

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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FOX FACTORY, INC.,  
Petitioner,

v.

SRAM, LLC,  
Patent Owner.

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IPR2017-00472  
Patent 9,182,027 B2

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Before MICHAEL W. KIM, *Vice Chief Administration Patent Judge*,  
FRANCES L. IPPOLITO, and  
KEVIN W. CHERRY, *Administrative Patent Judges*.

CHERRY, *Administrative Patent Judge*.

JUDGMENT  
Final Written Decision on Remand  
*Determining All Claims Unpatentable*  
35 U.S.C. §§ 144, 318

## I. INTRODUCTION

### A. BACKGROUND

#### 1. *Original Proceedings Before the Board*

Fox Factory, Inc. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting institution of *inter partes* review of claims 1–6 and 13–19 (“the challenged claims”) of U.S. Patent No. 9,182,027 B2 (Ex. 1001, “the ’027 patent”) on four asserted grounds for unpatentability:

<b>Claims Challenged</b>	<b>35 U.S. C. §</b>	<b>Reference(s)/Basis</b>
1, 2, 5, 6, 13–15, 18, 19	103(a) <sup>1</sup>	US 5,285,701 to Parachinni (“Parachinni”) (Ex. 1027), JP S56-42489 to Shimano (“JP-Shimano”) (Ex. 1006) <sup>2</sup>
3, 4, 16, 17	103(a)	Parachinni, JP-Shimano, US 3,375,022 to Hattan (“Hattan”) (Ex. 1004)
1, 2, 5, 6, 13–15, 18, 19	103(a)	Parachinni, JP-Shimano, US 4,576,587 to Nagano (“Nagano”) (Ex. 1010)
3, 4, 16, 17	103(a)	Parachinni, JP-Shimano, Nagano, Hattan

Pet. 16, 50, 63, 78. SRAM, LLC (“SRAM” or “Patent Owner”) filed a Preliminary Response (Paper 8, “Prelim. Resp.”).

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<sup>1</sup> The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29 (2011), revised 35 U.S.C. § 103, effective March 16, 2013. Because the ’027 patent has an effective filing date before March 16, 2013, we refer to the pre-AIA versions of § 103

<sup>2</sup> Exhibit 1006 includes both the published Japanese Patent Application (pages 1–10) and an English translation (pages 11–18). We refer exclusively to the English translation.

Pursuant to 35 U.S.C. § 314, we instituted *inter partes* review (“Decision to Institute”) of the ’027 patent on all claims and all grounds asserted in the Petition. Paper 10 (“Dec.”), 28.

After institution, Patent Owner filed a Patent Owner Response (Paper 17 (“PO Resp.”)), and Petitioner filed a Reply (Paper 37 (“Reply”). Patent Owner was also permitted to file a Sur-Reply (Paper 43 (“Sur-Reply”). We held a consolidated oral hearing with IPR2016-01876 and IPR2017-00118 on January 12, 2018. A transcript of the oral hearing has been entered into the record. Paper 63 (“Tr.”).

Petitioner relies on the testimony of Richard R. Neptune, Ph.D. (Ex. 1026 and Ex. 1051) in support of its contentions. Patent Owner relies on the testimony of Robert H. Sturges, Ph.D. (Ex. 2002 and Ex. 2074) and Ron Ritzler (Ex. 2004 and Ex. 2076) in support of its contentions.

Patent Owner filed Observations on Cross Examination. Paper 46 (“Obs.”). Petitioner filed a Response to Patent Owner’s Observations on Cross Examination. Paper 53 (“Response Obs.”). We have considered fully both the Observations and Response to Observations in reaching this Final Written Decision.

Petitioner also filed a Motion to Exclude certain evidence. Paper 50 (“Pet. Mot. Exclude”). Patent Owner filed an Opposition to Petitioner’s Motion to Exclude. Paper 56 (“PO Opp.”). Petitioner filed a Reply in support of its Motion to Exclude. Paper 58 (“Pet. Mot. Reply”). Patent Owner also filed a Motion to Exclude certain evidence. Paper 51 (“PO Mot. Exclude”). Petitioner filed an Opposition to Patent Owner’s Motion to Exclude. Paper 55 (“Pet. Opp.”). Patent Owner filed a Reply in support of its Motion to Exclude. Paper 57 (“PO Mot. Reply”).

On April 18, 2018, we issued a Final Written Decision. *See* Paper 64 (“Final Written Decision” or “Final Dec.”). We determined that Petitioner failed to demonstrate by a preponderance of the evidence that claims 1, 2, 5, 6, 13–15, 18, and 19 of the ’027 patent are unpatentable under 35 U.S.C. § 103(a) over the combinations of Parachinni and JP-Shimano or Parachinni, JP-Shimano, and Nagano, or that claims 3, 4, 16, and 17 are unpatentable under 35 U.S.C. § 103(a) over the combinations of Parachinni, JP-Shimano, and Hattan or Parachinni, JP-Shimano, and Hattan.<sup>3</sup> *Id.* at 69.

