductor 34 to rotate within the housing. *Id.* at 4:5–10, Fig. 2.

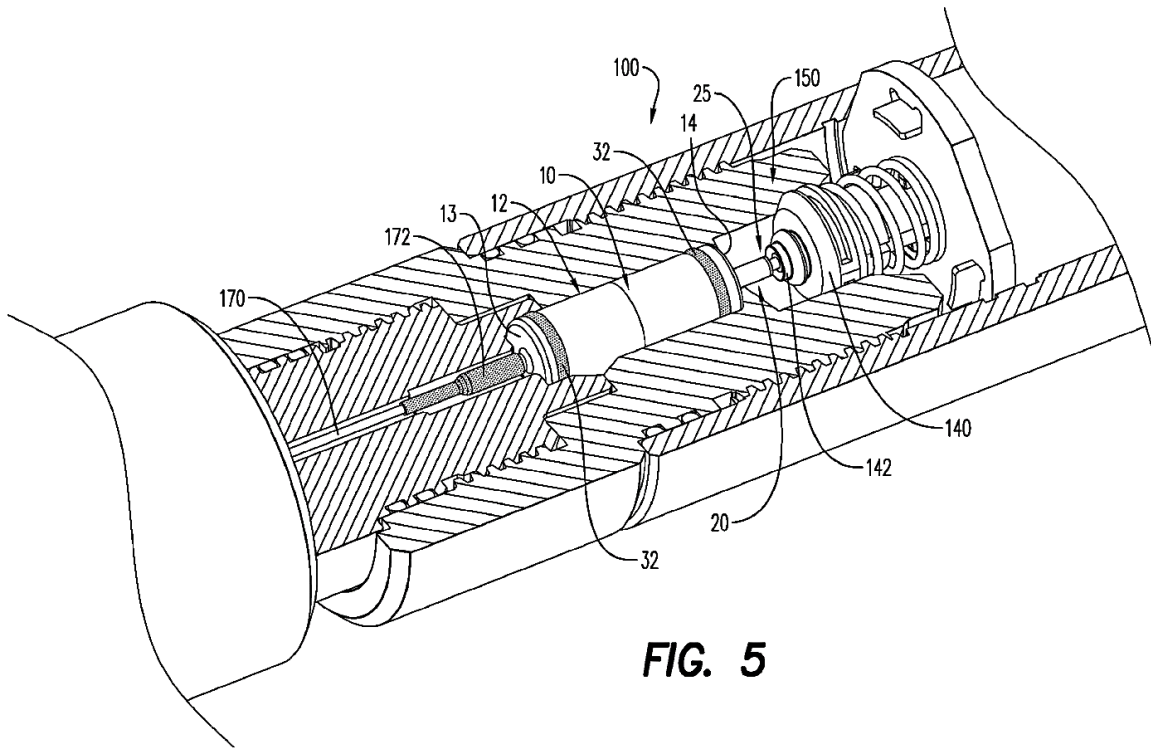
Rotary electrical connection 46 comprises electrical contacts 50, 52; and rotary electrical connection 48 comprises electrical contacts 54, 56. Ex. 1006, 4:14–39. Electrical contacts 50, 54 are coupled to electrical conductor 34 and rotate along with the explosive components 22, 24 within outer housing 26. *Id.* Electrical contacts 52, 56 are coupled to selective firing modules 32 and are stationary along with the remainder of connectors 30a, b. *Id.*

Detonating cord 22 in outer housing 26 is explosively coupled to detonating cord 40 in connector 30a by rotary detonation coupling 58, which transfers detonation from detonating cord 40 to detonating cord 22 via booster 60 and allows explosive components 22, 24 to rotate relative to outer housing 26, while selective firing module 32 does not rotate. Ex. 1006, 4:40–55.

2. *Eitschberger (Ex. 1007)*

Eitschberger discloses a bulkhead assembly having a pivotable electric contact component for use with a downhole tool. Ex. 1007, code (57), 1:15–18, 4:10–21. According to Eitschberger, a bulkhead provides an electrical contact or feed-through in string perforating gun assemblies. *Id.* at 2:15–29.

Figure 5 is reproduced below.



