

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

ETHANOL BOOSTING SYSTEMS, LLC, and MASSACHUSETTS
INSTITUTE OF TECHNOLOGY,
Patent Owner.

IPR2021-00339
Patent 10,619,580 B2

Before LYNNE H. BROWNE, BARRY L. GROSSMAN, and
JAMES J. MAYBERRY, *Administrative Patent Judges*.

BROWNE, *Administrative Patent Judge*.

DECISION

Granting Petitioner's Request on Rehearing
37 C.F.R. § 42.71(d)
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Ford Motor Company (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1, 2, 5–15, 18, 20, 21, 23, 25, 27–29, and 31 (the “challenged claims”) of U.S. Patent No. 10,619,580 B2 (Ex. 1001, the “’580 patent”) pursuant to 35 U.S.C. § 311 *et seq.* Paper 2 (“Petition” or “Pet.”). Ethanol Boosting Systems, LLC and Massachusetts Institute of Technology (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our prior authorization, Petitioner filed a Preliminary Reply to Patent Owner’s Preliminary Response. Paper 7. Also, with our prior authorization, Patent Owner filed a Preliminary Sur-reply. Paper 8.

We denied institution. Paper 10 (“Inst. Dec.”). Petitioner timely filed a Request for Rehearing of that decision, and also requested a Precedential Opinion Panel (“POP”) review our Institution Decision. Paper 11 (“Req. Reh’g” or “Rehearing Request”); Ex. 3002. POP review was denied. Paper 13.

Central to our decision denying institution, and Petitioner’s Rehearing Request, is a claim construction of the “fuel terms,” a construction originating in the parallel district court litigation and appealed to the U.S. Court of Appeals for the Federal Circuit. *See* Inst. Dec. 8–18; Req. Reh’g 1–2; *see also* Ex. 2014 (providing Notice of Appeal). In our Institution Decision, we adopted the claim construction that was adopted by the district court, and that was consistent with a previous construction affirmed by the Federal Circuit for a set of related patents. *See* Inst. Dec. 8–18. This construction was contrary to the construction asserted by Petitioner in the district court, but consistent with the construction asserted by Patent Owner in the district court and Petitioner in the Petition. *See id.*

As explained in more detail in the following Section, the Federal Circuit vacated the district court’s claim construction and remanded that case to the district court, agreeing with Patent Owner on the claim construction of the fuel terms. Paper 16; Ex. 1042 (providing the Federal Circuit’s opinion).

For the reasons discussed below, we grant Petitioner’s Rehearing Request, and institute an *inter partes* review. We determine, based on the information in the Petition, Rehearing Request, exhibits, and other briefing, that the information presented in the Petition shows “a reasonable likelihood that the petitioner would prevail with respect to at least [one] of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018).

II. ANALYSIS

A. Legal Standards

The applicable requirements for a request for rehearing are set forth in 37 C.F.R. § 42.71(d), which provides:

A party dissatisfied with a decision may file a single request for rehearing, without prior authorization from the Board. The burden of showing a decision should be modified lies with the party challenging the decision. The request must specifically identify all matters the party believes the Board misapprehended or overlooked, and the place where each matter was previously addressed in a motion, an opposition, or a reply.

We review our Decision under an abuse of discretion standard. 37 C.F.R. § 42.71(c). An abuse of discretion may arise if a decision is based on an erroneous interpretation of law, if a factual finding is not supported by substantial evidence, or if the decision represents an unreasonable judgment in weighing relevant factors. *Star Fruits S.N.C. v. United States*, 393 F.3d 1277, 1281 (Fed. Cir. 2005); *Arnold P’ship v. Dudas*, 362 F.3d 1338, 1340 (Fed. Cir. 2004); *In re Gartside*, 203 F.3d 1305, 1315–16 (Fed. Cir. 2000).

“Substantial evidence is ‘such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.’” *OSI Pharm., LLC v. Apotex Inc.*, 939 F.3d 1375, 1381 (Fed. Cir. 2019) (quoting *Consol. Edison Co. v. N.L.R.B.*, 305 U.S. 197, 229 (1938)). “The substantial evidence standard asks ‘whether a reasonable fact finder could have arrived at the agency’s decision.’” *OSI Pharm.*, 939 F.3d at 1381–82 (quoting *Gartside*, 203 F.3d at 1312).