## 2. *Federal Circuit Decision*

On December 18, 2019, the Federal Circuit issued a decision vacating the obviousness determination in our Final Written Decision and remanding this case to “reevaluate the import of the evidence of secondary considerations with the burden of proving nexus placed on the correct party.” *Fox Factory v. SRAM, LLC*, 944 F.3d 1366, 1380 (Fed. Cir. 2019) *cert. denied* No. 20-158, 2020 WL 5883383 (Mem. Oct. 5, 2020) (also in the record as Ex. 3002).

## 3. *Remand Proceedings*

On April 15, 2020, we conferred with the parties to discuss the procedure for the remand. Paper 67, 3. The parties agreed that no new evidence was necessary, but that additional briefing was necessary. *Id.* at 3.

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<sup>3</sup> We also denied-in-part and dismissed-as-moot in part the parties’ Motions to Exclude. Final Dec. 69. Neither party challenges the portion of our ruling denying their Motions. Furthermore, we have not relied on any of the exhibits for which we dismissed the Motions as moot. Accordingly, we do not revisit our determinations on the Motions to Exclude.

On April 24, 2020, we authorized additional briefing on the narrow issue of “the import of the evidence of secondary considerations with the burden of proving nexus placed on the correct party.” Paper 67, 4–5.

Patent Owner filed an opening Brief on Remand (Paper 69, “PO Br.”), Petitioner filed a Response Brief on Remand (Paper 70, “Pet. Br.”), Patent Owner filed a Reply Brief on Remand (Paper 72, “Remand Reply”), and Petitioner filed a Sur-Reply Brief on Remand (Paper 73, “Remand Sur-Reply”).

We have jurisdiction under 35 U.S.C. §§ 6(b) and 144(b). This Decision is a final written decision under 35 U.S.C. § 318(a) as to the patentability of the challenged claims. We determine that Petitioner has shown, by a preponderance of the evidence, that claims 1–6 and 13–19 are unpatentable.

#### B. RELATED PROCEEDINGS

Patent Owner has asserted infringement of the '027 patent in *SRAM, LLC v. Race Face Performance Products*, Case No. 1:15-cv-11362-JHL (N.D. Ill.). Paper 3, 2; Pet. 89.

The '027 patent is one of a number of related, issued patents and pending applications. *See* Paper 3, 2–3. The '027 patent is also at issue in the following post-grant proceedings: (1) *FOX Factory, Inc. v. SRAM, LLC*, IPR2016-01876 and (2) *FOX Factory, Inc. v. SRAM, LLC*, IPR2017-00118. Paper 3, 2. The '027 patent is currently undergoing *ex parte* reexamination proceedings under Reexamination Control No. 90/013,715, which was initiated on June 2, 2016. *Id.* We stayed this reexamination on April 3, 2017. *See* Paper 7.

C. THE '027 PATENT

The '027 patent relates generally to chainrings, and more particularly to a solitary chainring for use with a conventional chain in a bicycle drivetrain system that includes a bicycle crank. Ex. 1001, 1:5–7. Bicycles and other chain-driven vehicles typically employ one or more chainrings and a set of rear hub-mounted sprockets connected by a chain. *Id.* at 1:8–10. According to the '027 patent, the management of chain and chainring engagement in bicycles is important, and various mechanisms are used to maintain the chain on the chainring and the sprockets, including chain guards, chain tensioners, chain catchers, and derailleur configurations, among others. *Id.* at 1:10–13. The '027 patent explains that managing the connection between the chain and the chainring is particularly difficult in geared bicycles, which can experience severe changes in chain tension and energy motion of the chain, especially when riding over rough terrain. *Id.* at 1:14–20. Specifically, the '027 patent asserts that it is directed to a solution for the problem of chain management, especially for a bicycle that can successfully and reliably be ridden over challenging and rough terrain. *Id.* at 1:27–29.

Figure 3 of the '027 patent illustrates a drive chain and chainring, and is reproduced below:



“functions to engage a chain link earlier than a chain lacking the tip portion and provides better guiding of the chain.” *Id.* at 5:48–51.

#### D. ILLUSTRATIVE CLAIM

Claims 1 and 13, both apparatus claims, are the only independent claims of the '027 patent challenged in the Petition. Claims 2–6 each depend from claim 1. Claims 14–19 each depend from claim 13. Claim 1 is illustrative of the subject matter in this proceeding and is reproduced below.

1. A bicycle chainring for engagement with a drive chain, comprising:

a plurality of teeth formed about a periphery of the chainring, the plurality of teeth including a first group of teeth and a second group of teeth,

each of the first group of teeth wider than each of the second group of teeth and at least some of the second group of teeth arranged alternately and adjacently between the first group of teeth,

wherein each of the plurality of teeth includes a tooth tip;

wherein a plane bisects the chainring into an outboard side and an inboard side opposite the outboard side; and

wherein at least the majority of the tooth tip of at least one of each of the first and second groups of teeth is offset from the plane in a direction toward the outboard side of the chainring.