Eitschberger Figure 5 shows downhole tool or perforating gun assembly 100 including tandem seal adapter or tandem sub 150, bulkhead assembly 10, and electrical contact component 20. Ex. 1007, 7:30–57. First contact pin 24 (not shown in Figure 5) is covered by insulator 172 and connects to wired electrical connection 170, and second contact pin 25 wirelessly electrically contacts electrical contacting component 142 of initiator (detonator or igniter) 140. *Id.* at 7:50–8:6.¹⁰

3. *Claim 4*

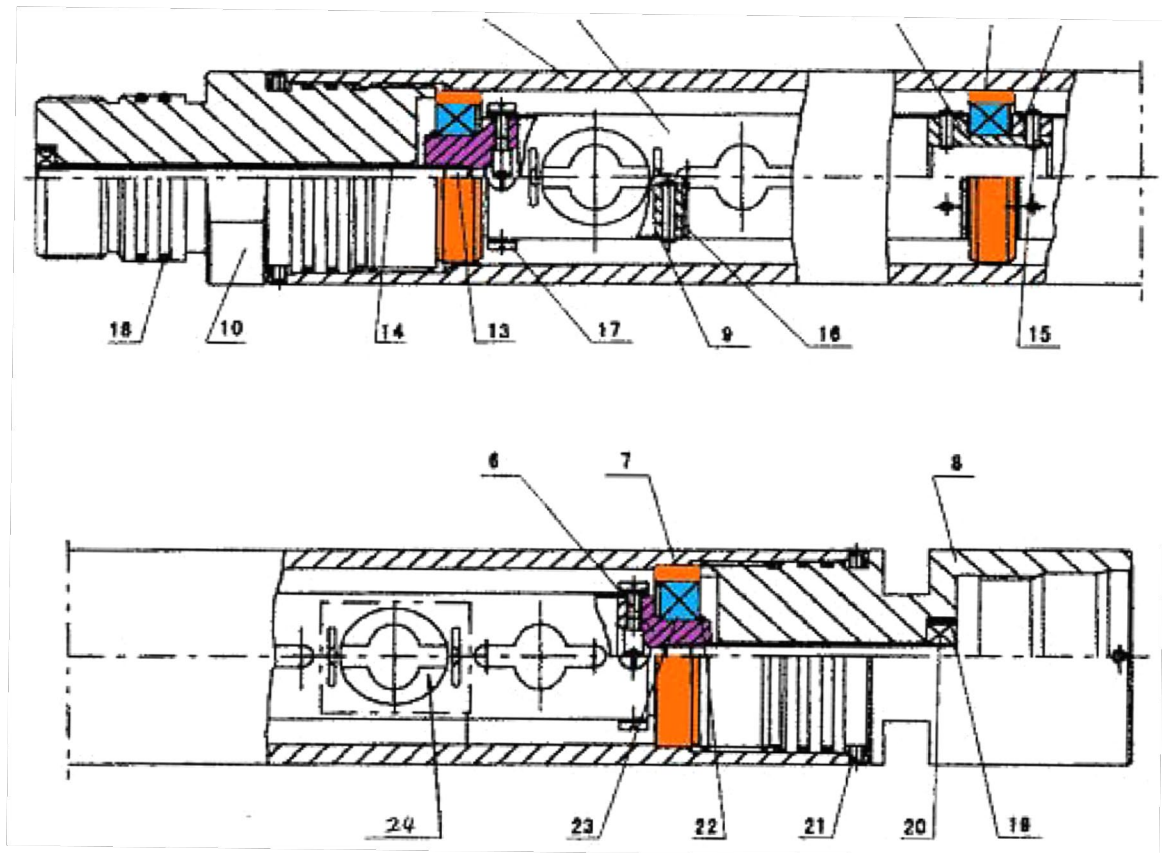
Claim 4 depends from disclaimed claim 1 and recites that the gun system further comprises “an end contact configured to transmit the

¹⁰ Eitschberger explains that “the term ‘wireless’ does not refer to a WiFi connection, but rather to th[e] notion of being able to transmit electrical signals through the electrical componentry without connecting external wires to the component.” Ex. 1007, 10:67–11:4.

electricity to the gun system, wherein the end contact is at least partially disposed through the collar and the bearing assembly.”

a) Yonghong and Schacherer

Petitioner acknowledges that Yonghong does not disclose the limitation of claim 4. Pet. 54. Petitioner contends that it would have been “obvious to incorporate Schacherer’s rotary electrical and detonation connections into Yonghong’s gun system to provide a reliable through wire connection for a select-fire gun system.” *Id.* Referring to the colored version of Yonghong Figure 1 reproduced below, Petitioner contends that it would have been “obvious to incorporate into the ‘support member’ (purple) . . . Schacherer’s electrical connector, through the collar (orange) and bearing assembly (blue).” Pet. 54–55.



Pet. 56. Yonghong Figure 1 shows a gun body of a perforating gun.