B. Background

The Petition asserts that claims 1, 2, 5–15, 18, 20, 21, 23, 25, 27–29, and 31 are unpatentable under 35 U.S.C. § 103(a) based on various combinations of Schray¹, Miura,² Rubbert,³ Yuushiro,⁴ Bosch,⁵ Ohtani,⁶ and Zhao.⁷ Pet. 1–2. In our Institution Decision, we explained the relationship between the “Bromberg Patents”⁸ (subject of *Ethanol Boosting Systems, LLC v. Ford Motor Company, LLC*, No. 1:20-cv-00706-CFC (Del.) (“Ford II”)) and the “Cohn Patents” (subject of *Ethanol Boosting Systems, LLC v. Ford Motor Company, LLC*, No. 1:19-cv-00196-CFC (D. Del.) (“Ford I”)). Inst. Dec. 2–4. We stated that “we [were] compelled to construe [claim] terms consistent with the construction adopted by the district court in both cases and, in one case [Ford I], affirmed by the Federal Circuit.” *Id.* at 15.

¹ US 6,505,603 B1, issued January 14, 2003 (Ex. 1005, “Schray”).

² JP 2003-13785 A, published January 15, 2003 (Ex. 1008, “Miura”).

³ DE 19853799 A1, published May 25, 2000 (Ex. 1007, “Rubbert”).

⁴ JP H10-252512, published September 22, 1998 (Ex. 1006, “Yuushiro”).

⁵ Automotive Handbook (3d Ed.), Bosch, published 1993 (Ex. 1011, “Bosch”).

⁶ US 2005/0098156 A1, published May 12, 2005 (Ex. 1009, “Ohtani”).

⁷ Automotive Gasoline Direct-Injection Engines, SAE R 315, 2002 (Ex. 1010, “Zhao”).

⁸ The ’580 patent is one of the “Bromberg patents” at issue in Ford II.

With this claim construction in mind, we determined that “the fuel terms of the ’580 patent . . . require a fuel other than gasoline to be directly injected into the cylinder—that is, we determine[d] that the fuel terms do not encompass single fuel systems.” Inst. Dec. 14–15 (citing Ex. 2002, 21:1–29:4; Ex. 2003, 19:11–20:11; Ex. 1033; Ex. 1022, 97) (footnote omitted). Reviewing the references advanced in each of Petitioner’s challenges, we determined that “each [reference] is directed to a single-fuel system that cannot satisfy our claim construction.” *Id.* at 18. As a result, we determined that “Petitioner fail[d] to demonstrate a reasonable likelihood of prevailing with respect to any claims on any ground raised by the Petition.” *Id.*

In response, Petitioner “submitted a request for Precedential Opinion Panel review” and the instant Request for Rehearing. Req. Reh’g. 1; Ex. 3002. In its Request for Rehearing, Petitioner requested that we hold our review “in abeyance until such time that the Federal Circuit has issued its decision on appeal as to the correct construction of the fuel terms in the Challenged Claims.” Req. Reh’g. 3. We agreed with Petitioner that simply holding our decision on the rehearing request in abeyance until the Federal Circuit rules would be the most appropriate approach, considering the parties approach to claim construction in this proceeding, and the possible harm to Petitioner.

The Federal Circuit has now ruled on the appeal, and vacated the district court’s construction of the fuel terms. Paper 16; Ex. 1042 (providing the Federal Circuit’s opinion). The Federal Circuit construed the fuel terms to encompass a configuration where the first fueling system and the second fueling system use the same fuel, consistent with how Patent Owner construed the claim at the district court, and how Petitioner construed the terms in the Petition. *See* Pet. 15 (“Petitioner adopts Patent Owner’s

construction and does not limit the type of PI or DI fuel⁹ used.”); Ex. 1042, 4 (“[Patent Owner] contends that the district court erred in construing the first fueling system to be limited to using fuels different than the fuel in the second system because there is no clear disclaimer of a single-fuel invention. We agree.”).

