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571-272-7822

Paper 10
Entered: September 10, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NINTENDO CO., LTD., and
NINTENDO OF AMERICA INC.,
Petitioner,

v.

AMERICAN GNC CORPORATION,
Patent Owner.

IPR2024-00667
Patent 6,508,122 B1

Before BRIAN J. McNAMARA, SCOTT A. DANIELS, and
LISA L. TSANG, *Administrative Patent Judges.*

McNAMARA, *Administrative Patent Judge*.

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

I. INTRODUCTION

Nintendo Co., Ltd. and Nintendo of America Inc. (collectively, "Petitioner") filed a petition, Paper 3 ("Petition" or "Pet."), to institute an *inter partes* review ("IPR") of claims 1 and 3 (the "challenged claims") of U.S. Patent No. 6,508,122 B1 ("the '122 patent"). 35 U.S.C. § 311. American GNC Corp. ("Patent Owner") filed a Preliminary Response, Paper 9 ("Prelim. Resp."), contending that the Petition should be denied as to all challenged claims. We have jurisdiction under 35 U.S.C. § 6. 35 U.S.C. § 314 provides that an *inter partes* review may not be instituted unless the information presented in the Petition "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."

A decision to institute under § 314 may not institute on fewer than all claims challenged in the petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018). In addition, per Board practice, if the Board institutes trial, it will institute "on all of the challenged claims and on all grounds of unpatentability asserted for each claim." *See* 37 C.F.R. § 42.108(a).

Having considered the arguments and the associated evidence presented in the Petition and the Preliminary Response, for the reasons described below, we institute *inter partes* review.

II. REAL PARTIES IN INTEREST

The Petition identifies Nintendo Co., Ltd. and Nintendo of America Inc. as Petitioner's real parties-in-interest. Pet. 1. Patent Owner identifies American GNC Corporation as its real party-in-interest. Paper 3, 2.

III. RELATED MATTERS

The parties state that the ’122 patent is the subject of the following pending litigation involving Petitioner: asserted in the following litigation: *American GNC Corporation v. Nintendo Co.*, No. 2:23-cv-00302-TL (W.D. Wash.). Pet. 1; Paper 3, 2.

IV. EXERCISE OF DISCRETION

A. Discretion Under 35 U.S.C. § 314(a)

Patent Owner contends that we should exercise discretion to deny institution for the reasons addressed below. *See* Prelim. Resp. 7–25.

1. *Patent Owner’s Hindsight Allegation*

Patent Owner argues we should exercise discretion to deny the Petition because it is based on impermissible hindsight. Prelim. Resp. 9–13. According to Patent Owner, Petitioner relies on the disclosure of the ’122 patent to explain its allegations of obviousness, and improperly relies on the patent’s disclosure to explain its challenge grounds. *Id.* at 9–10. Patent Owner further contends that Petitioner’s arguments about the rationale to combine the references is almost exclusively limited to description of what the references disclose. *Id.* at 10–11.

Patent Owner does not identify any knowledge Petitioner relies upon that was gleaned only from the ’122 patent’s disclosure, and which was not otherwise within the level of ordinary skill at the time of the invention. *See In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971) (“Any judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant’s disclosure, such a reconstruction is proper.”).

We acknowledge Patent Owner's generalized allegations, but, based on our review of the Petition, the cited art, and related references of record, we are not persuaded that Petitioner relies on knowledge gained from the '122 patent. Where appropriate, we address specific hindsight issues in our analysis of Petitioner's challenges.

2. *Patent Owner's Arguments That The Petition Is Mere Attorney Argument*

Based on our review of the Petition and Dr. Young's Declaration, we disagree with Patent Owner that we should not accord the declaration any weight because "the opinions of Dr. Young are merely attorney argument from the Petition affixed with the signature and CV of Dr. Young," or because parts of Dr. Young's testimony are reproduced verbatim in the Petition. *See* Prelim. Resp. 13–20. Patent Owner's comparison of the language in Dr. Young's Declaration with "template" language used by another expert in a different case involving the same counsel and Petitioner concerns mere introductory phrases about general principles and topics addressed by the experts. i.e., analogous art and reasons to combine references. *Id.* at 17.

The Petition cites Dr. Young's testimony as evidence to support contentions in the Petition; overlap or similarity results from the Petition citing Dr. Young's Declaration without deviating from the matters to which Dr. Young testifies. In addition, the Petition and Dr. Young's Declaration include detailed explanations and analyses that are supported by the prior art of record. *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (PTAB Aug. 24, 2022) (precedential) (the critical inquiry is whether a declaration is conclusory and unsupported and whether it discloses underlying facts or data on which the opinion is based) (quoting 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.")). We consider declaration testimony repeated in the Petition where that testimony appropriately supports contentions in the Petition.

3. *Patent Owner's Arguments That The Petition Is Time Barred*

Patent Owner contends the Petition is time-barred under 35 U.S.C. § 315(b) because (1) STMicroelectronics N.V. and STMicroelectronics S.R.l. (collectively, "STMicro") were served in 2020 with a complaint alleging infringement of patents including the '122 patent; and (2) STMicro is a unnamed real party-in-interest ("RPI") to this proceeding. Prelim. Resp. 21–25. Specifically, Patent Owner contends that STMicro and Petitioner have a "contractual supplier relationship," and Patent Owner's infringement litigation against Petitioner implicates STMicro's products. *Id.* at 20 (citing Ex. 2007 (Complaint for Patent Infringement) ¶¶ 46–56, 63–74). Patent Owner further alleges that STMicro and Petitioner "have a long relationship that includes obligations relevant to the precedential *Ventex*[1] analysis," STMicro would benefit from *inter partes* review, and Petitioner is herein representing STMicro's interests. *Id.* at 23–24 (citing Ex. 2015, 8, 12; Ex. 2014 (STMicro's Responses and Objections to American GNC Corp.'s Subpoena to Testify at a Deposition and to Produce Documents), 1–2).[2]

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[1] *Ventex Co., Ltd. v. Columbia Sportswear N. Am., Inc.*, IPR2017-00651, Paper 152 (PTAB Jan. 24, 2019) (precedential) ("*Ventex*").

[2] Patent Owner has not submitted an Exhibit 2015, but represents that a document exists to support Patent Owner's arguments regarding the long relationship and obligations between Petitioner and STMicro. Prelim.

A petition for *inter partes* review may be considered only if, among other things, it "identifies all real parties in interest." 35 U.S.C. § 312(a)(2). "[T]he IPR petitioner bears the burden of persuasion to demonstrate that its petitions are not time-barred under § 315(b) based on a complaint served on a real party in interest more than a year earlier." *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242 (Fed. Cir. 2018). However, "an IPR petitioner's initial identification of the real parties in interest should be accepted unless and until disputed by a patent owner," who, in turn, "must produce *some* evidence that tends to show that a particular third party should be named a real party in interest." *Id.* at 1242, 1244 (footnote omitted).

"[T]he two questions lying at [the] heart [of the real party in interest inquiry] are whether a non-party 'desires review of the patent' and whether a petition has been filed at a non-party's 'behest.'" *RPX Corp. v. Applications in Internet Time, LLC*, IPR2015-01750, Paper 128 at 26–27 (PTAB Oct. 2, 2020) (precedential) (citing *Applications in Internet Time, LLC v. RPX Corp.*, 897 F.3d 1336, 1351 (Fed. Cir. 2018) ("*AIT*")); *see also Wi-Fi One, LLC v. Broadcom Corp.*, 887 F.3d 1329, 1336 (Fed. Cir. 2018).

Whether a non-party is a real party in interest is a "highly fact-dependent question." *Ventex*, Paper 152 at 6 (quoting Trial Practice Guide, 77 Fed. Reg. 48756, 48759 (Aug. 14, 2012)); *see also* Patent Trial and Appeal Board Consolidated Trial Practice Guide 13 (Nov. 2019) ("Whether a party who is not a named participant in a given proceeding nonetheless constitutes a 'real party-in-interest' or 'privy' to that proceeding is a highly

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Resp. 23 n.4. Patent Owner also avers that Petitioner did not agree to a joint motion to file that document under seal in this proceeding. *Id.*

fact-dependent question.”).[3] We must ask “who, from a ‘practical and equitable’ standpoint, will benefit from the redress” that the *inter partes* review might provide. *AIT*, 897 F.3d at 1349 (quoting Trial Practice Guide, 77 Fed. Reg. at 48,759); *see also* Consolidated Trial Practice Guide 14–15. In addition, we must “probe the extent to which [the nonparty] . . . has an interest in and will benefit from [Petitioner]’s actions, and inquire whether [Petitioner] can be said to be representing [the nonparty’s] interest after examining its relationship with [the nonparty].” *AIT*, 897 F.3d at 1353; *see also Ventex*, Paper 152 at 8.

Patent Owner must produce some evidence to place in dispute the issue of whether an unnamed real party in interest renders the petition time-barred, but Petitioner bears the burden of persuasion on this issue. *See Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242–44 (Fed. Cir. 2018) (holding that an “IPR petitioner bears the ultimate burden of persuasion to show that its petitions are not time-barred under § 315(b) based on a complaint served on an alleged real party in interest.”). Based on the arguments and evidence of record, we determine that Patent Owner has not produced sufficient evidence to place in dispute the issue of whether STMicro should be named a real party in interest to this proceeding. Rather, at this stage, Patent Owner’s contentions regarding a relationship between Petitioner and STMicro constitute mere attorney argument because they are unsupported by any evidence of record. *See* Prelim. Resp. 21–25. For example, beyond self-serving allegations in Patent Owner’s district court complaint against Petitioner for infringement (*see* Ex. 2007 ¶¶ 46–56, 63–

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[3] Available at www.uspto.gov/sites/default/files/documents/tpgnov.pdf?MURL=TrialPracticeGuideConsolidated.

74, *cited in* Prelim. Resp. 22), we are not apprised of any evidence to support the argument that STMicro is a supplier of Petitioner. To the contrary, Patent Owner's evidence demonstrates that STMicro repeatedly asserts in the district court litigation that "ST[Micro] did not design, manufacture, or sell any STMicro IMU Components to [Petitioner]." *See* Ex. 2014, 13–18. Moreover, the evidence shows that STMicro does not acknowledge the existence of an indemnification agreement or any communications between it and Petitioner relating to the litigation, Patent Owner, or the '648 patent. *See id.* at 18–20, 24–25.

At best, Patent Owner's evidence and arguments at this juncture establish only that Patent Owner previously filed a complaint against STMicro, asserting infringement of patents including the '122 patent (*see generally* Ex. 2012); and that Patent Owner served a subpoena to compel STMicro to testify and produce documents in Patent Owner's infringement suit against Petitioner (*see generally* Ex. 2014). The record before us is insufficient to demonstrate a relationship between Petitioner and STMicro sufficient to show that STMicro is a real party in interest. *See Worlds*, 903 F.3d at 1244.

V. THE '122 PATENT

The '122 patent concerns a microelectromechanical (MEMS) system to measure the angular rate of a carrier. Ex. 1001, 1:14–17. The system includes an angular rate sensor unit, microelectronic circuitry, and signal processing designed to obtain accurate, sensitive, stable angular rate measurement of the carrier under dynamic environments. *Id.* at 1:17–21. As shown in Figure 1, reproduced below, the system includes angular rate sensor unit 10, central circuitry 20, and digital signal processing system 30. *Id.* at 1:17–21, 4:26–48.

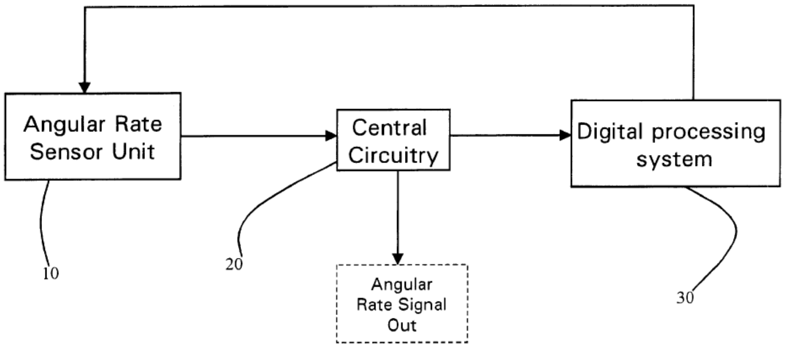

Figure 1

Ex. 1001, Fig. 1. Digital processing system 30 feeds back drive signals (dither drive signals) to angular rate sensor unit 10. *Id.* at 4:45–48.

The system's operation, based on the Coriolis force observed when an angular rate is applied to a translating body, relies on a tuning fork that uses closed-loop capacitive sensing. *Id.* at 3:53–56. The system picks off a signal generated by an oscillating micromachined mass as it deviates from its plane of oscillation under the Coriolis effect when the oscillating micromachined mass is submitted to a rotation about an access perpendicular to the plane of oscillation. *Id.* at 3:49–62.