*Id.* at 6:49–63.

## II. ANALYSIS

### A. OBVIOUSNESS OF CLAIMS 1, 2, 5, 6, 13–15, 18, AND 19 OVER PARACHINNI AND JP-SHIMANO

As discussed above, the Federal Circuit remanded on the issue of “reevaluat[ing] the import of the evidence of secondary considerations with the burden of proving nexus placed on the correct party.” *Fox Factory*, 944 F.3d at 1380. Before addressing the evidence of secondary considerations,



we briefly summarize our findings regarding the undisputed aspects of Petitioner's obviousness challenges to claims 1, 2, 5, 6, 13–15, 18, and 19 on remand.

1. *Differences Between the Prior Art and the Claimed Invention*

In the Petition, Petitioner maps each of the limitations of claims 1, 2, 5, 6, 13–15, 18, and 19 to teachings in Parachinni and JP-Shimano. Pet. 25–50; *see* Pet. 16–22. Patent Owner did not dispute that the references disclosed any of these limitations. *See generally* PO Resp. In the Final Written Decision, we were persuaded that Petitioner showed sufficiently that the references taught each of the limitations of the claims. *See* Final Dec. 13–14, 51–52.

2. *Motivation to Combine*

In the Final Written Decision, we determined that Petitioner provided a sufficient rationale to combine the teachings of the references. Final Dec. 14–18, 51–52. In particular, we were persuaded by Petitioner's evidence that "Parachinni would have been improved by adding the wide-narrow teeth of JP-Shimano in certain situations when the chain approaches the chairing from the rear gears at an angle." Final Dec. 17 (citing Ex. 1051 ¶¶ 10–13; Ex. 1006, 15:73–75). Additionally, on appeal, the Federal Circuit determined that any challenge by Petitioner to the motivation findings made in the Final Written Decision was waived or, alternatively, that the findings were supported by substantial evidence. *See Fox Factory*, 944 F.3d at 1378–79.

3. *Objective Indicia of Non-Obviousness*

In the Final Written Decision, we determined that Patent Owner was entitled to a presumption of nexus between its objective evidence of non-

obviousness (so called “secondary considerations”) tied to the X-Sync chainring and the invention recited in the challenged claims. Final Dec. 19–32. On appeal, the Federal Circuit determined that we “erroneously presumed nexus between the evidence of secondary considerations and the independent claims.” *Fox Factory*, 944 F.3d at 1378. However, the Federal Circuit explained that “[a] finding that a presumption of nexus is inappropriate does not end the inquiry into secondary considerations,” as Patent Owner still has the opportunity to “prove nexus by showing that the evidence of secondary considerations is the ‘direct result of the unique characteristics of the claimed invention.’” *Id.* at 1373–74. Specifically, the Federal Circuit explained that Patent Owner “bear[s] the burden of proving that the evidence of secondary considerations is attributable to the claimed *combination* of wide and narrow teeth with inboard or outboard offset teeth, as opposed to, for example, prior art features in isolation or unclaimed features.” *Id.* at 1378 (citing *Ethicon Endo-Surgery, Inc. v. Covidien LP*, 812 F.3d 1023, 1034 (Fed. Cir. 2016)).

On remand, Patent Owner presents evidence of long-felt need and licensing.<sup>4</sup> PO Br. 6–15. The only dispute is whether Patent Owner establishes a nexus between its evidence of secondary considerations and the claimed combination of outboard-offset, wide and narrow teeth. We have considered Patent Owner’s evidence on remand in light of the Federal

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<sup>4</sup> In its Patent Owner Response, Patent Owner also presented evidence of commercial success, industry praise, skepticism, and copying. *See* PO Resp. 15–45. Patent Owner has not presented any argument for a nexus under the clarifications provided by the Federal Circuit’s opinion in this case. Accordingly, we do not consider those categories of secondary considerations.

Circuit's Decision, and address the nexus for the evidence of long-felt need and licensing in turn. For the reasons below, despite our findings regarding Patent Owner's evidence of secondary considerations, we determine those findings are entitled to little or no weight because Patent Owner has failed to establish a nexus between that evidence and the claimed invention..

*a) Nexus for Evidence of Long-Felt Need*

Patent Owner asserts that there is a nexus between its evidence of long-felt need and the claimed combination of outboard-offset, wide and narrow teeth. PO Br. 10–13; Remand Reply 5–9. To support its nexus argument, Patent Owner relies on testimony from Dr. Sturges. PO Br. 10–12 (citing Ex. 2074 ¶¶ 78, 81–83); Remand Reply 5–8.