Petitioner contends that it would have been “obvious to substitute Yonghong’s ‘connector’—i.e., tandem sub—with Schacherer’s connector, including selective firing module and electrical connector coupling the selective firing module to an electrical feedthrough, to provide an electrical feedthrough system in Yonghong.” Pet. 55. Petitioner further contends that it would have been “obvious to couple Yonghong’s rotating detonating cord to Schacherer’s detonation coupling.” *Id.*

According to Petitioner, “incorporating Schacherer’s rotary electrical and ballistic connections would maintain Yonghong’s principle of rotating detonating cords while providing select-fire operation and would simplify Yonghong by replacing the detonating cord protecting tube and necessary assembly with a rotary detonation coupling.” Pet. 49–50 (citing Ex. 1003 ¶ 103).

Patent Owner argues that Yonghong’s detonating cord protection tube is a “fundamental component” that cannot be eliminated without “substantial reconstruction and redesign” and changing Yonghong’s basic principles of operation. Prelim. Resp. 27–28. Patent Owner contests the sufficiency of Petitioner’s rationale for combining Yonghong and Schacherer, arguing that the first benefit alleged by Petitioner—providing select-fire operation—has nothing to do with Petitioner’s proposed modification of Yonghong—incorporating a rotary connection as disclosed in Schacherer. Prelim. Resp. 28 (citing Ex. 2001 ¶ 70). Patent Owner argues that Petitioner’s proposed modification would complicate, rather than simplify, the system disclosed in Yonghong. *Id.* (citing Ex. 2001 ¶ 71).

After considering the parties’ arguments and evidence, we are not persuaded that Petitioner makes a sufficient showing for claim 4 based on Yonghong and Schacherer. In addition to the weaknesses identified by

Patent Owner and Dr. Wooley (Prelim. Resp. 27–28; Ex. 2001 ¶¶ 70–72), we identify the following additional shortcomings in Petitioner’s analysis.

Petitioner does not explain sufficiently why a POSITA would have combined Yonghong and Schacherer in a way that meets the limitation of claim 4. Although Petitioner asserts that a POSITA would have been motivated to provide select-fire operation in Yonghong by incorporating Schacherer’s rotary electrical and ballistic connections, Petitioner does not explain sufficiently how that motivation would have led a POSITA to the particular arrangement in claim 4.

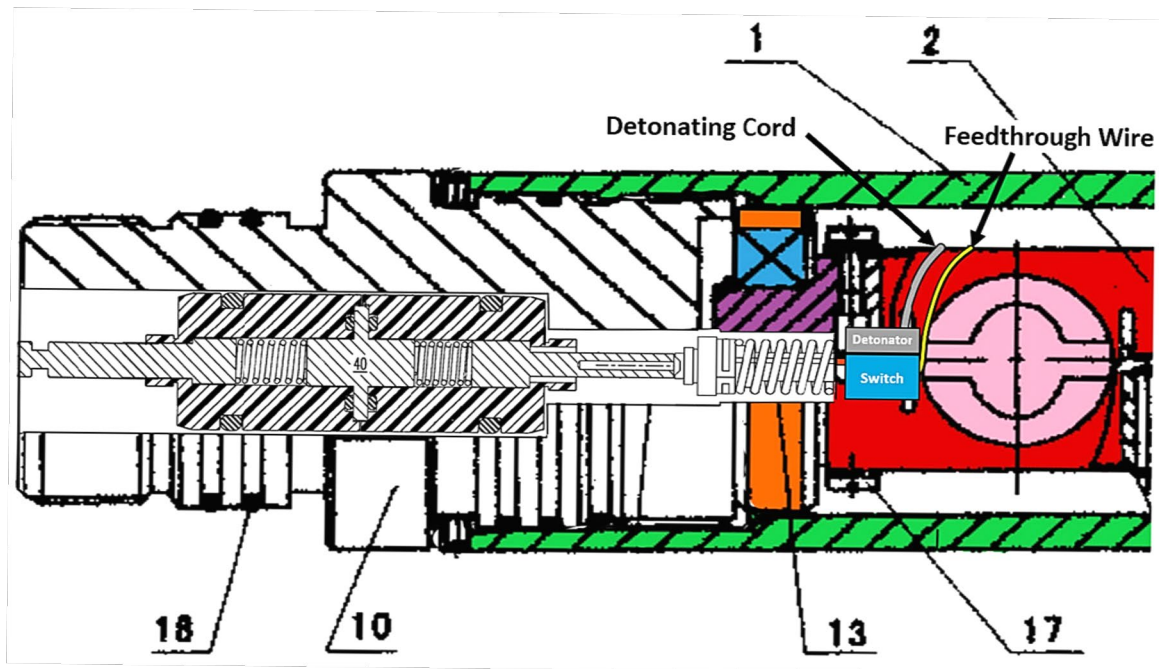
Schacherer discloses an explosive assembly having two rotary electrical connections 46 and 48 and one rotary detonation coupling 58. Ex. 1006, 4:5–7, 4:14–20, 4:27–33, 4:49–55, Fig. 2 (showing rotary electrical connection 46 and rotary detonation coupling 58 at one end of outer housing 26 and rotary electrical connection 48 at the other end). Only one of Schacherer’s rotary electrical connections—48—appears to meet the limitation of claim 4. *See* Pet. 22; Ex. 1003 ¶ 46 (discussing electrical contacts 54, 56 of rotary electrical connection 48). Yet neither Petitioner nor Dr. Rodgers explains why, when modifying Yonghong to include a rotary electrical connection, a POSITA would have selected the configuration of Schacherer’s rotary electrical connection 48 instead of the configuration of Schacherer’s rotary electrical connection 46.