Figure 2 of the '122 patent, reproduced below, shows a configuration of a micromechanical sensor unit with two suspended vibration devices that vibrate (dither) in opposite motion directions. Ex. 1001, 4:1–2, 4:65–5:8.

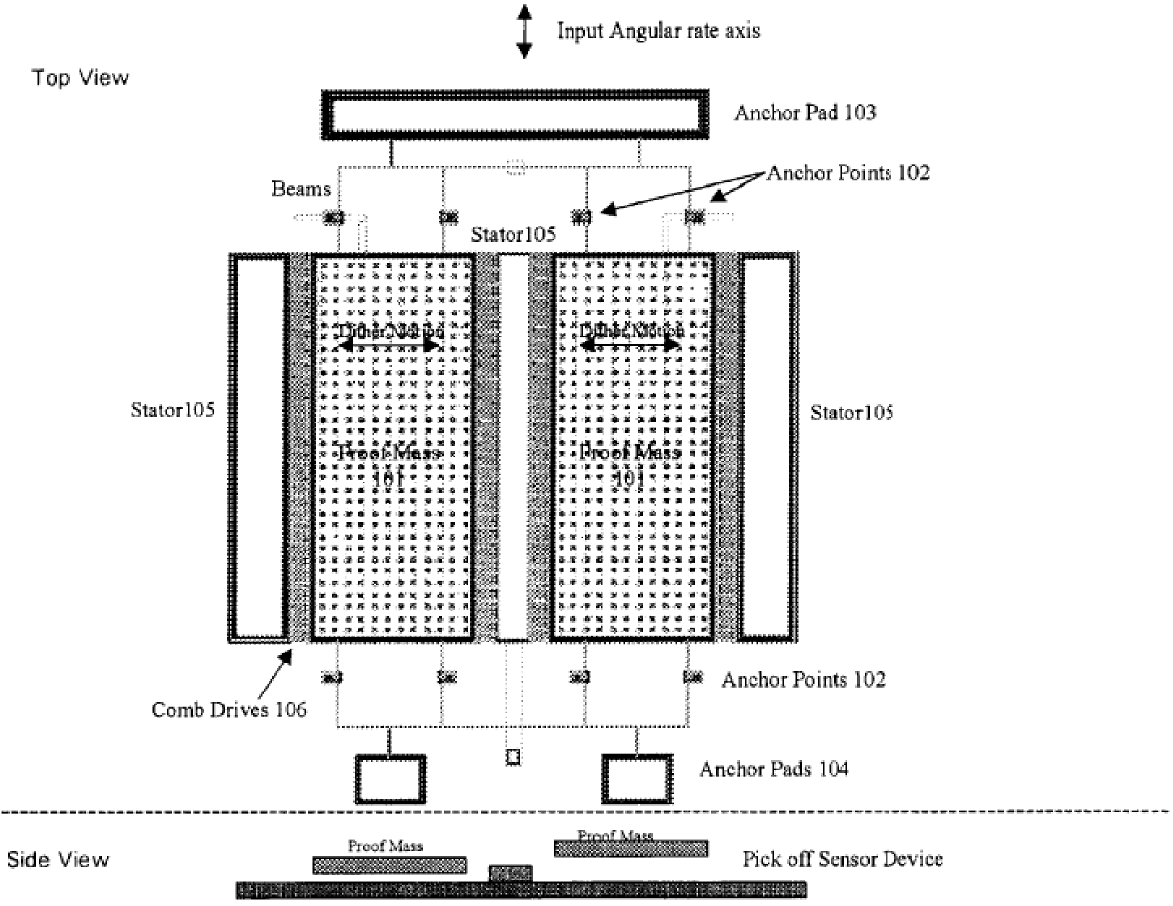

Figure 2

Ex. 1001, Fig. 2. Electric comb drives 106 controlled by stators 105 drive vibrating (dither) proof masses 101 in opposite directions, such that the dither motion is in a plane of the wafer. *Id.* at 5:8–10, 5:48–67. The proof masses 101 are attached with supporting beam springs to eight anchor points 102 that are connected to a silicon substrate 102. *Id.* at 5:49–55. When an angular rate is applied to the MEMS device about the input axis (which is in the plane of the tines), the Coriolis force causes the proof masses to oscillate out of the plane in an up-and-down motion whose amplitude is proportional to the input angular rate. *Id.* at 5:10–16. Capacitive pickoff plates underneath the proof masses detect and measure the perpendicular motion by measuring a change in capacitance. *Id.* at 5:15–22.

The comb drives move the masses out of phase with respect to each other so they respond to the Coriolis force in opposite directions. *Id.* at 5:17–19. When there is an angular rate in the gyro input axis, one proof mass moves toward its electrode and the other moves away from its electrode under the Coriolis force, so two sensor capacitors formed by the pairs of proof masses and sensor electrodes can be used to form a differential measurement circuit. *Id.* at 6:8–14.

The change in capacitance caused by the motion of the mass in response to a Coriolis force is determined by measuring the current flow from a high frequency signal (100 kHz–1 MHz). *Id.* at 5: 34 – 38. The sensitivity of the device depends on the amplitude of the dither motion, frequency of the oscillation, the mass of the device, and the detection method. *Id.* at 5:22 – 24. Sensitivity is proportional to the product of the velocity of the device and the angular rate; sensitivity is improved by maximizing the amplitude and frequency of oscillation by running the device at the resonant frequency of proof mass supporting springs (typically between 1000 Hz and 3000 Hz) that attach the proof masses to anchor points. *Id.* at 5:24 – 33, 5:49–52.

Figure 6 of the ’122 patent, reproduced below, is a diagram of the central circuitry. Ex. 1001, 4:10.

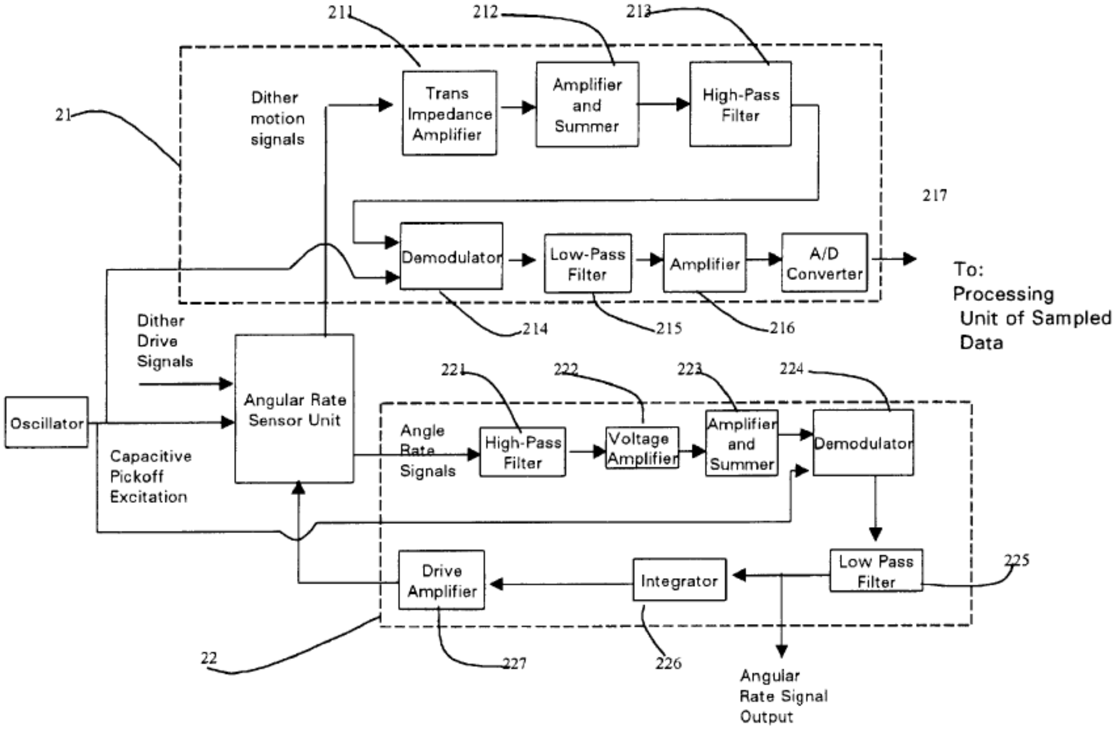

Figure 6

Ex. 1001, Fig. 6. Figure 6 shows dither motion control circuitry 21 and signal loop control circuitry 22. As shown in Figure 6 above, dither drive signals and signals from the oscillator are applied to the angular rate sensor unit; capacitive pickoff excitation signals are applied to demodulators in dither motion control circuitry 21 and signal loop control circuitry 22.

Dither motion control circuitry 21 includes transimpedance amplifier 211 that reduces the output impedance of dither signals it receives from the angular rate sensor unit and generates two A/C voltage dither displacement signals that represent the displacement between the inertial elements and the anchor combs. *Id.* at 7:66–8:6. Amplifier-summer 212 generates a dither displacement differential signal that passes through high pass filter 213, which removes residual dither drive signals and noise. *Id.* at 8:7–18. Demodulator 214 receives the capacitive pickoff signals as phase reference signals from the oscillator and extracts the in-phase portion of the filtered differential dither displacement signal to produce an inertial element displacement signal with a bandwidth of less than 3Khz that is amplified and converted to a digitized low frequency inertial element displacement signal as a digital sampled signal. *Id.* at 8:19–39.

In angle rate loop circuit 22, demodulator 224 combines amplified and filtered angle rate signals from the angle rate senor unit with oscillator reference signals to form an in-phase differential angle rate signal that is low pass filtered and provided to integrator 226, which forms a displacement restoring signal without an offset. Ex. 1001, 8:40–67. Drive amplifier 227 amplifies the displacement restoring signal to the drive angular rate sensor unit. *Id.* at 9:1–4.

Figure 7 of the '122 patent, reproduced below, illustrates the digital signal processing system. Ex. 1001, 4:11, 8:5.

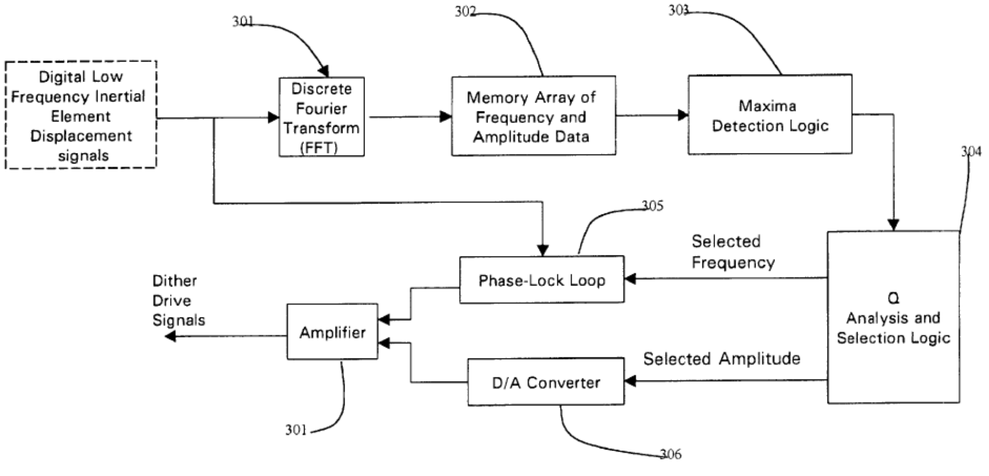

Figure 7

Ex. 1001, Fig. 7. The digital signal processing system performs a discrete Fast Fourier Transform 301 on sampled digitized low frequency inertial element displacement signals received from dither motion control circuitry 21 to form amplitude data with the frequency spectrum of the input inertial element displacement signal. *Id.* at 9:7–12. Memory array 302 and maximum detection module 303 choose frequencies with the largest amplitudes in the frequency spectrum and provide a signal to Q analysis and selection logic 304. *Id.* at 9:3:13–3:23. Q analysis and selection logic 304 provides a frequency signal to phase locked loop 305, which acts as a low pass filter to remove noise, and a corresponding amplitude signal to D/A converter 306 of a dither drive signal that is then amplified in amplifier 307. *Id.* at 9:23–37.

VI. ILLUSTRATIVE CLAIM

The challenged claims are reproduced below with the paragraph designations used in the Petition:

> 1(pre). A microelectromechanical system (MEMS) for measuring angular rate of a carrier, comprising:
> (a) an angular rate sensor unit receiving dither driver signals, capacitive pickoff excitation signals and a displacement restoring signal and outputting angle rate signals in response to motion of said carrier and dither motion signals;
> (b) a central circuitry receiving said angle rate signals in response to said motion of said carrier and said dither motion signals and outputting angular rate signals and digital low frequency inertial element displacement signals, and
> (c) a digital signal processing system analyzing said digital low frequency inertial element displacement signals and feeding back said dither driver signals to said angular rate sensor unit.
>
> 3. The microelectromechanical System, as recited in claim 1, wherein said central circuitry comprises a dither motion control circuitry and an angle rate signal loop circuitry.