Petitioner argues that Patent Owner's nexus evidence as to long-felt need fails to prove that the combination of the X-Sync's outboard-offset, narrow-wide teeth met the asserted long-felt need. Pet. Br. 4–9; Remand Sur-Reply 4–8. According to Petitioner, Dr. Sturges's testimony as to long-felt need refers to the X-Sync chainring overall, which cannot be attributed to the '027 patent because the X-Sync contains critical features that are unclaimed in the '027 patent. Pet. Br. 4–8; Remand Sur-Reply 4–5.

Petitioner asserts that Dr. Sturges's statements regarding specific features of the X-Sync do not address the claimed combination of outboard-offset, wide and narrow teeth. Pet. Br. 8. Further, Petitioner argues that Dr. Sturges's testimony is conclusory. Pet. Br. 6, 9; Remand Sur-Reply 5–6.

Having reviewed Patent Owner's evidence, we determine that, at best, Patent Owner shows a weak nexus between the evidence of long-felt need and the claimed combination of outboard-offset, wide and narrow teeth. Patent Owner does not dispute that Dr. Sturges's testimony directed to the

X-Sync chainring overall does not establish a nexus. Remand Reply 5–9. Thus, we consider Dr. Sturges’s testimony to the extent it discusses the ’027 patent and specific features of the X-Sync products.

Dr. Sturges’s testimony includes some statements addressing the ’027 patent and the claimed invention as a whole. *See* Ex. 2074 ¶ 78 (“It is my opinion that the claimed invention solves a long-felt need in the industry and succeeds where others have failed.”); *id.* ¶ 81 (“SRAM was able to eliminate these problems, along with the problem of chain drop, with their X-Sync chainrings and the features of the challenged claims.”); *id.* ¶ 82 (“No one else thought to combine narrow and wide teeth with asymmetric offsets in a chainring before the ’027 patent.”); *id.* ¶ 83 (“[T]he claimed invention addressed the long-felt need . . . for a chainring that could maintain a chain through specific tooth profiles and gap-filling dimensions compared to the chain link spaces (along with additional claimed features) without the additional chain-retaining mechanisms utilized over the last century.”). These general statements provide, at best, a weak link between Dr. Sturges’s testimony of long-felt need and the claims of the ’027 patent. They are not enough to prove that the evidence of long-felt need “is attributable to the claimed *combination* of wide and narrow teeth with inboard or outboard offset teeth, as opposed to, for example, prior art features in isolation or unclaimed features.” *See Fox Factory*, 944 F.3d at 1378.

To the extent that Dr. Sturges’s cited testimony mentions specific features of the X-Sync product, it does not establish a long-felt need that is met by the claimed combination of outboard-offset, wide and narrow teeth. *See* Ex. 2074 ¶ 82 (“No one else thought to combine narrow and wide teeth with asymmetric offsets in a chainring before the ’027 patent.”); *id.* ¶ 83

(“the claimed invention addressed the long-felt need . . . for a chainring that could maintain a chain through specific tooth profiles and gap-filling dimensions compared to the chain link spaces”). Indeed, Dr. Sturges’s long-felt need testimony is silent as to any outboard offset. *See id.* ¶¶ 78–84.

Dr. Sturges’s statements generally discussing the X-Sync and the challenged claims, as well as the absence of evidence specific to the claimed combination of outboard-offset, wide and narrow teeth, leads us to conclude that, at best, the nexus between the evidence of long-felt need and the combination of the outboard-offset, narrow-wide teeth is weak. We therefore accord Patent Owner’s evidence of long-felt need little weight.

*b) Nexus for Evidence of Licensing and Commercial Acquiescence*

Patent Owner also asserts that there is a nexus between its evidence of licensing and commercial acquiescence and the claimed combination of outboard-offset, wide and narrow teeth. PO Br. 15; Remand Reply 9–10. Patent Owner relies on seven licenses that are “affirmative evidence of nexus” because they are “specifically tied to the ’027 patent.” PO Br. 14–15 (citing Exs. 2092–2106).

Petitioner disputes that the evidence shows the licenses were a “direct result” of the claimed combination outboard-offset, wide and narrow teeth. Pet. Br. 13–15; Remand Sur-Reply 8–9. Petitioner argues that the licenses in Exhibits 2102 and 2104 identify other patents in addition to the ’027 patent. Pet. Br. 14. Petitioner asserts that Patent Owner’s remaining licenses (Exs. 2092, 2094, 2096, 2098, and 2100) do not mention the ’027 patent, and also cover at least nine U.S. patents and applications. *Id.* at 13–

Patent Owner responds that it “only ‘retains the burden of proving the degree to which evidence of secondary considerations tied to a product is attributable to a particular claimed invention.’” Remand Reply 9 (quoting *Fox Factory*, 944 F.3d at 1378).