Furthermore, Petitioner proposes to modify Yonghong by replacing Yonghong’s detonation cord protecting tube with Schacherer’s rotary electrical and ballistic connections. Pet. 49–50. But Petitioner does not explain sufficiently how such a modification would have been made or how it would satisfy claim 4. Yonghong’s detonation cord protecting tube 14 extends from both ends of charge tube 2. Ex. 1004, Fig. 1. In contrast,

Schacherer teaches rotary detonation coupling 58 at only one end of explosive component housing 26, and it is not the same end that has rotary electrical connection 48 that Petitioner contends would have been combined with Yonghong. Ex. 1006, Fig. 2; Pet. 54–55; Ex. 1003 ¶ 110. Petitioner fails to show how Yonghong would have been modified to include both a rotary ballistic connection and a rotary electrical connection that satisfies the limitation of claim 4.

b) Yonghong and Eitschberger

Petitioner contends that it would have been “obvious to incorporate the electrical contacting component of Eitschberger into Yonghong’s system” (Pet. 56) and illustrates its contention with the following modified version of a portion of Yonghong Figure 1.



Pet. 57.¹¹ Yonghong Figure 1 shows a gun body of a perforating gun, which Petitioner has modified to include bulkhead assembly 10 of Eitschberger Figure 2, initiator (detonator or igniter) 140 from Eitschberger Figure 5, a detonating cord, a feedthrough wire, a detonator, and a switch. *Id.*

Petitioner contends that it would have been “obvious to position the electrical contacting component of Eitschberger within the opening through the support member (purple) (also through the collar (orange) and bearing assembly (blue)) at the end of the charge tube (red) of Yonghong, to connect to a detonator and/or electrical feedthrough within the charge tube.”

Pet. 56–57 (citing Ex. 1003 ¶ 112, n.3). Petitioner asserts:

A POSITA would also understand that Yonghong describes tandem subs (“connectors”) within which, according to Eitschberger, a bulkhead including contact pins could be received in a bore to electrically connect to the electrical contacting component, for transferring a signal to a select-fire detonator within the charge tube, as part of the electrical feedthrough for the select-fire operation of Yonghong’s system in view of Eitschberger. In addition, Eitschberger’s single centerline pin contact provides the benefit of a low-friction electrical connection allowing free rotation of the charge tube in the gravity-oriented system.

Pet. 57–58 (citing Ex. 1003 ¶ 112).

Petitioner contends that a POSITA would have been motivated “to incorporate the select-fire electrical feedthrough assembly of Eitschberger, to provide select-fire operation in Yonghong while maintaining the basic

¹¹ We note that Petitioner’s modified figure appears to be inconsistent with Eitschberger. Petitioner shows Eitschberger’s bulkhead assembly 10 oriented such that first contact pin 24 is adjacent to detonator electrical contacting component 142. In contrast, Eitschberger Figure 5 shows bulkhead assembly 10 oriented such that second contact pin 25 is adjacent to detonator electrical contacting component 142. Ex. 1007, 7:58–8:6, Fig. 5.

configuration of components” and that “substitution of Eitschberger’s select-fire electrical feedthrough assembly for Yonghong’s detonating cord protecting tube” would have been “straightforward” and “predictable.”

Pet. 51–52 (citing Ex. 1003 ¶ 106). Petitioner contends that Eitschberger discloses an electrical contacting assembly extending through a central hole in an end cap coupled to an end of a charge tube (Pet. 51 (citing Ex. 1003 ¶ 107; Ex. 1007, 7:64–8:6, Fig. 5)) and, in Yonghong, “an electrical contacting assembly could likewise extend through an inner hole of the respective charge tube shafts,” which are coupled to a charge tube (Pet. 52–53 (citing Ex. 1003 ¶ 107; Ex. 1004, 6, Fig. 1)).