C. Claim Construction

Given the decision of the Federal Circuit reversing the district court’s claim construction, we now reconsider our claim construction determination in our Decision. As discussed above, on appeal the District Court’s finding that “the specification . . . makes clear that what is invented is a *dual* fuel engine” was reversed. Ex. 1042, 3, 7. In other words, the Federal Circuit determined that the claims do not require a dual-fuel system. The Federal Circuit’s decision was based on several determinations. *Id.* at 4–7. The Federal Circuit determined that “[t]here is nothing in the claim language that requires the use of different fuels in the direct-injection system and the port-injection system.” *Id.* at 4. It further determined that “[t]he asserted patents’ specifications do not impose a single-fuel requirement either.” *Id.* at 5. Accordingly, we adopt the Federal Circuit’s claim construction as our own.

D. Ground 1: Obviousness of Claims 1, 2, 5–15, 18, 21, 23, 25, 27–29, and 31 in View of the Combined Teachings of Schray and Miura

Petitioner asserts that claims 1, 2, 5–15, 18, 21, 23, 25, 27–29, and 31 are unpatentable over Schray and Miura. Pet. 1. We begin our analysis of this challenge with overviews of Schray and Miura.

⁹ “PI” is “port injection” and “DI” is “direct injection.”

1. Schray

Schray “relates to a fuel injection method for an internal combustion engine.” Ex. 1005, 1:6–7. Schray explains that high compression ratios are sought for internal combustion engines but such ratios lead to the problem of uncontrolled self-ignition of the engine’s air/fuel mixture (e.g. “knocking”). *Id.* at 1:10–15. Schray describes an object of improving the operation of an internal combustion engine at its operating limits without suffering a loss in torque due to knocking. *Id.* at 1:42–45.

Schray's Figure 1 (reproduced below) shows a schematic illustration of an internal combustion engine with a control apparatus. Ex. 1005, 2:1–2.

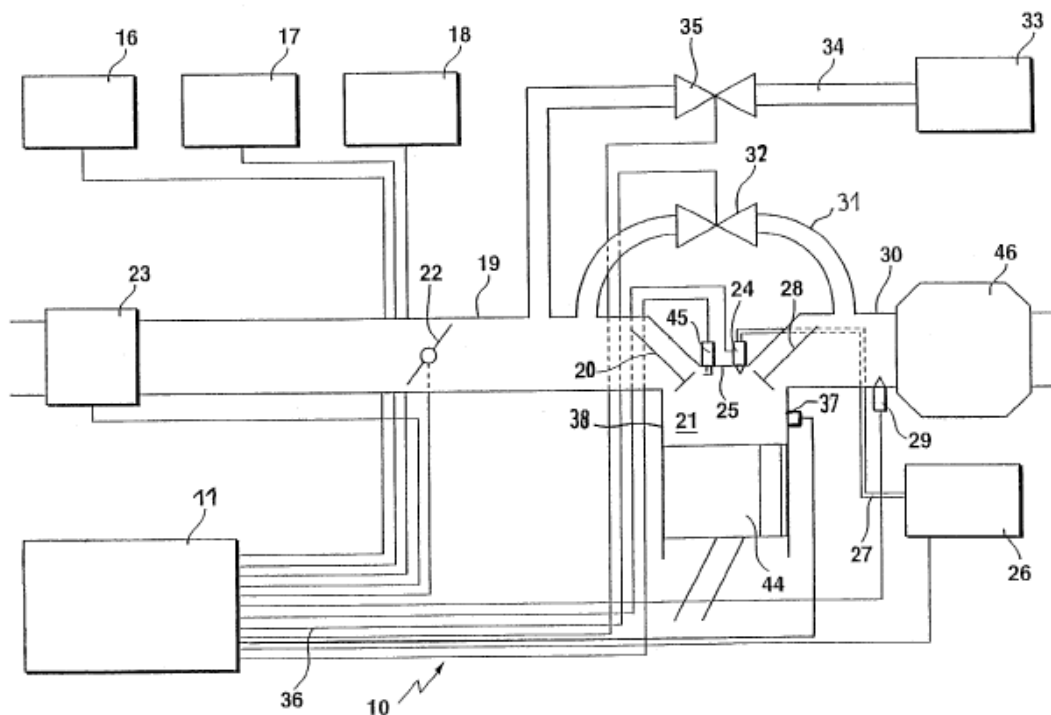


Fig. 1

Internal combustion engine having direct injection 10 operates by having fresh air supplied to cylinder 38 or combustion chamber 21 of cylinder 38 via intake manifold 19 and inlet valve 20. *Id.* at 2:9–12. Schray explains that “[a]n injection valve 24 and a spark plug are mounted in the cylinder

head 25” and that fuel “is injected into the combustion chamber 21 via a fuel line 27 and injection valves 24.” *Id.* at 2:16–20. Schray states that “[i]n homogeneous operation, the fuel is injected into the combustion chamber 21 by the injection valve 24 during an induction phase caused by the piston movement.” *Id.* at 3:1–3. The fuel is ignited via spark plug 45. *Id.* at 2:20–21.