VII. ASSERTED GROUNDS

Petitioner asserts that claims 1 and 3 would have been unpatentable on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)
1, 3	103	Fujiyoshi,[4] Kumar,[5] Cox,[6] Townsend[7]
1,3	103	Mitamura,[8] Townsend

In support of its arguments, Petitioner also cites testimony from the Declaration of Dr. Darrin Young (Ex. 1002, Young Decl.).

In support of its arguments, Patent Owner cites testimony from the Declaration of Professor Lawrence E. Larson (Ex. 2008, Larson Decl.)

VIII. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner describes a person of ordinary skill in the art ("POSITA" or "ordinarily skilled artisan") as having "a bachelor's degree in electrical engineering or similar degree, with two to three years of practical experience designing and/or implementing systems that include sensors for measuring movement, including rotation" or "more formal education and less practical experience, or vice versa." Pet. 5 (citing Ex. 1002, Young Decl. ¶¶ 12–15).

Patent Owner states that "[a] person of ordinary skill in the art with respect to the '122 Patent would have at least a Master's Degree in Electrical

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[4] U.S. Patent No. 5,945,599, filed Dec. 12, 1997, issued Aug. 31, 1999 (Ex. 1003)

[5] U.S. Patent No. 5,604,311, filed June 7, 1995, issued Feb. 18, 1997 (Ex. 1005)

[6] U.S. Patent No. 3,838,346, filed Nov. 1, 1973, issued Sept. 24, 1974 (Ex. 1006)

[7] International Patent Publication No. WO 99/14,557, filed Sept. 17, 1998, publ. Mar. 25, 2999 (Ex. 1004)

[8] Japanese Patent Appl. Publication No. 9[1997]-42973, filed Aug. 1, 1995, published Feb. 14, 1997 (Ex. 1007)

or Electronics Engineering, and approximately five years of relevant experience in the development of control systems for inertial navigation, MEMS semiconductor processing, and analog circuit design." Prelim. Resp. 36 (citing Ex. 2008, Larson Decl. ¶ 57).

The level of ordinary skill in the art usually is evidenced by the references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978). For purposes of this Decision, we apply the higher level of ordinary skill proposed by Patent Owner as commensurate with the subject matter of the '122 patent and the references. Although it is not clear that the parties' disagreement as to the level of ordinary skill in the art is material to this Decision, applying Patent Owner's description of a person of ordinary skill in the art suggests that such a person would have a deeper understanding of the technology and be able to infer more from the teachings of the references than one having the skill set proposed by Petitioner. The parties may want to address this issue further at trial.

IX. CLAIM CONSTRUCTION

We interpret claim terms using "the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b)." 37 C.F.R. § 42.100(b) (2019). In this context, claim terms "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (citations omitted) (en banc). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Extrinsic evidence is "less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317 (citations omitted).

Any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

"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)).

Both parties agree that no claim construction is required. Pet. 6, Prelim. Resp. 35. We note, however, that claim 1 recites the following three elements: (i) "an angular rate sensor unit" that receives certain signals and outputs other signals, (ii) "central circuitry" that receives certain signals and outputs other signals, and (iii) "a digital signal processing system" that analyzes certain signals and feeds back certain signals to the angular rate sensor unit. Ex. 1001, 9:39 – 54. Claim 3 depends from claim 1 and recites additional "control circuitry" and "angle rate signal loop circuitry." Although neither claim 1 nor claim 3 recite any further structure and both claims employ nonce words, such as "unit," "system," and "circuitry" to carry out recited functions, neither party proposes that any claim term be construed as a means-plus-function limitation.

Well-known nonce words can operate as a substitute for "means" in the context of § 112, para. 6. A claim that does not include the term "means" creates a rebuttable presumption that the claim is not written in means-plus-function format; this presumption may be overcome if the claim limitation "fails to recite sufficiently definite structure" or recites a "function without reciting sufficient structure for performing that function. *See Lighting World, Inc. v. Birchwood Lighting, Inc.*, 382 F.3d 1354, 1359 (Fed. Cir. 2004). Generic terms such as "mechanism," "element," "device," and other nonce words that reflect nothing more than verbal constructs may be used in a claim in a manner that is tantamount to using the word "means" because they "typically do not connote sufficiently definite structure" and therefore may invoke § 112, para. 6. *Williamson v. Citrix OnLine, LLC*, 792 Fed 1339, 1348–1359 (Fed. Cir. 2015).

At this stage of the proceeding, we do not explicitly construe any term or limit the claims to the structure disclosed in the Specification or its equivalent; we further consider the implications of the claim language in our substantive analysis below.

X. ANALYSIS

A. Introduction

"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")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in inter partes review).

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *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 Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (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")); *see In re Warsaw Orthopedic, Inc.*, 832 F.3d 1327, 1333 (Fed. Cir. 2016) (citing *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1360 (Fed. Cir. 2006)).

An obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418; *accord In re Translogic Tech., Inc.*, 504 F.3d 1249, 1259 (Fed. Cir. 2007). Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Instead, Petitioner must articulate a reason why a person of ordinary skill in the art would have combined the prior art references. *In re NuVasive*, 842 F.3d 1376, 1382 (Fed. Cir. 2016).

A reason to combine or modify the prior art may be found explicitly or implicitly in market forces; design incentives; the "interrelated teachings of multiple patents"; "any need or problem known in the field of endeavor at the time of invention and addressed by the patent"; and the background knowledge, creativity, and common sense of the person of ordinary skill. *Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328–29 (Fed. Cir. 2009) (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–21 (2007)).

In determining whether a claim is obvious in light of the prior art, when in evidence, we consider any relevant objective evidence of non-obviousness. *See Graham*, 383 U.S. at 17. Notwithstanding what the teachings of the prior art would have suggested to one of ordinary skill in the art at the time of the invention, the totality of the evidence submitted, including objective evidence of non-obviousness, may lead to a conclusion that the challenged claims would not have been obvious to one of ordinary skill. *In re Piasecki*, 745 F.2d 1468, 1471–72 (Fed. Cir. 1984). At this stage of the proceeding Patent Owner does not present evidence of such objective considerations.

We analyze the asserted grounds of unpatentability in accordance with these principles to determine whether Petitioner has met its burden to establish a reasonable likelihood of success at trial.

B. Petitioner's Contentions That Claims 1 and 3 Are Obvious Over Fujiyoshi in View of Kumar, Cox, and Townsend

1. *Fujiyoshi – Exhibit 1003*

Fujiyoshi discloses "a resonance type angular velocity sensor which excites a mass portion corresponding to an inertia mass, and detects an angular velocity on the basis of a displacement of the mass portion due to a Coriolis force generated in a direction perpendicular to both directions of an exciting direction of the mass portion and a rotating axis of the angular velocity sensor." Ex. 1003, 1:10 – 16. Figures 1A, 1B, and 1C of Fujiyoshi, reproduced below, show the structure of the resonance type vibrating component used in a conventional angular velocity sensor. Ex. 1001, 1: – 20.

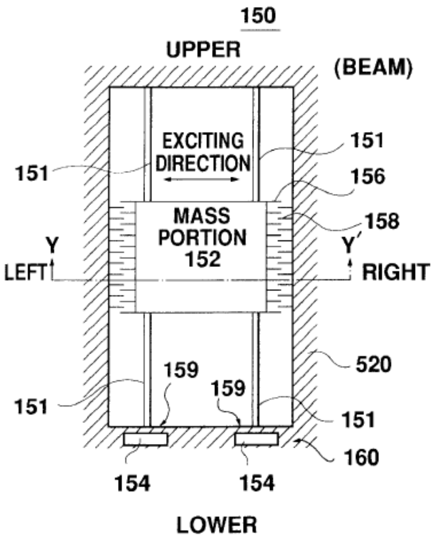

Fig. 1A
PRIOR ART

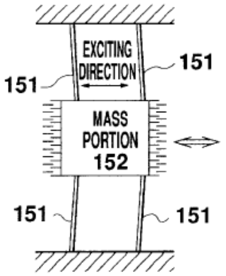

Fig. 1B
PRIOR ART

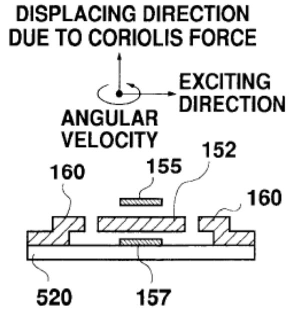

Fig. 1C
PRIOR ART

Id. at Figs. 1A, 1B, 1C. In vibrating component 150, plate like mass portion 152 corresponds to an inertia mass, supported in the vertical direction by two beams 151 having an end fixed to frame portion 160 of silicon substrate 152. Comb electrodes 156 are formed at the side portions in the horizontal direction of the drawing of mass portion 152; comb electrodes 158 are formed in frame portion 160, so as to mesh with and oppose comb electrodes 156. *Id.* at 1:24 – 29. When an alternating current is applied to an exciting conductive layer (not shown), an electrostatic force generated between comb electrodes 156 and 158 displaces mass portion 152 in the lateral direction causing vibration of mass portion 152. *Id.* at 1:30 – 37, Fig. 1B. During lateral excitation of mass portion 152, when angular velocity has a rotational axis in the horizontal direction of the drawing, a Coriolis force is generated in a direction perpendicular to the exciting direction and in the rotating axis direction; the Coriolis force acts to displace mass portion 152. *Id.* at 1:37–45. Figure 1C shows displacement detecting electrodes 155, 177 that detect displacement by a capacity detecting method as a measure of the angular velocity. *Id.* at 1:47–49. As the operating direction of the Coriolis force with respect to mass portion 152 is in the thickness direction of the substrate, Fujiyoshi sought an alternative to conventional approaches using an upper electrode, a mass portion and a lower electrode and to develop a structure that allows the Coriolis force to be generated in a plane direction of the substrate to simplify the manufacturing process. *Id.* at 1:60 – 2:10.

Figure 3 of Fujiyoshi, reproduced below, is a plan view of an angular velocity sensor in accordance with a first embodiment in which a mass portion is supported on a mass excitation supporting beam and mass displacement supporting beam so as to float on a substrate surface.
Ex. 1003, 11:51 – 63.

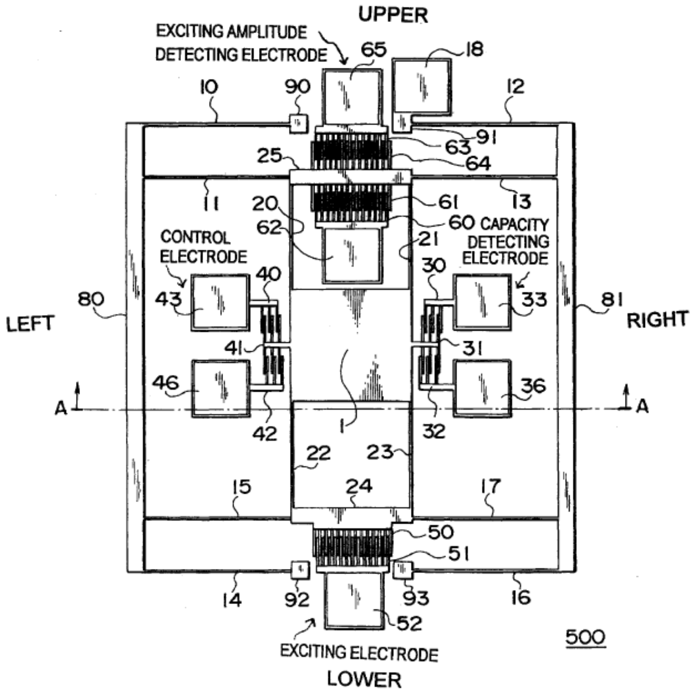

Fig. 3

Id. at Fig. 3. In angular sensor 500, an alternating voltage is applied to comb exciting electrode 51 and electrode 50, causing mass portion 1 to vibrate up and down vertically from the perspective shown in Figure 3. Ex. 1002, Young Decl. ¶¶ 57–58 (citing Ex. 1003, 12:29–12:44). Comb electrodes 60 and 63 detect an amplitude of mass portion 1's vertical motion based on a change in the capacitance between electrodes 61 and 64 and comb detecting electrodes 60 and 63, respectively. *Id.* ¶ 59 (citing Ex. 1003, 12:45–64). When undergoing angular velocity, mass portion 1 moves horizontally due to the Coriolis force and capacity detecting electrodes 30 and 32 detect the displacement based on the differential output of the changing capacitance of the capacitors formed by electrodes 30 and 32 and projecting electrode 31. *Id.* ¶ 60 (citing Ex. 1003, 13:9–13, 13:25–30). An alternating voltage applied through control electrodes 40, 42 creates an electrostatic force between electrodes 41, 42 and projecting electrode 41 that causes the detected displacement of mass portion 1 to be zero. *Id.* ¶ 61 (citng Ex. 1003, 13:13–21). The displacement amount of mass portion 1 is calculated based on the control amount necessary to make displacement of the mass portion zero. *Id.* (citing Ex. 1003, 13–24). Fujiyoshi employs feedback technology by forming a feedback loop that restricts the motion of mass portion 1 to the adjacent portion of the zero point. *Id.* (citing Ex. 1003, 16:33–36).