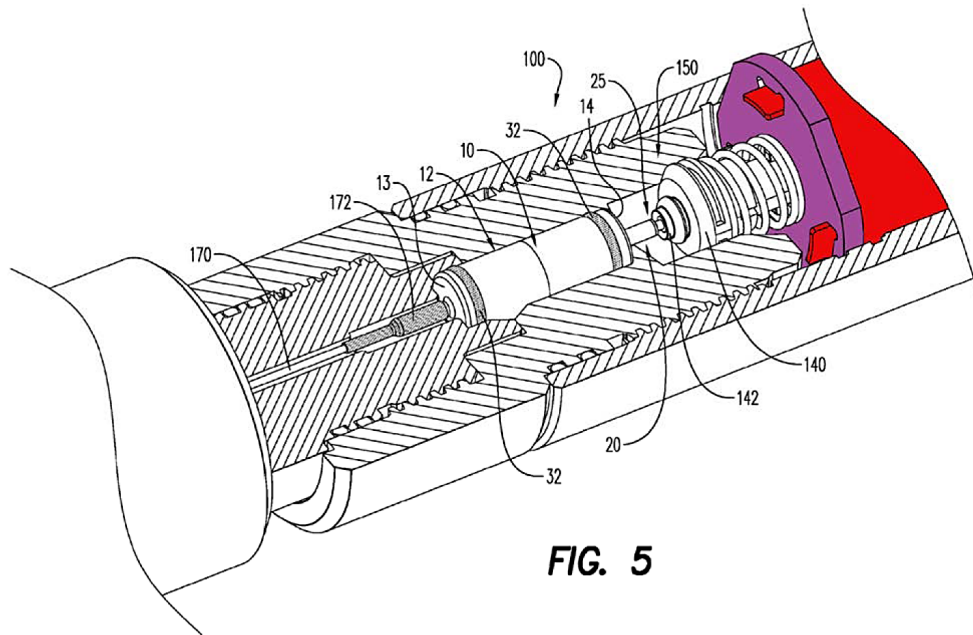
Patent Owner contests the sufficiency of Petitioner’s rationale for combining Yonghong and Eitschberger, arguing that Petitioner’s proposed modification of Yonghong “ultimately has nothing to do with allowing for select-fire configuration”—Petitioner’s alleged motivation for combining Yonghong and Eitschberger. Prelim. Resp. 28–29 (citing Ex. 2001 ¶ 73). Patent Owner argues that Petitioner’s proposed modification would complicate, rather than simplify, the mechanism of Yonghong. *Id.* at 29 (citing Ex. 2001 ¶ 74). According to Patent Owner, Petitioner has “failed to identify any reason why a [POSITA] would have reconstructed the device disclosed in Yonghong by eliminating the ‘safe detonation propagation mechanism.’” *Id.* at 30.

After considering the parties’ arguments and evidence, we are not persuaded that Petitioner makes a sufficient showing for claim 4 based on Yonghong and Eitschberger. In addition to the weaknesses identified by Patent Owner and Dr. Wooley (Prelim. Resp. 28–30; Ex. 2001 ¶¶ 73–75), we identify the following additional shortcomings in Petitioner’s analysis.

Petitioner does not explain sufficiently why a POSITA would have combined Yonghong and Eitschberger in a way that meets the limitation of claim 4. Although Petitioner asserts that a POSITA would have been motivated to provide select-fire operation in Yonghong by incorporating the electrical feedthrough assembly of Eitschberger, Petitioner does not explain sufficiently how that motivation would have led a POSITA to the particular arrangement in claim 4.

Petitioner acknowledges that Yonghong does not disclose the limitation of claim 4. Pet. 54. Petitioner does not identify a collar or bearing assembly in Eitschberger and does not allege that Eitschberger discloses the limitation of claim 4. Nor does Petitioner provide a sufficient reason or motivation for combining Yonghong and Eitschberger in a way that satisfies claim 4. More particularly, neither Petitioner nor Dr. Rodgers provides a reason or motivation for positioning “the electrical contacting component 142 of Eitschberger within the opening through the support member (purple) (and thus also through the collar (orange) and bearing assembly (blue)) at the end of the charge tube (red) of Yonghong, to connect to a detonator and/or electrical feedthrough within the charge tube.” Ex. 1003 ¶ 112; Pet. 56–57.

As support for their contentions, Petitioner and Dr. Rodgers provide the following colored version of Eitschberger Figure 5.