Schray describes determining a “tendency-to-knock signal” on the basis of a detected cylinder charge and the rpm N or on the basis of an injected fuel mass and the engine’s rpm and “[t]he tendency-to-knock signal is compared to a threshold value and double injections are initiated when this threshold value is exceeded.” Ex. 1005, 3:47–52. Schray explains that “double injection means that the first injection takes place in the induction stroke and the second injection takes place in the compression stroke.” *Id.* at 3:53–55. According to Schray, “[t]he second injection causes the air/fuel mixture present in the combustion chamber 21 because of the first injection to be cooled whereby the danger of an uncontrolled ignition of the air/fuel mixture is reduced.” *Id.* at 3:55–60.

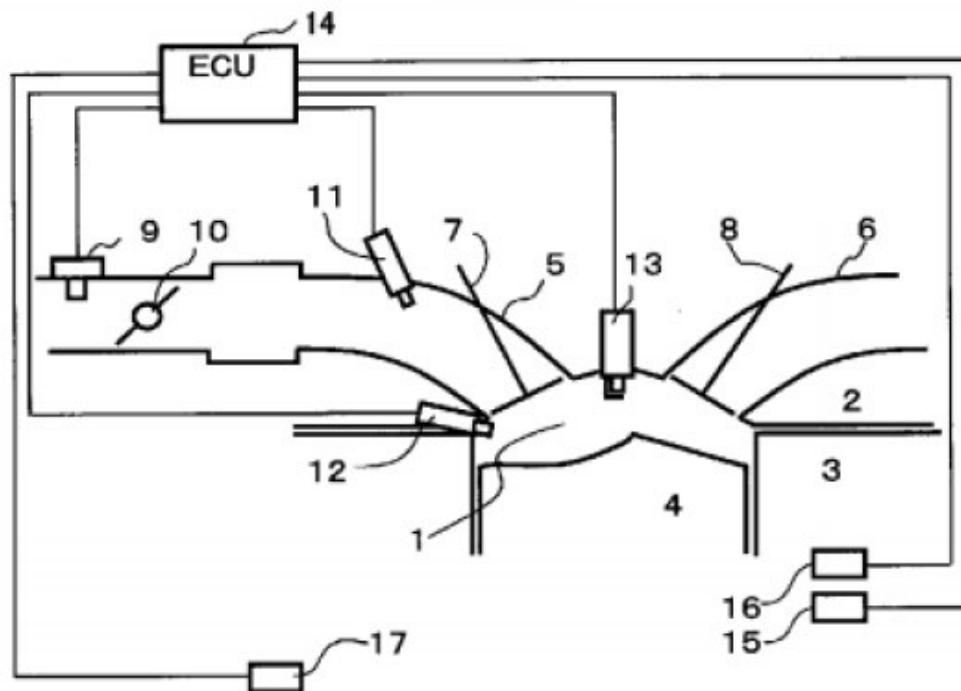
2. *Overview of Miura*

Miura “relates to a control device for a direct injection spark ignition internal combustion engine for suppressing generation of knocking by sub-stratifying an air-fuel mixture in a prescribed operation range.” Ex. 1008 ¶ 1. Miura explains that “in a high load range in which knocking regularly occurs, it is possible to suppress occurrence of knocking by injecting fuel after dividing into an intake stroke and a compression stroke.” *Id.* ¶ 3. More specifically, Miura describes “injecting an amount of fuel for the combustion chamber overall to become lean in the intake stroke and injecting the remaining fuel in the compression stroke to form a sub-stratified air-fuel

mixture within the combustion chamber” so that “an end gas portion is made leaner to suppress and improve generation of knocking.” *Id.*

Miura’s Figure 1 (reproduced below) shows a schematic illustration of Miura’s system. Ex. 1008 ¶ 37.