A second embodiment shown in Figure 8 enables adjusting the frequency difference between the exciting frequency of mass portion 1 and the vibrating frequency in the Coriolis force detecting direction via additional electrodes 70 – 77, such that "either of the exciting frequency of the mass portion 1 or the vibrating frequency to the Coriolis force detecting direction can be selectively adjusted." Ex. 1003, 17:34–21:60.

2. *Kumar – Exhibit 1005*

Kumar "relates to rotation sensors, and more particularly to a rotation sensor and sensing method that utilizes the Coriolis effect" and "can be manufactured in bulk using inexpensive photolithographic techniques." Ex. 1005, 1:7–9, 1:57–58. In a preferred embodiment,

> three members with substantially equal resonance frequencies are mechanically coupled to form an "I"-shaped structure. The vertically extending member is vibrated along a first direction at its resonance frequency. The "horizontally" extending members are supported so that they will only vibrate along an orthogonal direction. Orthogonal vibrational modes are coupled to the horizontally extending members when the structure is rotated about a rotational axis that is orthogonal to both vibration directions.

Id. at 2:3–10. "The structure is preferably coated with an electrically conductive material so that vibrations can be induced in the vertically extending member with a capacitive forcer electrode, and sensed in the vertically and horizontally extending members with capacitive pickoff electrodes." *Id.* at 2:16–21.

Figures 2a and 2b, reproduced side-by-side below, show a combined elevational view and block diagram of a preferred embodiment (Figure 2a on the left) and a sectional view that illustrates operation of a forcer electrode (Figure 2b on the right). Ex. 1005, 2:31–32, 3:50–51.

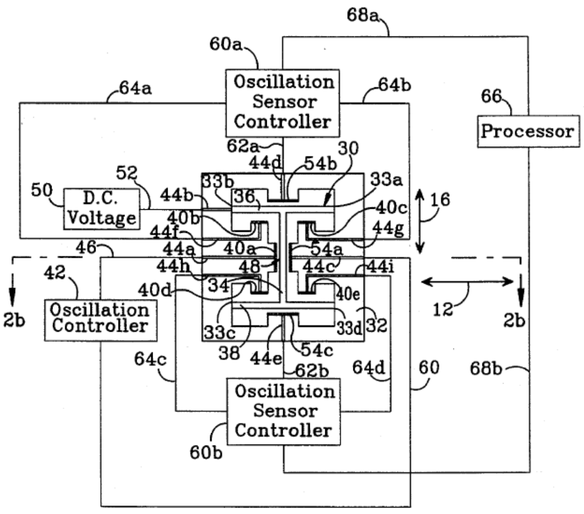

FIG.2a

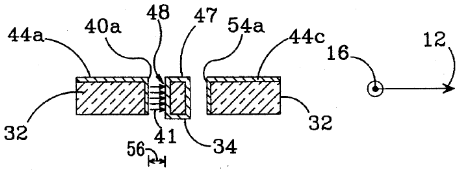

FIG.2b

Id. at Figs. 2a, 2b. In Figure 2a, a DC bias is applied to the entire electrically conductive structure 30 and oscillation controller 42 applies a time-varying voltage to capacitive forcer electrode 40a inducing oscillations in central member 34 along X-direction 12. Ex. 1005, 2:3–12, 3:42–49. Central member 34 is coated with a layer of electrically conductive material 47, such that forcer electrode 40a and an adjacent area 48 of the central member 34 form a parallel plate capacitor. *Id.* at 3:50–54. The time varying voltage applied to forcer electrode 40a results in a time varying electric field between force electrode 40a and central member 34 causing central member 34 to flex in X-direction 12. *Id.* at 3:54–58. Capacitive pickoff electrode 54a senses the displacement of central member 34 and provides feedback to oscillation controller 42. *Id.* at 3:58–62. Capacitive pickoff electrode 54a and central member 34 form a parallel plate capacitor whose capacitance varies with variations in the distance between pickoff electrode 54a and central member, such that with a DC voltage present on conductive layer 47 of central member 34, the varying capacitance causes a variation in the electrical signal sent to the oscillation controller 42.

3. *Townsend – Exhibit 1004*

Townsend discloses a "digital control system for vibrating structure gyroscope of the kid using a vibrating structure". Ex. 1004, 1.[9] Townsend notes that "[a] common features these known systems is that they are required to maintain a resonance carrier node oscillation at a natural frequency determined by the mechanical vibratory structure." *Id.* Figure 1 of Townsend illustrates a conventional analog closed loop control system with a primary excitation loop and secondary damping loop. *Id.* at 1–2. The primary excitation loop, between a primary motion detector pickoff and a primary driver, controls the amplitude of the primary pickoff signal, such that the driver excites the vibrating structure to vibrate at its natural resonant frequency. *Id.* at 2. The primary loop, which includes a filter, a voltage controlled oscillator, gain control circuit, and an amplifier, controls the amplitude of the signal at the primary pickoff means, which in effect is the amplitude of the resulting vibration, using a reference level. *Id.* at 2–4. The secondary damping loop in a typical force feedback configuration provides

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[9] Page numbers refer to the pages of the original document, not to the pages of the exhibit.

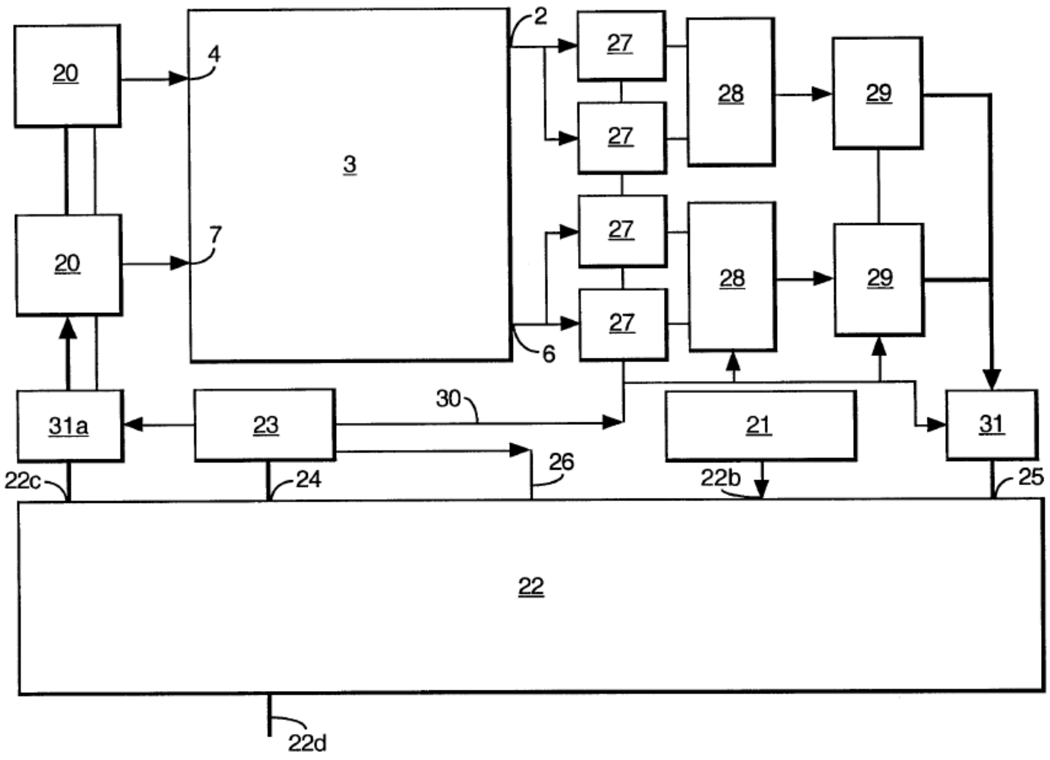
damping or the high Q rate response to achieve the required system performance. *Id.* The secondary loop includes an amplifier, a filter, and a demodulator, which outputs a direct current output signal proportional to the applied angular rate. *Id.* at 3–4. Townsend notes that conventional analog systems rely on their ability to accurately track the resonant frequency of the high Q mechanical vibrating structure and to discriminate between relative phasing between wanted and unwanted error signals, require "using precision analog electronic circuits which are notoriously difficult to specify, design and integrate into small low-cost systems." *Id.* at 2–3. Townsend also observes the modern systems require sensor outputs the digital format. *Id.* at 3.

Figure 2 of Townsend illustrates "[a] conventional sampled data system . . . which utilizes digital processing." Ex. 1004, 4. "The conventional system of Figure 2 utilizes analog-to-digital converters 19 for sampling and converting output signals respectively from the primary pickoff means 2 and secondary pickoff means 6." *Id.* Digital to analog converters 20, as well as analog to digital converters 19, are synchronized to fixed frequency crystal oscillator 21 that operates at a high frequency (14 MHz), while vibrating structure 3 of the gyroscope operates at a lower frequency (approximately 20 kHz). *Id.* As this system typically requires a 70 ns sample/conversion rate, Townsend proposes a system that operates at lower sample rates as more suitable to a vibrating structure gyro control system. *Id.* at 5. Townsend's system incorporates a digital processing unit that samples primary output signals at selected intervals, converting the signals in an analog to digital converter, digitally processing the signals and passing the processed signals to a primary drive that adjusts the frequency of the variable frequency oscillator via digital to analog converters. *Id.* at 5 – 6.

The digital control system also processes signals for the secondary drive means. *Id.* at 6.

One embodiment of Townsend is illustrated in Figure 4 reproduced below.

Fig.4.

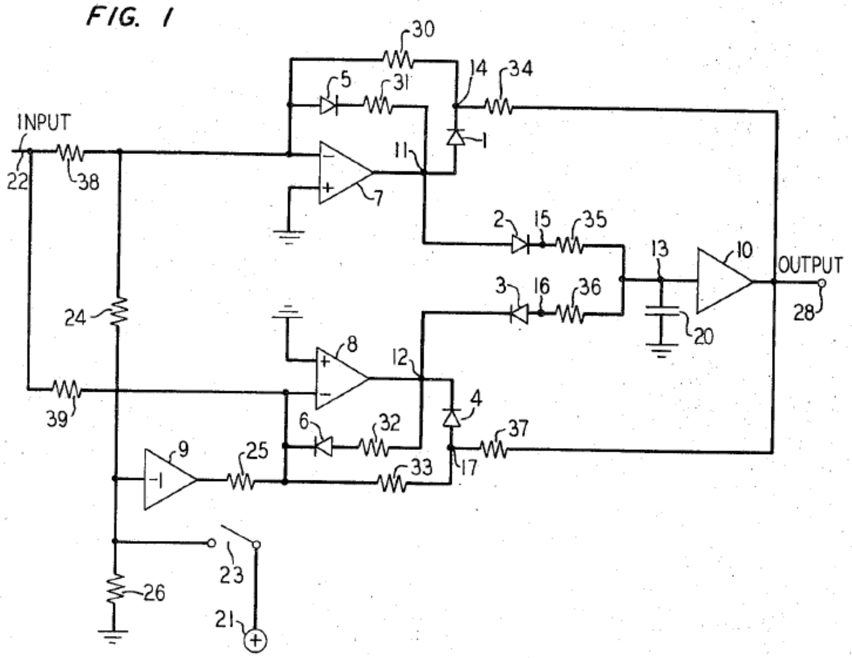


Ex. 1004, Fig. 4. In Figure 4, vibrating structure 3 outputs signals from primary pickoff means 2 and secondary pickoff means 6. *Id.* at 4, 10, 11. These pickoff signals are output to sample and hold devices 27 that "provide a high degree of noise rejection" by "averag[ing] or integrat[ing] the input waveform over the sample period." *Id.* at 12, 18. Signals from sample and hold devices 27 are output to multiplexers 28 that "select the appropriate quarter sample for conversion" and output the samples to analog-to-digital converters 29. *Id.* at 12-13. These digital signals are stored in buffer 31 and input to digital processing unit 22 via data input 25. *Id.* at 13. Data output from the digital processing unit 22 via output 22c, is stored in buffer 31a, and converted to analog signals via digital to analog converters 20. *Id.* These analog signals are fed back into vibrating structure gyro 3 via primary drive means 4 (to drive vibration) and secondary drive means 7 (for damping). *Id.* at 3.