Pet. 52; Ex. 1003 ¶ 107. Eitschberger Figure 5 shows a perforating gun assembly. Referring to the above figure, Dr. Rodgers asserts that Eitschberger discloses “an electrical contacting assembly (142, 140) extend[ing] through a central hole in [an] end cap (purple)” which is “coupled to an end of [a] charge tube (red).” Ex. 1003 ¶ 107 (citing Ex. 1007, 7:64–8:6); *see* Pet. 51. Dr. Rodgers’ assertion is not sufficiently supported by Eitschberger, which does not disclose that either initiator 140 or electrical contacting component 142 extends through an end cap of a charge tube. Furthermore, there is insufficient evidence to support positioning a detonator within a charge tube, as proposed by Petitioner and Dr. Rodgers. Pet. 57; Ex. 1003 ¶ 112.

4. *Claim 16*

Claim 16 depends from disclaimed claim 1 and recites that the gun system further comprises “an insulated electrical contact configured to transmit electricity to the gun system.”

Petitioner acknowledges that Yonghong does not disclose the limitation of claim 16, but contends that Eitschberger does. Pet. 58 (citing Ex. 1003 ¶ 113; Ex. 1007, 4:38–50, 5:25–34, Figs. 2, 5). Petitioner relies on the same rationale for incorporating “Eitschberger’s bulkhead and electrical contact into Hardesty’s system” for claim 16 as it presents for claim 4. Pet. 83–87, 91. For claim 16, Petitioner further contends that it would have been obvious to use a bulkhead including an electrical contact configured to transmit electricity within a non-conductive bulkhead body “because those features are necessary for transferring electrical signals and insulating the electrical connection from, e.g., a tandem sub within which the bulkhead is positioned and which the bulkhead is contacting.” Pet. 59 (citing Ex. 1003 ¶ 114; Ex. 1007, Figs. 2, 5).

Patent Owner contests the sufficiency of Petitioner’s rationale for combining Yonghong and Eitschberger, presenting the same arguments for claim 16 as discussed above for claim 4. Prelim. Resp. 28–30.

After considering the parties’ arguments and evidence, we view Petitioner’s showing for claim 16 based on Yonghong and Eitschberger as weak. On this record, it is unclear why replacing Yonghong’s detonating cord protecting tube with Eitschberger’s electrical feedthrough assembly would have been necessary or desirable in order to provide select-fire operation. Pet. 51. Based on Petitioner’s complicated composite drawing with several added components (Pet. 57), it does not appear that Petitioner’s

modification would have been a “straightforward substitution,” as argued by Petitioner (Pet. 51).

The parties are invited to address the above issues concerning Petitioner’s Yonghong-led obviousness challenge for claims 4 and 16 at trial.

G. Petitioner’s Hardesty-led Obviousness Challenge

Petitioner challenges claims 4 and 16 as obvious based on Hardesty in view of Schacherer or Eitschberger. Pet. 80–92. Patent Owner opposes. Prelim. Resp. 30–31.

1. Claim 4

a) Hardesty and Schacherer

Petitioner acknowledges that Hardesty does not disclose the limitation of claim 4. Pet. 87. Petitioner contends that it would have been obvious to modify Hardesty by incorporating Schacherer’s electrical contact 54 into the purple structure that Petitioner identifies as a “support member.”

Pet. 88–89; *see supra* page 18 (reproducing Petitioner’s colored version of Hardesty Figure 7 with alleged “support member” in purple). According to Petitioner, it would have been “obvious to use a corresponding sub according to Schacherer’s connector incorporating a select-fire module and corresponding electrical contact of the rotary electrical connection, to electrically connect successive selective firing modules to a feedthrough.” Pet. 88–89.

Petitioner contends that a POSITA “would understand that Schacherer discloses a perforating gun system that meets the need for a rotatable select-fire perforating gun system with no through wire pinch points” and “would be motivated to modify Hardesty with the rotary electrical connection of