We determine that, at best, Patent Owner shows a weak nexus for two of its licenses. The only two licenses that explicitly mention the '027 patent are the licenses with Saris Cycling Group (Ex. 2102) and White Industries (Ex. 2104). As such, these licenses are linked to the claims of the '027 patent. Nonetheless, such references to the '027 patent generally are not enough to prove that the licenses are attributable to the claimed combination of outboard-offset, wide and narrow teeth. Moreover, the licenses with Saris Cycling Group (Ex. 2102) and White Industries (Ex. 2104) are not limited to just the '027 patent and include related patents and other patents. Thus, the link to the claimed combination of outboard-offset, wide and narrow teeth is weak, at best.

Patent Owner does not dispute that its remaining licenses (Exs. 2092, 2094, 2096, 2098, 2100) do not mention the '027 patent. *See* Pet. Br. 13; Remand Reply 9–10. Because Patent Owner’s remaining five licenses (Exs. 2092, 2094, 2096, 2098, 2100) do not mention the '027 patent, we are not persuaded that Patent Owner shows sufficiently that the remaining licenses are attributable to the claimed outboard offset, wide-narrow teeth. Even if Patent Owner correctly states that its burden is only to prove the degree to which evidence of secondary considerations is attributable to a particular claimed invention (Remand Reply 9), Patent Owner has not shown that the licenses in Exhibits 2092, 2094, 2096, 2098, and 2100 are attributable to the '027 patent to any degree.

Accordingly, we determine that, at best, there is a weak nexus with respect to the licenses to Saris Cycling Group (Ex. 2102) and White Industries (Ex. 2104), and no nexus with respect to the remaining licenses (Exs. 2092, 2094, 2096, 2098, 2100). We therefore accord Patent Owner's licensing evidence little weight.

4. *Conclusion of Obviousness for Claims 1, 2, 5, 6, 13–15, 18, and 19*

As discussed above, we find that Petitioner has shown sufficiently that the references teach each limitation of claims 1, 2, 5, 6, 13–15, 18, and 19. *See supra* § II.A.1. We also find that Petitioner has shown there would have been a rationale to combine the references. *See supra* § II.A.2.

Although Patent Owner presents evidence of secondary considerations, we find that Patent Owner establishes, at best, a weak nexus for its evidence of long-felt need and licensing, and accord that evidence some, but only little weight. This weak showing of objective indicia does not outweigh Petitioner's sufficient showing of obviousness. *See Intercontinental Great Brands LLC v. Kellogg North Am. Co.*, 869 F.3d 1336, 1347 (Fed. Cir. 2017) (finding secondary considerations insufficient to outweigh showing of obviousness based on the teachings of the art and the motivation to combine); *Western Union Co. v. MoneyGram Payment Sys., Inc.*, 626 F.3d 1361, 1373 (Fed. Cir. 2010) (“weak secondary considerations generally do not overcome a strong prima facie case of obviousness”).

Accordingly, weighing all four *Graham* factors, we find that Petitioner has shown by a preponderance of the evidence that claims 1, 2, 5, 6, 13–15, 18, and 19 would have been obvious over the combination of Parachinni and JP-Shimano.

B. OBVIOUSNESS OF CLAIMS 3, 4, 16, AND 17 OVER PARACHINNI, JP-SHIMANO, AND HATTAN

1. *Differences Between the Prior Art and the Claimed Invention*

Claim 3 depends from claim 1 recites, in relevant part, that “wherein each of the first group of teeth fills at least 75 percent of an axial distance defined by the outer link spaces.” Ex. 1001, 7:8–10. Claim 16 depends from claim 13 and recites similar limitations to claim 3. Claim 4 depends from claim 1 and recites, in relevant part, that “wherein each of the second group of teeth fills at least 75 percent of an axial distance defined by the inner link spaces.” Ex. 1001, 7:18–20. Claim 17 depends from claim 13 and recites similar limitations as claim 4.

Petitioner contends that Parachinni, JP-Shimano, and Hattan disclose each limitation of claim 3. Specifically, Petitioner contends that Parachinni discloses a bicycle chainring “for engagement with a roller drive chain having alternating outer and inner chain links defining outer and inner link spaces, respectively.” Pet 56–57. Petitioner asserts that Parachinni discloses a chainring for engaging with a chain, and that one of ordinary skill in the art “would have understood that *Parachinni* teaches the use of such a chain, or at the very least, would have found it obvious to use such a chain with the bicycle disclosed by *Parachinni* because such use would be conventional.” Pet. 57 (citing Ex. 1004, 4:32–40; Ex. 1006, 15:69–86, 16:99–117; Ex. 1026 ¶ 92; Ex. 1027, 1:56–2:11, 3:22–4:3).

Petitioner also contends that JP-Shimano teaches “wherein each of the first group of teeth is sized and shaped to fit within one of the outer link spaces and each of the second group of teeth is sized and shaped to fit within



one of the inner link spaces.” Pet. 58 (citing Ex. 1006 at 15:73–86, 16:99–117, Fig. 2; Ex. 1026 ¶ 94).