4. *Cox – Exhibit 1006*

Cox concerns sample and hold circuits responsive to bipolar input signals used in analog-to-digital converters and data acquisition systems. Ex. 1006, 1:6–11. Recognizing the disadvantages of conventional approaches that offset input signals with d.c. to make them unipolar, Cox discloses a sample and hold circuit that "is directly responsive to a bi-polar input signal without d.c. offset and which utilizes the holding capacitor for low-pass filtering." *Id.* at 1:27–30. Figure 1 of Cox, reproduced below, is a schematic diagram of the circuit.

FIG. 1



Ex. 1006, Fig. 1. Cox discloses a tracking mode and a hold mode—the activated by closing switch 23. *Id.* at 1:52–57. In the tracking mode, voltage 13 at capacitor 20 follows voltages 11 and 12. *See id.* at 2:1–3:18. Resistors 35, 36 and holding capacitor 20 function as a low pass filter; resistors 35, 36 may be to zero where low pass filtering is not required. *Id.* at 3:51–53. Cox explains that

> low-pass filtering is often needed in analog-to digital converters to restrict the bandwidth of a sampled input signal in order to prevent aliasing of high frequency components of the sampled signal into the low frequency portion of the sampled signal spectrum. It is convenient to incorporate the RC low-pass filter into the sample and hold circuit utilizing the circuit's holding capacitor.

Id. at 3:59–68.

Closing switch 23 engages the hold mode by applying a voltage greater than the input voltage 22 at all times, so that the voltage at node 11 is always negative with respect to node 13 and the voltage at node 12 is always positive relative to the voltage at node 13. *Id.* at 4:13–21. As a result, diodes 1, 2, 3, and 4 are biased off, so that capacitor 20 cannot leak through them; capacitor 20 is electrically isolated from the rest of the circuit, such that, with unity gain amplifier 10 having a high input impedance, the capacitor holds the sample voltage. *Id.* at 4:21–33.

5. *Claim 1*

a) *Claim 1 – Preamble*

Petitioner cites Fujiyoshi as being directed to embodiments of a sensor for measuring angular rate of a carrier, e.g., a vehicle. Pet. 9–1 (citing Ex. 1003, 1:1–7; 18:10–13; Ex. 1002, Young Decl. ¶ 115). In particular, Petitioner cites Fujiyoshi's second embodiment as disclosing an angular velocity (or angular rate) sensor and Fujiyoshi's seventh embodiment as disclosing two instances of its second embodiment in a differential arrangement. *Id.* (citing Ex. 1003, 17:42 – 44, 20:28–34, 24:54–57, Fig. 8; Ex. 1003, Young Decl. ¶¶ 114, 115).

b) Limitation 1(a)

Claim limitation 1(a) recites "an angular rate sensor unit receiving dither driver signals, capacitive pickoff excitation signals and a displacement restoring signal and outputting angle rate signals in response to motion of said carrier and dither motion signals." Petitioner contends that Fujiyoshi discloses the claimed angular sensor unit (Pet. 11–12) that receives dither driver signals (*id.* at 13–15) and a displacement restoring signal (*id.* at 15–18). The Preliminary Response does not explicitly dispute Petitioner's contentions that Fuiyoshi discloses an angular sensor unit that receives dither drive signals and a displacement restoring signal. *See* Prelim. Resp. 36–51.

Petitioner also contends that Fujiyoshi discloses an angular rate sensor receiving the claimed capacitive pickoff excitation signals (*id.* at 18–23) and that an ordinarily skilled artisan would have understood it would have been obvious to use capacitive pickoff excitation signals in Fujiyoshi's system based on Kumar (*id.* at 23–29). The Preliminary Response contends that Petitioner has not demonstrated that Fujiyoshi, alone or in combination with other references discloses capacitive pickoff signals, as claimed. Prelim. Resp. 37–39.

(1) Angular rate sensor- dither drive signals

As an illustration of Fujiyoshi's angular rate sensor unit, Petitioner provides the annotated version of Figure 9 of Fujiyoshi reproduced below.

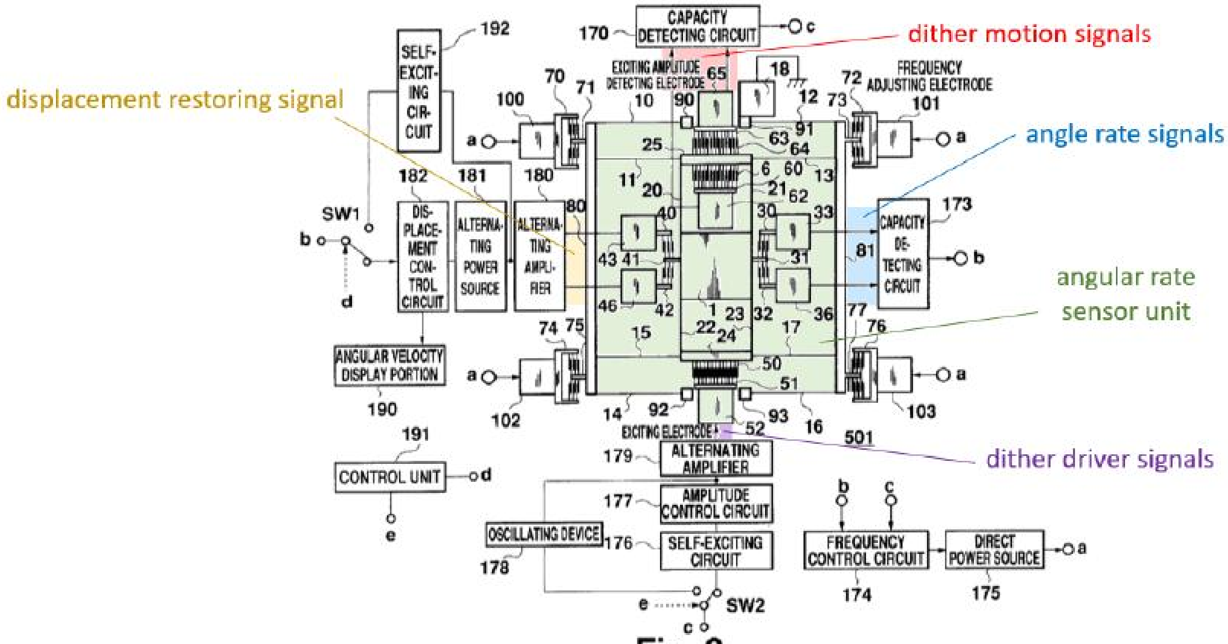


Fig. 9

Pet. 11. Petitioner identifies hardware highlighted in green in the center of annotated Figure 9 as an angular rate sensing unit that vibrates mass portions 1 in the vertical direction, such that, when the system undergoes angular rotation, a Coriolis force displaces mass portion 1 in the horizontal direction in an amount indicative of the angular rate. *Id.* (citing Ex. 1003, 19:63–20:34; Ex. 1002, Young Decl. ¶ 119). Petitioner contends that, similar to claim 1 of the ’122 patent, Fujiyoshi’s angular rate sensor unit receives dither drive signals that vibrate the inertial elements (mass portions 1) back and forth along one axis (the “exciting direction”) so that when the system undergoes angular rotation the inertial elements are displaced along a different axis (the “detecting direction”) by the Coriolis force. *Id.* at 12 (citing Ex. 1003, 19:63 – 20:19; Ex. 1002, Young Decl. ¶ 121). Petitioner states that, in Fujiyoshi, dither vibration of mass portion 1 is controlled by an alternating voltage supplied through amplifier control circuit 177 and alternating amplifier 179 from self-exciting circuit 176 applied to electrode 51, so that mass portion 1 is vibrated to the exciting direction. *Id.* (citing Ex. 1003, 19:63–67; 12:35–44, 21:29–33). Petitioner also states that the dither vibration is controlled via an alternating voltage (the dither driver signals) applied to the exciting electrode 52 as highlighted in the purple highlighted portions of annotated Figure 9. *Id.* (citing Ex. 1003, 21:29–33). Thus, according to Petitioner, Fujiyoshi discloses an angular rate sensor unit receives dither signals, as claimed. *Id.* at 13. Petitioner further contends that, to the extent claim 1 is deemed to require plural dither drive signals, Fujiyoshi's second and seventh embodiments disclose alternating voltage applied to electrode 52, which teach this feature. *Id.* at 13–15.

(2) Displacement Restoring Signal

Petitioner states that an ordinarily skilled artisan would have understood the displacement restoring signal is a signal used to restore the position of an inertial element to its approximate pre-Coriolis force location after its displacement. Pet 14. Petitioner cites the control voltage from alternating amplifier 180 in Fujiyoshi's second and seventh embodiments as disclosing the claimed displacement restoring signal because it restores mass portion 1 to its original position after Coriolis force induced displacement. Pet. 15–18.

(3) Capacitive Pickoff Excitation Signals

Petitioner acknowledges that Fujiyoshi does not explicitly use the term "capacitive pickoff excitation signals," but contends that Fujiyoshi teaches or renders obvious an angular rate sensor unit that receives such capacitive pickoff excitation signals. Pet. 18–19 (citing Ex. 1002, Young Decl. ¶¶ 135–148). Petitioner cites Dr. Young's declaration as evidence that capacitive pickoff excitation signals were well-known in the field of angular rate sensors and gyroscopes. *Id.* (citing Ex. 1003, Young Decl. ¶ 135, quoting the following text at page 72 of J.M. Slater's 1964 textbook *Inertial Guidance Sensors* (Ex. 1011, 11): "[c]apacitor pick-off systems typically include as the sensing element a differential-type capacitor of variable effective area or (and more usually) variable gap."). Referencing another annotated version of Fujiyoshi Figure 9, Petitioner points out that the angular rate sensor units in Fujiyoshi's second and seventh embodiments include capacity detecting electrodes 30, 32, 33, and 36 and that the capacitance of these electrodes is detected via a capacity detecting circuit 173 as the capacitance changes over time due to the motion of mass portion 1. *Id.* at 19 (citing Ex. 1003, 20:42–48, 19:67–20:8, 16:25–28, 13:35–41, 13:66–14:4, Figs. 5, 8, 9, 17; Ex. 1002, Young Decl. ¶ 136). According to Petitioner, based on teachings in Slater's textbook to implement a capacitive sensor by providing an oscillating signal in the audio or radio frequency range, an ordinarily skilled artisan would have known to implement Fujiyoshi's capacity detecting circuit by providing a high frequency signal to electrodes 30 and 32 that would get modulated by the change in capacitance, such that measuring the modulated signal would indicate the capacitance change and, therefore, the motion of mass portion 1 over time. *Id.* at 20–21 (citing Ex. 1002, Young Decl. ¶¶ 137–138). Petitioner and Dr. Young cite page 429 and circuit diagrams from a 1994 textbook by Ljubisa Rustic as providing further evidence that constructing such a capacitive sensing circuit would have been within the ambit of an ordinarily skilled artisan. *Id.* at 21–23 (citing Ex. 1002, Young Decl. 139–140; Ex. 1010, Part II, 183–186).

Petitioner cites Kumar as further evidence it would have been obvious to an ordinarily skill artisan to use capacitive pickoff excitation signal in Fujiyoshi's system. Pet. 23–24. Petitioner describes Kumar's gyro system as having loop control circuitry for driving vibrating motion and sensing motion caused by the Coriolis force. *Id.* (citing Ex. 1005, 3:50–4:45, Fig. 2a; Ex. 1002, Young Decl. ¶ 142). According to Petitioner, like Fujiyoshi, Kumar senses motion of an inertial element by measuring a change in capacitance as the distance between a vibrating inertial element (a central member) and a pickoff electrode that forms a parallel plate capacitor with the central member. *Id.* (citing Ex. 1005, 3:62–65; Ex. 1003, Young Decl. ¶ 142). Petitioner notes that, as DC bias is present on the central member's electrically conductive layer, the varying capacitance that results from the change in the distance between Kumar's pickoff electrode and the central member causes a variation in the electrical signal that is output as a motion sensing signal. *Id.* at 23–24 citing Ex. 1005, 3:62–4:2, 4:19–25). Petitioner also notes Kumar discloses that other types of oscillators, such as high frequency carrier signal capacitive pickoff that operates without DC bias, can be used. *Id.* at 24 (citing Ex. 1005, 6:29–34; Ex. 1002, Young Decl. ¶ 142).

Patent Owner contends that Petitioner has failed to show Fujoyoshi alone or in combination with Kumar discloses the claimed capacitive pickoff excitation signals. Prelim. Resp. 37–39. Patent Owner emphasizes Petitioner's acknowledgment that Fujiyoshi does not explicitly use the term capacitive pickoff excitation signals or identify specific disclosure in Fujiyoshi suggesting high frequency signal representative of such excitation signals. Prelim. Resp. 37.