[FIG. 1]



Miura explains that combustion chamber 1 of an engine is defined by cylinder head 2, cylinder block 3, and piston 4. *Id.* ¶ 14. Intake path 5 includes throttle valve 10 for controlling the intake air volume and intake unit fuel injection valve 11 that “injects fuel into the intake path 5 in front of the combustion chamber 1.” *Id.* ¶ 15. Miura also describes “[a]n in-cylinder direct injection fuel injection valve 12 for injecting fuel into the combustion chamber 1.” *Id.* ¶ 16. Miura explains that, although the engine is described as including intake unit fuel injection valve 11 and in-cylinder direct injection fuel injection valve 12, “the present invention may be applied to an engine of a type for performing the intake stroke injection and compression

stroke injection using only the in-cylinder direct injection fuel injection valve 12.” *Id.* ¶ 36.

3. *Petitioners Contentions For Claim 1*

Petitioner asserts that claim 1 is unpatentable over the combined teachings of Schray and Miura. Pet. 12–19.

The preamble (1.Pre)¹⁰ recites, “[a] fuel management system for a spark ignition engine, comprising.” Ex. 1001, 16:62–63. Petitioner asserts that “[t]o the extent the preamble of Claim 1 is limiting, Miura and Schray discloses an engine having a spark plug.” Pet. 12 (citing Ex. 1005, 2:20–21; Ex. 1008 ¶ 16; Ex. 1003 ¶¶ 152–154).

The first limitation (1.A) requires, “a first fueling system that uses direct injection.” Ex. 1001, 16:64. Petitioner asserts that “Schray discloses an engine, controlled by control apparatus 11, and having an injection valve 24 for DI.” Pet. 13 (citing Ex. 1005, 2:16–17, 55–56; Ex. 1003 ¶¶ 155, 158).

The second limitation (1.B) requires, “a second fueling system that uses portion fuel injection.” Ex. 1001, 16:65. Petitioner asserts that “Miura discloses an ECU,¹¹ PI, and DI.” Pet. 13 (citing Ex. 1008 ¶¶ 15–16; Ex. 1003 ¶¶ 156, 160). Petitioner asserts further that “A POSITA¹² would have modified Schray to include a port fuel injector as well as its disclosed direct fuel injector, as is taught by Miura, to provide the engine of Schray with additional benefits relating to mixing and stable combustion at low loads.” Pet. 10.

¹⁰ As labeled by Petitioner. For clarity in reproducing Petitioner’s position, Petitioner’s labeling is referenced throughout this section.

¹¹ Engine control unit.

¹² Person of ordinary skill in the art.

The third limitation (1.C) requires, “a three-way catalyst configured to reduce emissions from the spark ignition engine.” Ex. 1001, 16:66–67. Petitioner asserts that “Schray teaches a three-way catalyst in the form of a catalytic converter 46 which is tasked with converting toxic exhaust-gas components such as CO, HC, and NO into CO₂, H₂O, and N₂, thereby reducing these emissions.” Pet. 14 (citing Ex. 1005, 2:39–42; Ex. 1003 ¶ 165; Ex. 1034, 2). Petitioner asserts further that “Schray discloses that the air/fuel mixture is adjusted to stoichiometric in order to obtain a high torque and a low development of toxic substances with the combustion.” *Id.* (citing Ex. 1005, 3:13–16; Ex. 1003 ¶¶ 163–165). Petitioner also asserts that “Miura discloses a stoichiometric ratio and inclusion of a catalyst.” *Id.* (citing Ex. 1008, ¶ 29; Ex. 1003 ¶ 166).

The fourth limitation (1.D) requires a fuel management system “configured to provide fueling in a first torque range, the first torque range being a first range of torque values at which both the first fueling system and the second fueling system are operable throughout the first range of torque values.” Ex. 1001, 17:1–5. Petitioner asserts “Miura discloses a high load range as well as low and medium load ranges.” Pet 15 (citing Ex. 1008 ¶¶ 20–21; Pet. 10–12; Ex. 1003 ¶ 169). According to Petitioner, “[i]n the high load range, and thus the first range of torque values, Miura discloses that the required fuel is injected via PI and DI.” *Id.* (citing Ex. 1008 ¶ 21; Ex. 1003 ¶ 170).