Petitioner further relies on Hattan’s disclosure for the limitation “wherein each of the first group of teeth fills at least 75 percent of an axial distance.” Pet. 59–61; *see* Pet. 50–52. Petitioner asserts that Hattan discloses “a standard 3/32 of an inch chain” that has an inner link spacing of 0.09375 inches. Pet. 59 (Ex. 1004, 7:52–66; Ex. 1026 ¶ 95). Petitioner also asserts that Hattan discloses it is “preferred” to have an axial thickness of sprocket teeth between about .070 inch and .090 inch, and “desirably” about .080 inch. *Id.* (citing Ex. 1004, 7:52–66; Ex. 1026 ¶ 95). According to Petitioner, “[t]he ratio of the widest ‘preferred’ tooth width, 0.090 inches, to the width of the inner link space, 0.09375 inches, corresponds to 96 percent axial fill,” and “the ‘desirable’ tooth width of 0.08 inches for the inner link space corresponds to an axial fill above 85 percent.” *Id.* (citing Ex. 1026 ¶ 95). Petitioner also cites JIS as demonstrating that such an axial fill for chainring teeth was known in the art. Pet. 42, 54 (citing Ex. 1026 ¶¶ 85, 88; Ex. 1025, 6, 7).

Petitioner asserts that JP-Shimano further supports the axial fill percentage through its teaching of the first group of teeth being “smaller than the spaces between the outer link plates of the chain, but greater than other teeth that engage between the inner link plates.” Pet. 60 (quoting Ex. 1006, 15:78–86; citing Ex. 1006, 16:108–113, Fig. 2; Ex. 1026 ¶ 97). Petitioner argues that it would have been obvious to one of ordinary skill to “maintain the same ratio of axial fill when modifying the *Parachinni* chainring to incorporate the narrow/wide teeth profile of JP-Shimano such that the wide teeth (i.e., first group of teeth) fill at least 75 percent of an axial

distance defined by the outer link spaces.” Pet. 52–56, 59–60. Thus, Petitioner asserts that the combination of Parachinni, JP-Shimano, and Hattan accounts for the limitation of filling 75 percent of the axial distance “defined by the outer link spaces.” Pet. 60–61.

Petitioner further asserts that the combination of Parachinni, JP-Shimano, and Hattan accounts for the limitations of claims 4, 16, and 17. Pet. 61–62.

The only disputed limitation is whether the combination of references teach or suggest the claimed axial fill percentage for an outer link space as recited in claims 3 and 16.<sup>5</sup> PO Resp. 51–60; Reply 5–11.

The parties dispute whether JP-Shimano teaches wide teeth that fill at least 75% of outer link spaces. PO Resp. 56–59; Reply 9–12. However, we need not determine whether JP-Shimano teaches an outer link axial fill of at least 75% because, as we discuss below, we find that the combination of Parachinni, JP-Shimano, and Hattan accounts for this limitation.

The parties’ remaining dispute centers on the reasoning for this combination, not whether the combination accounts for the limitation itself. And because we determine that the combination of Parachinni, JP-Shimano, and Hattan, adequately accounts for the limitation, we only need to address

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<sup>5</sup> Patent Owner’s arguments are directed to whether the cited references render obvious the limitation “fills at least 75 percent of an axial distance defined by the outer link spaces,” as recited in claims 3 and 16. Claims 4 and 17, however, are directed to the fill percentage of inner link spaces, not outer link spaces. *See* Ex. 1001, 7:18–20, 8:61–63. Because Patent Owner does not present arguments directed to the fill percentage of inner link spaces for claims 4 and 17, we find that any such arguments are waived.

below Patent Owner's arguments on the motivation to combine and reasons to modify.

2. *Motivation to Combine and Reasons to Modify*

We agree with Patent Owner and Dr. Sturges that Hattan does not teach or suggest that the axial fill of the first group of teeth should be greater than 75% for the outer link spaces, or that axial fill is beneficial for chain retention. *See* PO Resp. 52–56; Ex. 2074 ¶¶ 91–95. However, we agree with Petitioner that the Petition does not rely on Hattan to directly teach this limitation. *See* Reply 6–7. Instead, Petitioner relies on design choice and routine experimentation in view of the teachings of Hattan and JIS. Pet. 54–56.

Patent Owner does not dispute that Hattan or JIS disclose an axial fill range of at least 75%. *See generally* PO Resp. 51–60. Instead, Patent Owner argues that Hattan only discloses inner fill percentages, which one of ordinary skill in the art would not have considered to inform the axial fill for outer link spaces due to geometric differences between inner link spaces and outer link spaces. PO Resp. 53–56 (citing Ex. 1001, 3:21–33; Ex. 2074 ¶¶ 87–89).

Petitioner responds that JP-Shimano expressly teaches widening teeth to improve chain retention, so one of ordinary skill in the art would have understood that higher axial fill would reduce chain detachment. Reply 7. Petitioner asserts that one of ordinary skill in the art would have started with Hattan's axial fill ratios rather than "reinventing the wheel." *Id.* at 6–7. Petitioner submits that accounting for the geometric differences Patent Owner identifies would have been well within the skill of an ordinary artisan. *Id.* at 8 (citing Ex. 1005; Ex. 1006; Ex. 1051 ¶¶ 23–26).