Noting Petitioner's reference to the Slater and Ristic textbooks as indicative of the knowledge of an ordinarily skilled artisan, Patent Owner contends that Petitioner offers no analysis of whether Slater or Ristic would be within the background knowledge of a person of ordinary skill, arguing that Petitioner instead relies on attorney argument and the "conclusory say-so of a paid expert." *Id.* Patent Owner's argument fails to rebut Petitioner's contentions. Patent Owner asserts that a person of ordinary skill has a relatively high degree of technical knowledge (i.e., a Masters degree and five years of relevant experience in the development of control systems for inertial navigation and MEMS semiconductor processing). *Id.* at 35. Even applying a level of skill lower than that advocated by Patent Owner, we would expect a person of ordinary skill to be familiar with the subject matter in Slater's 60 year old textbook and Ristic's 30 year old textbook concerning capacitive pickoff signals. *See* Ex. 1011, 11; Ex. 1010, 183–186.

Patent Owner's arguments referring to Section II of the Preliminary Response concerning hindsight are also ineffective, as they fail to identify specific instances of impermissible hindsight concerning the claimed capacitive pickoff excitation signals. *See* Prelim. Resp. 38.

Patent Owner further argues that the embodiment in Kumar disclosing a DC bias voltage on the capacitive elements in question teaches an approach that is the opposite of a frequency excitation signal. Prelim. Resp. 38 (citing Ex. 1005, 3:65–4:2). Patent Owner's argument overlooks Kumar's explicit disclosure that "although oscillation sensing is accomplished with DC biased capacitive pickoffs in the preferred embodiment, other types oscillation sensors may be employed, such as high frequency carrier signal capacitive pickoffs (which operate without a DC bias voltage) and tunneling current displacement sensors." Ex. 1005, 6:29–34.

(4) Contentions Concerning Reasons to Combine Teachings of Fujiyoshi and Kumar

Petitioner states that, like the subject matter of the ’122 patent, Fujiyoshi and Kumar both concern the design of vibrating gyroscopes and associated control circuitry. Pet. 24 (citing Ex. 1002, Young Decl. ¶¶ 144; Ex. 1005, 1:7–9, 3:50–4:45). Petitioner cites Fujiyoshi for its high-level disclosures about capacitive sensing systems, i.e., capacity detecting circuits, and Kumar for its detailed description of how such circuits work. *Id.* at 24–25 (citing Ex. 1003, 20:12–19, Fig. 9; Ex. 1005 3:62–4:2; Ex. 1002, Young Decl. ¶ 145). Accordingly, arguing that Kumar provides a sensor design that is highly similar to that of Fujiyoshi, Petitioner contends that an ordinarily skilled artisan would have had reason to combine the teachings of Fujiyoshi and Kumar. *Id.* at 24 (citing Ex. 1002, Young Decl. ¶¶ 143–148).

Emphasizing Petitioner’s evidentiary burden, Patent Owner contends that Petitioner’s arguments that Kumar provides detail not disclosed in Fujiyoshi is insufficient basis or reason to combine their teachings. Prelim. Resp. 38–39. Patent Owner’s arguments do not sufficiently rebut Petitioner’s contentions that a skilled artisan would have had reason to look to Kumar for further implementation details of a circuit that performs functions similar to those performed by Fujiyoshi. *See* Pet 25–26. For example, Petitioner’s citation to Kumar, not only for an explicit disclosure of capacitive pickoff signals, but also for its disclosure of both DC bias and AC carrier signals, recognizes the applicability of an AC carrier pickoffs that operates without DC bias. *Id.*; Ex. 1005, 3:65–4:2, 6:29–36.

Having considered the arguments and evidence of record, we are persuaded that Petitioner has demonstrated a person of ordinary skill would have had reasons combine the teachings of Fujiyoshi and Kumar and that their combined teachings would have disclosed or suggested limitation 1(a) to the ordinarily skilled artisan.

c) Limitations 1(b) and 1(c)

Limitation 1(b) recites "a central circuitry receiving said angle rate signals in response to said motion of said carrier and said dither motion signals and outputting angular rate signals and digital low frequency inertial element displacement signals." Petitioner references Figure 6 of the '122 patent as disclosing central circuitry that consists of one circuit block related to dither motion that is centrally located between the angular rate sensor unit and a digital signal processing system and another circuit block related to motion due to the Coriolis force that is centrally located between the angular rate sensor unit and the angular rate signal output. Pet. 29–30 (citing Ex. 1001, 7:61–63 Fig. 6; Ex. 1002, Young Decl. ¶¶ 156–158).

To illustrate Petitioner's contention that Fujiyoshi discloses a circuit block structure similar to that of the '122 patent, Petitioner provides the annotated version of Fujiyoshi's Figure 9 reproduced below.

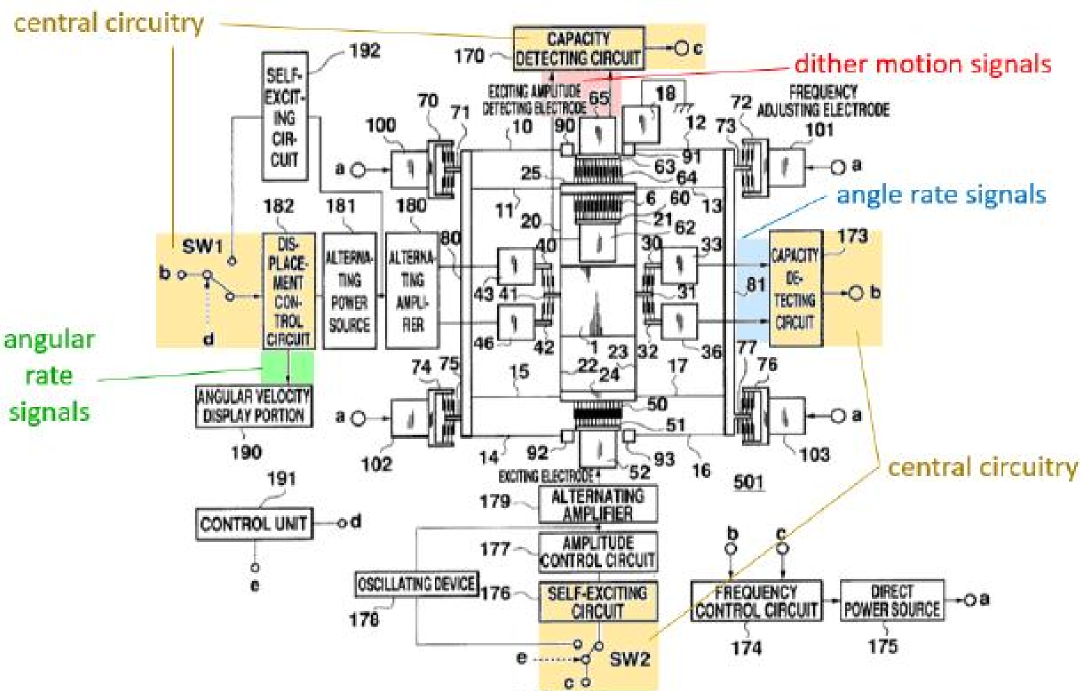


Fig. 9

Pet. 30. Petitioner states that Fujiyoshi discloses the dither motion signals and angle rate signals in claim limitation 1(a) are received by central circuitry highlighted in orange. *Id.* at 31. Petitioner cites the orange highlighted boxes at the top and bottom of the annotated figure connected to node "c" as related to dither motion and the orange highlighted boxes on the left and right connected at node "b" as related to Coriolis force motion. *Id.* Petitioner asserts that the Coriolis force motion circuitry is central circuitry located between the angular rate sensor and angular rate signals output (highlighted in green), and the dither motion circuitry is central circuitry located between the angular rate sensor and a processing unit, in particular, the digital signal processor disclosed by Townsend and addressed more completely in Petitioner's discussion of limitation 1(c). *Id.* at 30–31. Petitioner also states that Fujiyoshi's second and seventh embodiments derive angular rate signals, and that Fujiyoshi's displacement control circuit 182 calculates the angular velocity and outputs it to the angular velocity display portion 190. *Id.* at 31.

Petitioner contends that the claimed low frequency inertial element displacement signals correspond to dither motion signals from which noise has been removed. Pet. 31 (citing Ex. 1001, Fig. 6; Ex. 1002, Young Decl. ¶ 165). On this basis, Petitioner argues the claimed digital low frequency inertial element displacement signal would have been obvious over Fujiyoshi in light of Townsend's sample and hold devices 27 that average or integrate an input waveform over a sample period to provide sampled signals to A/D converter 29 for use by digital processing unit 22. *Id.* at 32, 34–35. Petitioner also states that, to the extent there is any dispute about whether Townsend's sample-and-hold devices would have resulted in low frequency signals, Cox discloses the use of a low pass filtering this application. *Id.* at 32.

Limitation 1(c) recites "a digital signal processing system analyzing said digital low frequency inertial element displacement signals and feeding back said dither driver signals to said angular rate sensor unit." Petitioner cites Fujiyoshi's dither motion control system as disclosing a feedback loop in which dither motion driver signals are fed back to the angular rate sensor unit that forms the dither driver signals. Pet. 35–36. Petitioner provides annotated versions of Figure 9 of Fujoyoshi showing dither motion control signals connect to dither driver generation circuity at node "c." *Id.* (citing Ex. 1003, 20:2–11; Ex. 1002, Young Decl. ¶ 177); *see also id.* at 38. Noting that Townsend teaches conventional gyroscopes with a primary loop for exciting the vibrating circuit and a secondary loop for damping, Petitioner cites Townsend as demonstrating that a digital implementation of these loops offers advantages over Fujiyoshi's analog implementation. *Id.* at 36–37 (citing Ex. 1004, 1–3, Fig. 4; Ex. 1002, Young Decl. ¶ 178).

Petitioner argues an ordinarily skilled artisan would have had reason to connect node "c" to a sample-and-hold device, analog converter, buffer, and digital signal processing unit and to connected the digital processing unit's output in a feedback configuration to node "c" through a digital-to-analog converter. *Id.* at 39, 41–42. Petitioner states that both Fujiyoshi and Townsend concern vibrating gyroscopes and describe similar structures for controlling vibration of the vibrating element and for controlling motion caused by the Coriolis force when a system undergoes angular rotation. *Id.* at 40 (citing Ex. 1003, 19:63–20:34; Ex. 1004, 1–2; Ex. 1002, Young Decl. ¶ 184). Petitioner further notes Townsend's description of analog circuitry drawbacks when used to control vibrating structure gyroscope circuitry as "notoriously difficult to specify, design and integrate into small low cost systems, (i.e. ASICS)," difficult to calibrate, and less compatible with modern sensors that provide digital outputs. *Id.* at 41 (citing Ex. 1004, 3; Ex. 1002, Young Decl. ¶ 185).

As to limitation 1(b), Patent Owner contends that Petitioner does not specify where Townsend's sample and hold devices are inserted into Fujiyoshi, what they are for, or how they accomplish noise rejection, and that Petitioner relies on hindsight knowledge derived from the '122 patent. Prelim. Resp. 40–41. For example, Patent Owner argues that Fujiyoshi does not mention noise rejection circuitry. *Id.* at 41–43. As to limitation 1(c), Patent Owner argues that Petitioner relies upon "a complicated mosaic of references and individual circuit elements" to make "a massive change to the feedback wire disclosed in Fujiyoshi" with "no explanation of disclosures in Fujiyoshi to support it." *Id.* at 45. Patent Owner cites to testimony of Dr.

Larson contrasting the complexity of Petitioner's proposed implementation of a digital feedback loop with Fujiyoshi's "simple analog loop" and stating that "[t]he Townsend reference does not disclose any specific benefit that would have been deemed applicable to the complete analog feedback loop taught in Fujiyoshi." Ex. 2009, Larson Decl. ¶ 67. According to Dr. Larson, "[t]rue or not, Fujiyoshi taught a person of ordinary skill that its analog feedback loop would solve known problems in the art." *Id.*

Patent Owner's arguments generally devalue digital processing in angular motion sensors and gyroscope control loops, including, e.g., as in the '122 patent, because Fujiyoshi "worked fine" and "solved problems in the art." Pet. 46. These arguments are not persuasive. Contrary to Patent Owner's assertions, the Petition cites Townsend's explicit identification of well-known drawbacks to analog technology. *Id.* at 41 (citing Ex. 1004, 3; Ex. 1002, Young Decl. ¶ 185). Additionally, Townsend teaches that it was conventional to use a "sampled data system . . . which utilizes digital processing" and "analogue to digital converters . . . for sampling and converting output signals respectively from the primary pick off means . . . and secondary pickoff means" in a gyroscope application. Ex. 1004, 4. Townsend proposes a system with lower sample rates to improve performance. Ex. 1004, 4–5. The Petition explicitly identifies where in Fujiyoshi such a sample-and-hold circuit would be incorporated and how digital processing would be employed. Pet. 39–42. Although Patent Owner contends that Cox "is not in the same field as the '122 patent or the other references" (Prelim. Resp. 48–50 (citing Pet. 33, Ex. 1002, Young Decl. ¶ 169)), Petitioner cites Cox for the well-known proposition that low pass filtering would be employed in a sample-and-hold circuit providing inputs to an analog to digital converter to improve performance in the presence of noise (Pet. 33–35). In view of these disclosures, we determine that Petitioner has demonstrated an ordinarily skilled artisan would have had reason to combine the teachings of Fujiyoshi, Townsend and Cox, and that, in combination, these references teach limitations 1(b) and 1(c).

d) Claim 1 Conclusion

Accordingly, having considered the evidence and arguments of record, we determine that, for purposes of institution, Petitioner has demonstrated a person of ordinary skill would have had reason to combine the teachings of Fujiyoshi, Kumar, Townsend and Cox, and that in combination these teachings would have disclosed or suggested all the limitations of claim 1 to an ordinarily skilled artisan.