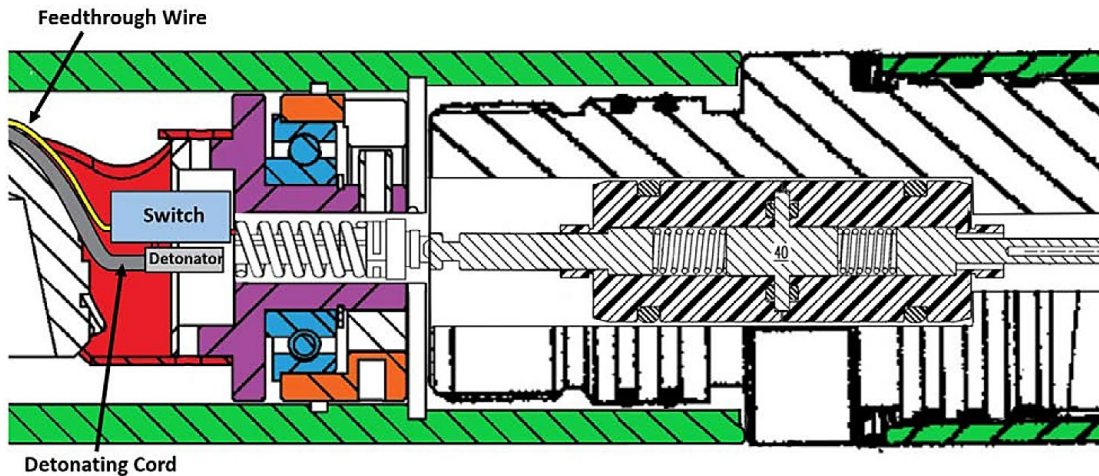
Schacherer to obtain the benefit of a fully rotating charge assembly.” Pet. 81–82 (citing Ex. 1003 ¶ 161). Petitioner contends that its proposed modification would have simplified Hardesty’s perforating gun assembly by “eliminat[ing] the need for a coarse orientation component because the weight alone orients the explosive charges.” Pet. 82 (citing Ex. 1005, 4:7–10).

Patent Owner argues that Petitioner’s proposed combination of Hardesty with Schacherer is “meritless because the ‘benefit’ purported to motivate the combination”—full rotation—“is the very aspect Hardesty expressly teaches away from.” Prelim. Resp. 30–31 (citing Ex. 1005, 2:65–3:24; Ex. 2001 ¶ 94). Patent Owner argues that “Hardesty itself teaches that a fully rotating configuration is more expensive, more complicated, less reliable, and less efficient.” *Id.* at 31.

After considering the parties’ arguments and evidence, we are not persuaded that Petitioner makes a sufficient showing for claim 4 based on Hardesty and Schacherer. In addition to the weaknesses identified by Patent Owner and Dr. Wooley (Prelim. Resp. 30–31; Ex. 2001 ¶¶ 94–96), Petitioner does not explain sufficiently why a POSITA would have combined Hardesty and Schacherer in a way that meets the limitation of claim 4. Although Petitioner asserts that a POSITA would have been motivated to modify Hardesty with the rotary electrical connection of Schacherer (Pet. 81–82, 88), Petitioner does not explain why a POSITA would have selected Schacherer’s rotating electrical contact 54 instead of Schacherer’s rotating electrical contact 50, which does not appear to meet the limitation of claim 4.

b) Hardesty and Eitschberger

Petitioner contends that it would have been “obvious to incorporate the detonator electrical contacting component into Hardesty’s system” and illustrates its contention with the following figure derived from Hardesty Figure 7 and Eitschberger Figures 2 and 5.



Pet. 90. Hardesty Figure 7 shows a perforating gun, which Petitioner has modified to include bulkhead assembly 10 of Eitschberger Figure 2, initiator (detonator or igniter) 140 from Eitschberger Figure 5, a detonating cord, a feedthrough wire, a detonator and a switch.

Petitioner contends that it would have been “obvious to position the electrical contacting component of Eitschberger within the opening through the support member (purple) (and thus also through the collar (orange) and bearing assembly (blue)) at the end of the charge tube (red) of Hardesty, according to Eitschberger.” Pet. 90 (citing Ex. 1003 ¶ 172).

Petitioner contends that a POSITA would have been “motivated to incorporate Eitschberger’s electrical feedthrough assembly into Hardesty’s select-fire perforating gun system at least because Hardesty’s configuration is complementary to Eitschberger’s FIG. 5.” Pet. 86. According to

Petitioner, this combination would have been “straightforward” and “predictable.” *Id.*

Patent Owner presents the same arguments for Petitioner’s Hardesty-Eitschberger combination as it presents for Petitioner’s Hardesty-Schacherer combination. Prelim. Resp. 30–31.

After considering the parties’ arguments and evidence, we are not persuaded that Petitioner makes a sufficient showing for claim 4 based on Hardesty and Eitschberger. In addition to the weaknesses identified by Patent Owner and Dr. Wooley (Prelim. Resp. 30–31; Ex. 2001 ¶¶ 94–96), we have similar concerns about Petitioner’s Hardesty-Eitschberger combination for claim 4 as discussed above for Petitioner’s Yonghong-Eitschberger combination for claim 4. *See supra* pages 30–32. Petitioner does not explain sufficiently why a POSITA would have combined Hardesty and Eitschberger in a way that meets the limitation of claim 4. In addition, there is insufficient support for Petitioner’s assertion that Eitschberger discloses “a detonator or initiator positioned within a charge tube (red).” Pet. 84 (citing Ex. 1007, 7:64–8:4, Fig. 5). Petitioner’s colored version of Eitschberger Figure 5 does not show detonator or igniter 140 positioned within the red structure that Petitioner identifies as a charge tube. Pet. 85.