The Federal Circuit has explained that ““where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”” *E.I. du Pont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018) (quoting *In re Aller*, 220 F.2d 454, 456 (CCPA 1955)). “This rule is limited to cases in which the optimized variable is a ‘result-effective variable.’” *In re Applied Materials, Inc.*, 692 F.3d 1289, 1295 (Fed. Cir. 2012) (quoting *In re Antonie*, 559 F.2d 618, 620 (CCPA 1977)); see also *In re Boesch*, 617 F.2d 272, 276 (CCPA 1980) (“[D]iscovery of an optimum value of a result effective variable . . . is ordinarily within the skill of the art.”).

Petitioner has offered evidence from JP-Shimano that the width of the wide teeth relative to the spacing between the outer link plates, i.e., the axial fill, was recognized in the art as a variable that affects chain retention. *See* Ex. 1006, 16:108–115 (noting the width of wide teeth 22 “can be set to conform to the spaces between the outer link plates (32), so that the chain does not drop when the outer link plates (32) engage with teeth (22), even [when] the chain line is displaced”). This is supported by the testimony of Dr. Neptune. Ex. 1026 ¶¶ 97–98. Thus, we determine that Petitioner has shown that it would have been obvious to optimize the width, and hence, the axial fill, of JP-Shimano’s teeth relative to the outer link spacing.

Moreover, “discovery of an optimum value of a result effective variable . . . is ordinarily within the skill of the art.” *In re Boesch*, 617 F.2d at 276. Petitioner has shown, and Patent Owner does not dispute, that Hattan discloses 74.6% to 96% axial fill for the inner link spaces and JIS further discloses 88% axial fill for the inner link spaces. *See* Ex. 1004, 7:52–66; Ex. 1025, 6, 7; Ex. 1026 ¶ 95; PO Resp. 51–60.

We are not persuaded by Patent Owner’s argument that geometric differences of the inner link spaces and outer link spaces would have discourage one of ordinary skill in the art from considering teachings such as Hattan and JIS when optimizing the axial fill of the outer link spaces of JP-Shimano. *See* PO Resp. 51–60. Patent Owner appears to base its argument on the geometric shape shown in the ’027 patent, but no specific geometric shape is claimed in claims 3, 4, 16, and 17. We decline to require optimization based on some unclaimed shape. Instead, we agree with Petitioner that one of ordinary skill in the art would be able to avoid undesirable contact between the teeth and the outer link spaces when implementing a chainring with wide and narrow teeth. *See* Ex. 1005; Ex. 1006; Ex. 1051 ¶ 25.

Thus, we determine that Petitioner has shown that it would have been obvious to optimize the width of JP-Shimano to yield an axial fill within the range claimed.<sup>6</sup>

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<sup>6</sup> In IPR2017-01440 (“the -1440 case”), we considered the claims of U.S. Patent No. 9,291,250 C1 (“the ’250 patent”), which is related to the ’027 patent. The ’250 patent claims are similar to the claims of the ’027 patent, but do not include the limitation that the teeth are “offset from the plane in a direction toward the outboard side of the chainring.” Instead, the ’250 patent claims all recite a limitation of “wherein a maximum axial width about halfway between a root circle and a top land of the first group of teeth fills at least 80 percent of an axial distance defined by the outer link spaces.” In the -01440 case, Petitioner presented two obviousness grounds—Hattan in view of JP-Shimano and JP-Shimano in view of Hattan. In our Final Written Decision in the -01440 case, we determined that it would *not* have obvious to modify Hattan in view of JP-Shimano. IPR2017-01440, Paper 62, at 17–25. However, we further found that it *would have been* obvious, for the combination of JP-Shimano in view of Hattan, “to optimize the width of the teeth, and hence, the axial fill, of the base of JP-Shimano’s teeth relative to the outer link spacing” and that, in view of the teachings of

3. *Objective Indicia of Non-Obviousness*

On remand, Patent Owner does not present any additional arguments regarding secondary considerations for claims 3, 4, 16, and 17. *See generally* PO Br., Remand Reply. In particular, Patent Owner does not present any arguments addressing nexus and the additional limitations of claims 3, 4, 16, and 17. Accordingly, we determine that Patent Owner fails to establish a nexus between its evidence of secondary considerations and the claimed combination in claims 3, 4, 16, and 17, and give that evidence no weight.<sup>7</sup>

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Hattan and JIS, it would have further been “obvious to optimize the base width of JP-Shimano to yield an axial fill within the range claimed [i.e., 80 percent].” *Id.* at 31. That is precisely the optimization addressed by Petitioner in the present case. In addition to the particular percentage of the axial fill, the claims of the ’250 patent require that the maximum axial width of the first group of teeth occur at “about halfway between a root circle and a top land.” For this requirement, we found that although Petitioner had shown that it would have been obvious to optimize the axial fill, Petitioner had *not* shown sufficiently that it would have been obvious to perform this optimization at the “*halfway*” point claimed. *Id.* at 31–35. In contrast, there is no requirement in claims of the ’027 patent that the maximum axial fill occur at the halfway point. Thus, our findings between the two cases are consistent.