The fifth limitation (1.E) requires a fuel management system “further configured such that a fraction of fueling provided by the first fueling system is higher at a highest value of torque in the first torque range than in a lowest value of torque in the first torque range.” Ex. 1001, 17:6–10. Petitioner asserts “that Miura discloses that the fraction of DI increases from

no DI in the low and medium load ranges to at least some DI in the high load range.” Pet. 16 (citing Ex. 1008 ¶¶ 20–21; Ex. 1003 ¶ 175).

The sixth limitation (1.F) requires a fuel management system further configured to provide fueling in a second torque range, the second torque range being a second range of torque values at which the second fueling system is operable throughout the second range of torque values and the first fueling system is not operable throughout the second range of torque values.

Ex. 1001, 17:11–17. Petitioner asserts Miura discloses that “when the engine is not in the high load range, normal control is performed (*e.g.*, fueled by the second fueling system or the port fueling system).” Pet. 18 (citing Ex. 1008 ¶¶ 4, 25; Ex. 1003 ¶ 180).

The seventh limitation (1.G) requires a fuel management system “further configured such that when the system provides fueling at a torque value that exceeds the second range of torque values the spark ignition engine is operated in the first torque range.” Ex. 1001, 17:18–22. Petitioner asserts the combined teachings of Schray and Miura disclose a “first torque range [that] includes values of torque or load that are greater than those in the second torque range.” Pet. 19 (citing Pet. 15, 18; Ex. 1003 ¶¶ 182–183).

The eight, and final, limitation requires a spark ignition engine “configured to operate at a stoichiometric air/fuel ratio in at least part of the first torque range and in at least part of the second torque range.” Ex. 1001, 17:23–26. Petitioner asserts that “the disclosure of a three-way catalyst (*see* Limitation 1.C) indicates that an engine is operating at a stoichiometric fuel/air ratio.” Pet 19 (citing Ex. 1034, 10–11).

4. Patent Owner’s Response For Claim 1

Patent Owner does not contest Petitioner’s assertions regarding

claim 1. *See generally*, Prelim. Resp. Instead, Patent Owner contends that the challenge fails because both Schray and Miura teach single fuel systems, whereas the claim requires a dual-fuel system. *Id.* at 26–27.

*5. Analysis For Claim 1*¹³

As discussed in Section II.C above, we have determined that the claim construction in our Institution Decision was wrong. In the Institution Decision we determined that claim 1 required a dual-fuel system. *See* Inst. Dec. 19 (stating, “we construe the fuel terms consistent with the constructions applied in Ford I and Ford II.”). We now understand the claims to be applicable to single fuel systems. Accordingly, Patent Owner’s contentions that Schray and Miura are directed to single fuel systems are unavailing.

6. Conclusion For Claim 1

We have reviewed Petitioner’s assertions set forth in Section II.D.3 above. Based on the current record, we find these assertions to be sufficiently persuasive and supported by the cited evidence to justify institution of review.

7. Claims 2, 5–15, 18, 20, 21, 23, 25, 27–29, and 31

Having determined that Petitioner has sufficiently demonstrated a reasonable likelihood of prevailing for claim 1 based on Ground 1, we do not separately address the challenge to claims 2, 5–15, 18, 20, 21, 23, 25, 27–29, and 31 under this Ground.

¹³ As Petitioner’s Preliminary Reply and Patent Owner’s Preliminary Sur-Reply are directed only to issues of claim construction which are now moot, we do not discuss these Papers.

E. Grounds 2 and 3

Having determined that Petitioner has sufficiently demonstrated a reasonable likelihood of prevailing for claim 1 based on Ground 1, and given the unique circumstances of this case, we do not separately address Grounds 2 and 3. *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require “a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

III. CONCLUSION

For the above reasons, we determine Petitioner has carried its burden of showing that we erred in denying institution of *inter partes* review in this proceeding. We further determine that Petitioner has demonstrated a reasonable likelihood of prevailing for at least one claim.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner’s Rehearing Request is *granted*;

FURTHER, ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1, 2, 5–15, 18, 20, 21, 23, 25, 27–29, and 31 of U.S. Patent No. 10,619,580 B2 is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of U.S. Patent No. 10,619,580 B2 shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2021-00339
Patent 10,619,580 B2

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