2. *Claim 16*

Petitioner acknowledges that Hardesty does not disclose the limitation of claim 16, but contends that Eitschberger does. Pet. 91 (citing Ex. 1003 ¶¶ 175, 176). Petitioner relies on the same rationale for incorporating “Eitschberger’s bulkhead and electrical contact into Hardesty’s system” for claim 16 as it presents for claim 4. Pet. 83–87, 91. For claim 16, Petitioner further contends that it would have been obvious to use a bulkhead including

an electrical contact configured to transmit electricity within a non-conductive bulkhead body “because those features are respectively necessary for transferring electrical signals and insulating the electrical connection from, e.g., a tandem sub within which the bulkhead is positioned and in contact.” Pet. 92 (citing Ex. 1003 ¶¶ 114 n. 4, 177).

Patent Owner contests the sufficiency of Petitioner’s rationale for combining Hardesty and Eitschberger, presenting the same arguments for claim 16 as discussed above for claim 4. Prelim. Resp. 30–31.

After considering the parties’ arguments and evidence, we view Petitioner’s showing for claim 16 based on Hardesty and Eitschberger as weak for the reasons identified by Patent Owner and Dr. Wooley. Prelim. Resp. 30–31; Ex. 2001 ¶¶ 94–96.

The parties are invited to address the above issues concerning Petitioner’s Hardesty-led obviousness challenge for claims 4 and 16 at trial.

H. Alleged Obviousness Based on Hardesty and Yonghong

Petitioner challenges claims 3, 7, 24–26, 29, 30, and 34–36 as obvious based on Hardesty and Yonghong. Pet. 92–102. Patent Owner opposes. Prelim. Resp. 24–26.

For the limitation of independent claims 24 and 29 that recites “one or more explosive charges coupled to the gun body,” Petitioner contends that it would have been obvious to modify Hardesty to incorporate a slotted charge pressing structure, as shown in Yonghong Figure 1, “because a pressing structure or other structure/component for retaining the energetic charges would be a routine feature of the gun body.” Pet. 100 (citing Ex. 1003 ¶ 193). According to Petitioner, a “POSITA would have been motivated to make this change at least because Hardesty discloses that the energetic

charges rotate with the gun body and must therefore be coupled to the gun body.” Pet. 101 (citing Ex. 1005, 8:61–65, 9:2–5, 9:12–14; Ex. 1003 ¶ 193).

For dependent claims 26 and 35, which each recites “a second collar,” “a second support member,” and “a second bearing assembly,” Petitioner contends that “[t]o the extent that Hardesty does not expressly disclose the corresponding structures as ‘second’ components according to claims 26 and 35, a POSITA would have found it obvious to incorporate the corresponding structures at each end of the gun body.” Pet. 99 (citing Ex. 1005, Figs. 7, 8).

Petitioner discusses “reasons to combine” Hardesty and Yonghong, but Petitioner’s reasons do not appear to relate to the particular combinations of teachings Petitioner advances for claims 24, 26, 29, and 35. Pet. 92–94. Instead, Petitioner discusses similarity of the references and reasons for substituting a combined ballistic and electric transfer for a ballistic transfer. *Id.*

Patent Owner argues that Yonghong does not cure the alleged deficiencies of Hardesty (Prelim. Resp. 24–25), but does not otherwise address Petitioner’s combination of Hardesty and Yonghong.

In view of our determination that Petitioner’s anticipation challenges meet the threshold for institution for at least one claim, we do not provide any further comment on Petitioner’s Hardesty-Yonghong combination at this stage of the proceeding.

III. CONCLUSION

After considering the Petition and the Preliminary Response, we determine that the information presented establishes a reasonable likelihood that Petitioner would prevail in showing that at least one non-disclaimed claim of the ’762 Patent is unpatentable. Accordingly, we institute an *inter*

partes review of all non-disclaimed challenged claims on all grounds asserted against those claims in the Petition. 37 C.F.R. §§ 42.107(e), 42.108(a). *See* Guidance on the Impact of SAS on AIA Trial Proceedings (April 26, 2018);¹² *see also SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018).

IV. ORDER

It is

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 3, 4, 7, 16, 24–26, 29, 30, and 34–36 of the '762 Patent is instituted commencing on the entry date of this Decision; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of trial.

¹² Available at <https://www.uspto.gov/patents-application-process/patent-trial-and-appeal-board/trials/guidance-impact-sas-aia-trial>.

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