<sup>7</sup> In *Fox Factory, Inc. v. SRAM, LLC*, 813 F. App’x 539 (Fed. Cir. 2020), the Federal Circuit reviewed our Final Written Decision in the -01440 case discussed *supra* note 6. The claims from the -01440 case included a limitation regarding the axial fill and recited that “the first group of teeth fills at least 80 percent of an axial distance defined by the outer link spaces.” *Id.* at 540. In affirming the Board’s conclusion that the claims of the ’250 patent would not have been obvious, the Federal Circuit considered whether the Board erroneously granted SRAM a presumption of nexus between the claimed invention and its evidence of secondary considerations. *Id.* at 542. The Federal Circuit determined that substantial evidence supported the Board’s findings on secondary considerations. *Id.* at 543.

4. *Conclusion of Obviousness for Claims 3, 4, 16, and 17*

As discussed above, we find that Petitioner has shown sufficiently that the references teach each limitation of claims 3, 4, 16, and 17. *See supra* § II.B.1. We also find that Petitioner has shown there would have been a rationale to combine the references. *See supra* § II.B.2. Although Patent Owner presents evidence of secondary considerations, we find that Patent Owner has not sufficiently established a nexus between its evidence of long-felt need or licensing and the claimed combination of claims 3, 4, 16, and 17. *See supra* § II.B.3. We, therefore, accord that evidence no weight.

Weighing all four *Graham* factors, we determine that Petitioner has shown by a preponderance of the evidence that claims 3, 4, 16, and 17 would have been obvious over the combination of Parachinni, JP-Shimano, and Hattan.

C. OBVIOUSNESS OF CLAIMS 1–6 AND 13–19 OVER PARACHINNI, JP-SHIMANO, NAGANO, AND HATTAN

Petitioner argues that claims 1, 2, 5, 6, 13–15, 18, and 19 are rendered obvious over Parachinni, JP-Shimano, and Nagano, and claims 3, 4, 16, and

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Nonetheless, we do not consider whether or not a presumption of nexus applies to claims 3, 4, 16, and 17 of the '027 patent here, because Patent Owner does not argue that a presumption of nexus should apply on remand. *See generally* PO Br., Remand Reply. Moreover, the claims here are different for two reasons: they recite “75 percent” axial fill and they include the outboard offset limitations of the independent claims. As we found above, Patent Owner has not shown a nexus, or at least a very strong one, between the X-Sync chainring and the offset limitations of the independent claims. Moreover, there has been no attempt, on this record, to show on remand a nexus between the 75 percent axial fill limitation and the X-Sync chainring.

17 are rendered obvious over Parachinni, JP-Shimano, Nagano, and Hattan. Pet. 63–88. We have determined that each of the claims challenged in these grounds to be unpatentable over Parachinni, JP-Shimano, and Hattan. *See supra* §§ II.A–B. Therefore, we need not determine whether the same claims are additionally unpatentable based on Parachinni, JP-Shimano, Nagano, and Hattan. *See Boston Scientific Scimed, Inc. v. Cook Group Inc.*, 809 F. App’x 984, 990 (Fed. Cir. 2020) (rejecting argument that it is improper for the Board to decline to address a petitioner’s alternative grounds with respect to claims it found unpatentable on other grounds, and determining that “the Board need not address issues that are not necessary to the resolution of the proceeding”); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (explaining that an administrative agency “is at perfect liberty” to reach a decision based on a single dispositive issue because doing so “can not only save the parties, the [agency], and [the reviewing] court unnecessary cost and effort, it can greatly ease the burden on [the agency] faced with a . . . proceeding involving numerous complex issues and required by statute to reach its conclusion within rigid time limits.”).

### III. CONCLUSION

For the reasons expressed above, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–6 and 13–19 are unpatentable. These findings are summarized in the table below.<sup>8</sup>

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<sup>8</sup> Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner*



<b>Claims</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/ Basis</b>	<b>Claims Shown Unpatentable</b>	<b>Claims Not Shown Unpatentable</b>
1, 2, 5, 6, 13–15, 18, 19	103(a)	Parachinni, JP-Shimano	1, 2, 5, 6, 13– 15, 18, 19	
3, 4, 16, 17	103(a)	Parachinni, JP-Shimano, Hattan	3, 4, 16, 17	

#### IV. ORDER

Accordingly, it is:

ORDERED that claims 1–6 and 13–19 of U.S. Patent No. 9,182,027 B2 have been shown to be unpatentable; and

FURTHER ORDERED that parties to the proceeding seeking judicial review of this Final Written Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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*Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).*

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