6. *Claim 3*

Claim 3 depends from claim 1 and recites that the "central circuitry comprises dither motion control circuitry and an angle rate signal loop circuitry." Ex. 1001, 10:13–16. Petitioner cites another annotated version of Fujiyoshi Figure 9 to illustrate dither motion control circuitry involved in detecting dither motion of mass portion 1 and generating dither drive signals to vibrate mass portion 1. Pet. 42–43. Petitioner also cites angle rate signal loop circuitry as involved in detecting later displacement of mass portion caused by angle rate of the system. *Id.* at 44. Patent Owner does not explicitly address Petitioner's contentions concerning the additional limitations recited in claim 3.

Having considered the evidence and arguments of record, we determine, for purposes of institution, that Petitioner has demonstrated a person of ordinary skill would have had reason to combine the teachings of Fujiyoshi, Kumar, Townsend and Cox, and that in combination these teachings would have disclosed or suggested all the limitations of claim 3 to an ordinarily skilled artisan.

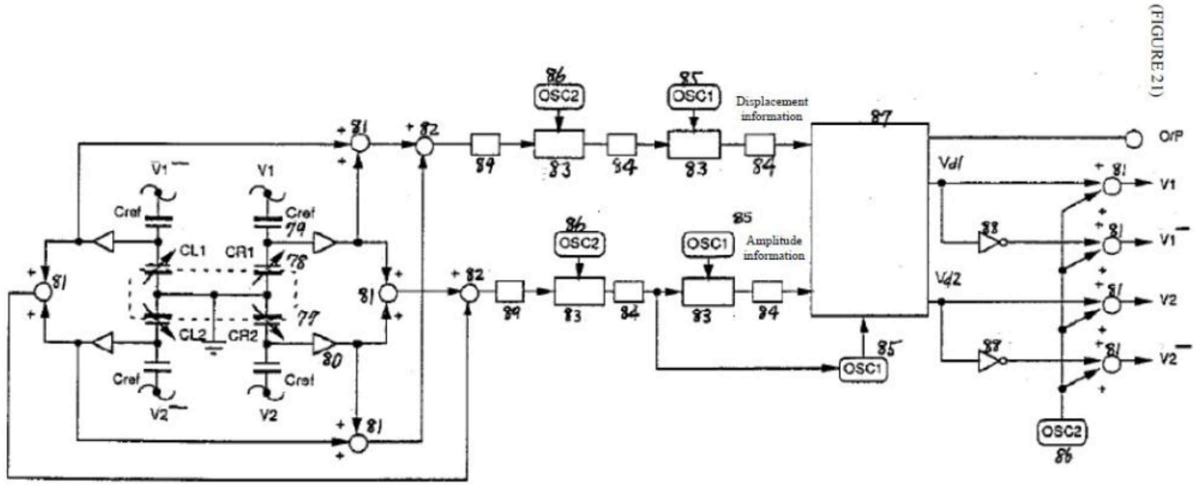
C. Petitioner's Contention that Claims 1 and 3 Are Unpatentable Over Mitamura and Townsend

1. *Mitamura*

Mitamura concerns an angular velocity sensor that is not susceptible to the effects of noise and achieves high sensitivity and high precision using semiconductor technology. Ex. 1009 (code 57). In Mitamura's angular sensor, a mass isolated from a substrate by supports vibrates in a first direction and a second orthogonal direction. *Id.* Drive electrodes and drive means affixed to the substrate drive the vibrating mass in the first axial direction. *Id.* Detection electrodes and detection means affixed to the substrate detect displacement of the vibrating mass in the second axial direction. *Id.* The driving electrodes are segmented in a manner that allows the application of multiple voltage values. *Id.* When the vibrating mass is rotated around a third axis perpendicular to the main surface of the substrate while vibrating in the first axial direction, the Coriolis force produced in the second axial direction is detected and the angular velocity around the third axis is measured. *Id.*

Electrostatic force generated by voltage applied to comb electrodes vibrates the mass in a drive axis and the amplitude of the vibration is detected by circuitry, e.g., the circuitry of a third embodiment shown in Figure 21, reproduced below.

[FIGURE 21]



77…vibrating mass, 78…detection capacitance, 79…reference capacitance Cref, 80…buffers, 81…adder
82…subtractor, 83…demodulator, 84…low-pass filter, 85…oscillator OSC1, 86…oscillator OSC2
87…control circuit, 88…inverter, 89…high-pass filter

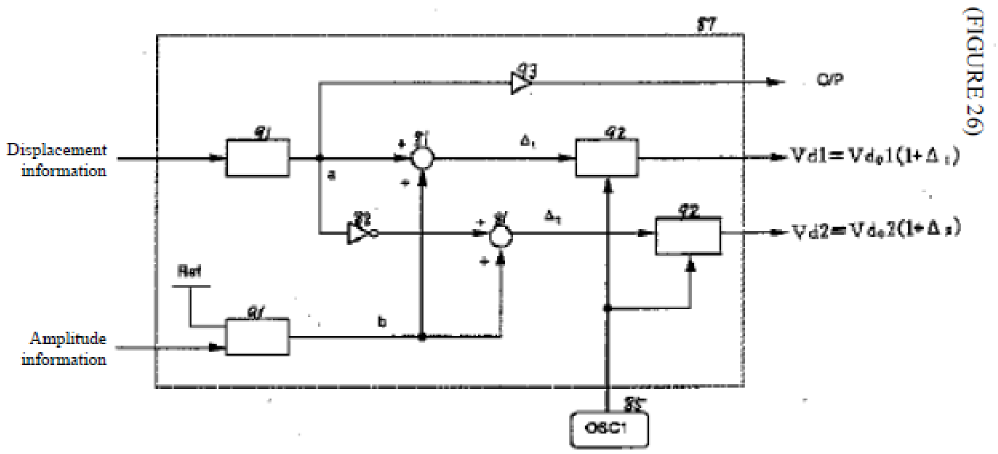
Ex. 1009, Fig. 21, ¶¶ 45–56. In Figure 21, the electrostatic capacitances between opposing electro terminals and the vibrating mass are designated CR1, CR2, CL1, and CL2. *Id.* ¶ 44. Reference capacitances Cref 79 are connected to the opposing electrodes terminals and drive voltages are applied to CR1, CR2, CL1, and CL2 via reference capacitors Cref. The detection capacitance is shown in the figure as reference designator 78. Adder 81 adds the voltages of the right electrodes (R1, R2) and left electrodes (L1, L2), subtractor 82 finds the difference and these are sent to demodulator 83 via high pass filter 89. *Id.* ¶ 45.

> After carrying out synchronous detection with an oscillator 86 using the demodulator 83, the signal passes through the low pass filter 84, part is returned to the oscillator 85 for self-excited oscillation of the vibrating mass, and the other part is once again input into the demodulator 83. This time synchronous detection with the oscillator 85 is carried out, and the signal passes through the low-pass filter 84 and is input into a control circuit 87 as amplitude information of the vibrating mass.

Id. A similar approach using oscillator 86 provides displacement information of the vibrating mass as a result of the Coriolis force to control circuit 87. *Id.*

The details of control circuit 87 are shown in Figure 26, reproduced below.

[FIGURE 26]



81…adder addition 85…oscillator OSC1, 87…control circuit, 88…inverter, 91…arithmetic unit
92…amplitude modulator 93…amplifier

Ex. 1009, Fig. 26. In Figure 26,

> the displacement information and the amplitude information are input into arithmetic units 91. In the arithmetic units 91, the displacement information and the amplitude information are calculated as modulation amounts of the drive voltage, based on a deviation from zero level for the displacement information and based on a deviation from a set reference level for the amplitude information.

Id. ¶ 46. The calculated modulation amounts ("a" for displacement, "b" for amplitude) are input to amplitude modulator 92, where the amplitude of oscillator 85 is modulated according to each and drive outputs Vd1 and Vd2 are output. *Id.* For clarity, Dr. Young provides a modified version of Figure

21, rearranged to include the detection circuit of Figure 26, which we reproduce below.

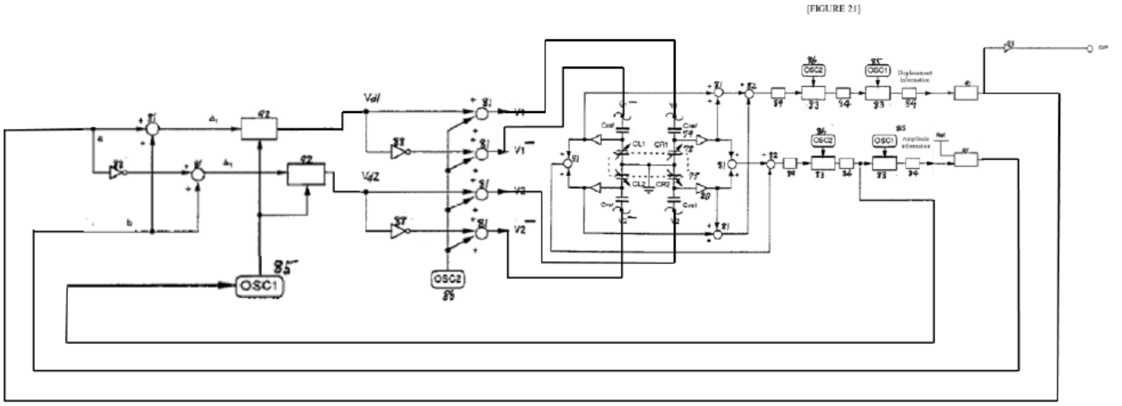


Fig. 21 (modified using Fig. 26; rearranged by Dr. Young for clarity)

See Ex. 1002, Young Decl. ¶ 104. The modulation amount “a” is output as the angular velocity which is input to amplifier 93. Ex. 1004 ¶ 46.

2. *Claim 1*

Petitioner cites Mitamura’s third embodiment for measuring angular rate (or angular velocity) as disclosing a vibrating mass (mechanical component) and opposing electrodes (electrical components) with a thickness in the range of a few micrometers, i.e., sufficiently small as to constitute a MEMS system. Pet. 44–45 (citing Ex. 1009 ¶ 42; Ex. 1002, Young Decl. ¶¶ 193–196). Petitioner also cites Mitamura’s third embodiment as measuring the angular rate of a carrier using vibrating mass 72 connected to supports 73 secured to a substrate by securing sections 74, such that rotation of the carrier substrate causes the vibrating mass to rotate. *Id.* at 46 (citing Ex. 1009 ¶ 43; Ex. 1002, Young Decl. ¶¶ 197–198).

a) Limitation 1(a)

Petitioner provides an annotated versions of Figure 21 combined with control circuit 87 in Figure 26 of Mitamura as illustrating the combined circuitry constitutes an angular rate sensor. Pet. 47–48. Petitioner notes that Figure 21 includes a vibrating mass driven to vibrate using electrostatic forces generated by comb electrodes that sense Coriolis forces along an axis perpendicular to the dither vibrations and can use the comb electrodes to sense when the system undergoes angular rotation. *Id.* at 48. Petitioner further notes that control circuitry 87 provides signals for controlling the motion of the vibrating mass through the comb electrodes. *Id.* (citing Ex. 1009 ¶ 46, Fig. 26). According to Petitioner, an ordinarily skilled artisan would have understood that a vibrating mass sensor like that disclosed in Mitamura senses rotation only if it is vibrating and is, therefore, an integral part of the angular rate sensor unit. *Id.* 48–49 (citing Ex. 1002, Young Decl. ¶ 202). Petitioner states that in Mitamura's third embodiment, the angular rate sensor unit receives signals from arithmetic unit 91. *Id.* at 49 (citing Ex. 1009 ¶ 46, Fig. 26). Petitioner notes that these signals are summed and used to modulate other signals before being input into the comb electrodes to control the motion of vibrating mass 72. *Id.* According to Petitioner, the force exerted on vibrating mass 72 to cause vibration (dither) depends on the magnitude of signals from arithmetic unit 91, i.e., dither driver signals received by the angular rate sensor unit. *Id.* at 50 (citing Ex. 1009 ¶ 63).

Petitioner further contends that Mitamura discloses the angular rate sensor unit receives capacitive pickoff excitation signals, as claimed. Pet. 51 (citing Ex. 1002, Young Decl. ¶¶ 206–207). Petitioner points out that, in Mitamura, OSC2 signal, output from oscillator 86, is added to the outputs of control circuit 87 to produce a sum of signals applied to comb electrodes R1, R2, L1, L2 on vibrating mass 72. *Id.* (citing Ex. 1009 ¶¶ 45, 50, 54, 56). Petitioner further notes that Mitamura teaches oscillator 86 can be used to carry out synchronous detection using demodulator 83, such that an ordinarily skilled artisan would have understood that OSC2 signals from oscillator 86 are being used as capacitive pickoff excitation signals, as they provide excitation to the comb electrode capacitors via a high-frequency signal. *Id.* at 51 (citing Ex. 1009 ¶¶ 45, 50, 54; Ex. 1002, Young Decl. ¶ 206).

Petitioner argues that Mitamura also discloses the claimed angular rate sensor unit receiving a displacement restoring signal. Pet. 52 – 54 (citing Ex. 1002, Young Decl. ¶¶ 208–210). Again citing an annotated version of Mitamura Figure 21, Petitioner argues that a signal from arithmetic unit 91 reflecting the displacement of vibrating mass 72 caused by the Coriolis force is supplied to the angular rate sensor unit to compensate for the Coriolis force. *Id.* at 51–52.

Petitioner also argues that Mitamura discloses an angular rate sensor unit outputting angular rate signals in response to motion of the carrier. Pet. 54–56. According to Petitioner, angle rate signals shown in an annotated version of Mitamura Figure 21 indicate motion of the vibrating mass in the angular rate sensor unit due to the Coriolis force. *Id.* at 54 (citing Ex. 1002, Young Decl. ¶ 212; Ex. 1009, ¶ 57 (disclosing "the displacement y of the vibrating mass due to the Coriolis force is found")).

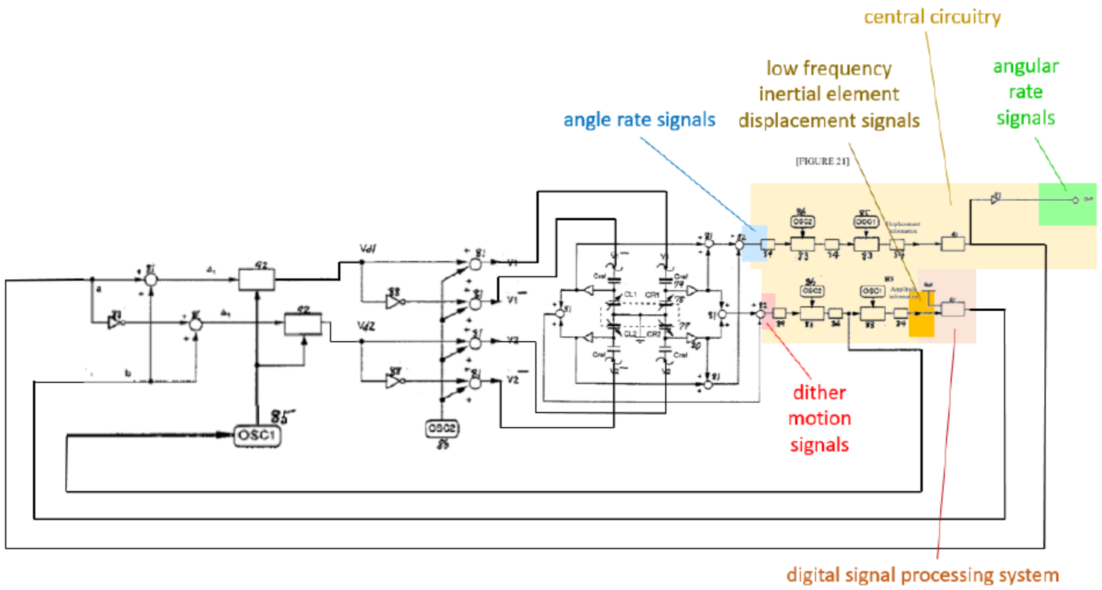
Petitioner also cites its annotated version of Mitamura's Figure 21 as illustrating the angular rate sensor unit outputs dither motion signals as claimed. Pet. 56 – 58 (citing Ex. 1002, Young Decl. ¶¶ 214–216). Petitioner states that the dither motion signals in Figure 21 reflect the vibration motion of vibrating mass 72 in the dither axis perpendicular to the Coriolis force sensing access, in a manner similar to that of the '122 patent. Petitioner notes that in Mitamura the signals result after the varying voltages of the rightmost and leftmost position-sensing capacitors for vibrating mass

72 are added and subtracted from the sum, such that the dither motion signals vary with motion of vibrating mass 72, as recited in claim 1. *Id.* at 55–58.

Patent Owner does not respond explicitly to Petitioner's contentions concerning Mitamura's disclosure of limitation 1(a).

b) Limitations 1(b) and 1(c)

Petitioner's annotated combination and rearrangement of Figures 21 and 26 of Mitamura is reproduced below.



Pet. 60. In Petitioner's annotated Figure, yellow highlighted central circuitry receives blue highlighted angle rate signals reflecting vertical displacement of vibrating mass 72 caused by the Coriolis force and processes those signals into green highlighted angular rate signals that are output from the system. *Id.* at 60–63 (citing Ex. 1009, ¶¶ 45–46, 51, 53, 55, 57–58, Fig. 21, Fig. 26; Ex. 1002, Young Decl. ¶ 223). Petitioner notes that in Mitamura, blue highlighted angle rate signals in annotated Figure 21 are input to high-pass filter 89, demodulators 83, low pass filters 84, and control circuit 87 provides the green highlighted angular velocity output through amplifier 93.

Id. at 63 (citing Ex. 1009 ¶¶ 45–46, 57–58, Figs 21, 26). Petitioner adds that "similarly, the '122 patent discloses high-pass filter 221, amplifiers 222 and 223, demodulator 224, and low-pass filter 225 between 'angle rate signals' and 'angular rate signals' in Figure 6." *Id.* (citing Ex. 1001, 8:40-67, Fig. 6).

Petitioner identifies red highlighted dither motion signals in its annotated figure as signals that reflect dither motion, i.e., vibrating motion in the horizontal direction of Figure 21 of vibrating mass 72, and asserts that these signals are processed by central circuitry and output as the orange highlighted digital low frequency inertial displacement signals. *Id.* at 63 (citing Ex. 1002, Young Decl. ¶ 72). Petitioner explains that Mitmura's red-highlighted signals reflect motion of vibrating mass 72 in a dither axis perpendicular to the Coriolis force sensing axis and result after voltages VR1 and VR2, (which varies with the capacitance of the rightmost position sensing capacitors for vibrating mass 72) are added, and the voltages VL1 and VL2 (which varies with the capacitance of the leftmost position-sensing capacitors) are subtracted from the sum. *Id.* at 66. According to Petitioner, Mitamura's disclosures about the red highlighted signals are similar to those of the '122 patent's dither motion signals. *Id.* at 66–67 (citing Ex. 1002, Young Decl. ¶ 230). Petitioner argues that the orange highlighted signals are inertial element displacement signals because they are reflective of dither motion and they have passed through low-pass filtering stages, such that they are "low frequency" signals from which high-frequency noise has been removed. *Id.* at 67 (citing Ex. 1009 ¶ 56, Fig. 21).

Petitioner also argues that Mitamura's discussion of the processing of orange highlighted signals by control circuit 87 renders digital low frequency inertial element displacement signals obvious. Pet. 68. Petitioner acknowledges that Mitamura does not explicitly disclose analog to digital conversion, but argues that an ordinarily skilled artisan would have understood using analog to digital conversion to digitally implement arithmetic units 91 in control circuitry 87. *Id.* at 68–60 (citing Ex. 1002, Young Decl. ¶ 237).

Turning to limitation 1(c), Petitioner notes that Mitamura discloses arithmetic unit 91 outputs a signal ("b") that determines the driving force ("Fd") used to vibrate mass 72. Accordingly, signal "b" is derived from the dither motion signals of the angular rate sensor unit and fed back to the angular rate sensor unit to control the angular rate sensor. Pet. 70–71. Thus, according to Petitioner, the orange highlighted signals are low frequency inertial displacement signals. Petitioner cites Mitamura's disclosure that amplitude information is calculated as modulation amounts of the drive voltage based on a deviation from a reference level and argues implementing such processing in a digital signal processor would have been obvious to a person of ordinary skill. *Id.* at 71–72. According to Patent Owner, Mitamura's disclosure of setting a reference level is particularly suggestive of a digital implementation of arithmetic unit 91 as a digital signal processing system because it would have provided a simple reference level setting interface. *Id.* at 72.

Petitioner further cites Townsend as an analogous reference disclosing a digital implementation of vibrating structure gyroscope circuitry with circuit loops for controlling the vibrating element and controlling Coriolis force induced motion when the system undergoes angular rotation. Pet. 74. Petitioner highlights Townsend's discussion of the drawbacks of using analog circuits in vibrating structure gyroscope control loops and the digital outputs available from modern sensors as indicative of reasons why an ordinarily skilled artisan would have looked to use digital signal processing to implement Mitamura's arithmetic units and feedback loops. *Id.* at 75–78. Petitioner also notes that a digital signal processor implementation would include appropriate ancillary circuits, including sample and hold circuits and analog to digital converters. *Id.* at 76–77.

Patent Owner characterizes Mitamura's arithmetic unit 91 as an analog circuit that computes a modulation amount based on a deviation from a set reference level and not a digital circuit. Prelim. Resp. 52–53. Patent Owner contends that Petitioner "points to nothing in Mitamura that might possibly suggest converting its arithmetic unit circuit to a digital implementation—and then adding an A/D converter to convert the input to that unit to digital." Prelim. Resp. 53 (citing Pet. 68–69). According to Patent Owner, "Mitamutra's arithmetic unit 91 as disclosed is analog, and would break if fed the output of an analog-to-digital converter." *Id.* at 54. As to limitation 1(c), Patent Owner again emphasizes that Mitamura discloses an analog feedback loop with analog circuit components and that Petitioner ignores the simple nature of the calculating an analog voltage deviation from a reference to determine modulation.

Patent Owner cites its similar arguments concerning the Petitioner's combination of Fujiyoshi with Townsend. Prelim. Resp. 54–58 (citing arguments advanced in Section III.E.2 of the Preliminary Response, and characterizing its other arguments in the context of "as with Fujiyoshi"). We addressed these arguments in our discussion of the Fujiyoshi/Townsend combination.

Petitioner cites Townsend as suggesting a digital control loop implementation in Mitamura, for reasons similar to those Petitioner argued apply to Fujiyoshi. Mitamura's disclosure of arithmetic units for calculation of modulation signals provides an even more explicit suggestion. Such implementations would require related circuits, including A/D converters and related sample and hold circuits and filters. As we discuss in Section X.B herein, Townsend also discloses that sampled systems with digital feedback loops were conventional implementations of vibrating gyroscopes.

For reasons similar to those we discussed in our analysis of Fujiyoshi and Townsend, we determine that Petitioner has sufficiently demonstrated a person of ordinary skill would have had reason to combine the teachings of Mitamura and Townsend, and that in combination, their teachings would have disclosed or at least suggested all the limitations of claim 1 to such an ordinarily skilled artisan.

3. *Claim 3*

As discussed above, Petitioner argues that Mitamura discloses angle rate loop circuitry as part of the circuitry that detects angular rotation of the carrier and feeds it back into the comb electrode drive circuitry to compensate for Coriolis force. Pet. 79 (citing Ex. 1009 ¶¶ 45–46, 57–58, Figs. 21, 26; Ex. 1002, Young Decl. ¶ 250). Petitioner also contends that Mitamura discloses dither motion control circuitry because it is part of the circuitry that processes signals related to the vibrating motion. *Id.* at 79–80 (citing Ex. 1009 ¶¶ 45–46, 57–58, Figs. 21, 26; Ex. 1002, Young Decl. ¶ 250).

Patent Owner does not explicitly respond to Petitioner's arguments concerning claim 3. Having considered the evidence and arguments of record, we determine, for purposes of institution, that Petitioner has demonstrated a person of ordinary skill would have had reason to combine the teachings of Mitamura and Townsend and that in combination these teachings would have disclosed or suggested all the limitations of claim 3 to an ordinarily skilled artisan.

XI. CONCLUSION

For the reasons discussed above, we determine that Petitioner has demonstrated a reasonable likelihood that it will succeed on the following challenges to patentability:

Claims 1 and 3 and unpatentable as obvious over Fujiyoshi in view of Kumar, Cox, and Townsend; and

Claims 1 and 3 as unpatentable over Mitamura and Townsend.

XII. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a) an *inter partes* review of the ’122 patent is hereby instituted, commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

FURTHER ORDERED that the trial is authorized on all grounds set forth in the Petition; and

FURTHER ORDERED that the trial will be conducted in accordance with a corresponding separately issued Scheduling Order.

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