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Paper 47
Date: January 8, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioner,

v.

RESONANT SYSTEMS, INC.,
Patent Owner.

IPR2023-00992
Patent 9,369,081 B2

Before JAMES J. MAYBERRY, STEVEN M. AMUNDSON, and MICHAEL T. CYGAN, *Administrative Patent Judges*.

AMUNDSON, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (collectively "Petitioner") filed a Petition requesting an *inter partes* review of claims 1–9, 11, and 14–17 in U.S. Patent No. 9,369,081 B2 (Ex. 1001, "the '081 patent") under 35 U.S.C. §§ 311–319. Paper 3 ("Pet."). Resonant Systems, Inc. ("Patent Owner") filed a Preliminary Response. Paper 10. Further, after receiving Board authorization to address issues concerning discretionary denial, Petitioner filed a Preliminary Reply, and Patent Owner filed a Preliminary Sur-reply. *See* Paper 12; Paper 13; Paper 15.

In the Institution Decision, we instituted review based on all challenged claims and all challenges included in the Petition. Paper 16 ("Inst. Dec.").

We have jurisdiction under 35 U.S.C. § 6. We issue this Final Written Decision under 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons explained below, Petitioner has shown by a preponderance of the evidence that claims 1, 2, 7, 8, 11, and 17 are unpatentable but has not shown by a preponderance of the evidence that claims 3–6, 9, and 14 are unpatentable. *See* 35 U.S.C. § 316(e) (2018). We do not address the patentability of claims 15 and 16 because Patent Owner statutorily disclaimed claims 15 and 16 during this proceeding. *See* Paper 27, 1; Ex. 2015.

II. BACKGROUND

A. Procedural History

After we instituted review, Patent Owner filed a Response to the Petition. Paper 26 ("Resp."). Petitioner filed a Reply to Patent Owner's

Response. Paper 37 ("Reply"). Patent Owner filed a Sur-reply to Petitioner's Reply. Paper 40 ("Sur-reply").

On October 10, 2024, we held an oral hearing, and the record includes the hearing transcript. Paper 46 ("Tr.").

B. Real Parties in Interest

Petitioner identifies the following as the real parties in interest: Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. Pet. 95. Patent Owner identifies itself as the sole real party in interest. Paper 5, 1. The parties do not raise any issue about real parties in interest.

C. Related Matters

Petitioner and Patent Owner identify the following civil actions as related matters involving the '081 patent:

- *Resonant Systems, Inc. v. Samsung Electronics Co., Ltd. et al.*, No. 2:22-cv-00423 (E.D. Tex. filed Oct. 26, 2022) (the "Samsung litigation"); and
- *Resonant Systems, Inc. v. Sony Group Corp. (Japan) et al.*, No. 2:22-cv-00424 (E.D. Tex. filed Oct. 26, 2022) (the "Sony litigation").

Pet. 95; Paper 5, 1; Paper 22, 1; Paper 28, 1.

Petitioner and Patent Owner identify the following Office proceeding as a related matter involving the '081 patent: *Sony Interactive Entertainment Inc. et al. v. Resonant Systems, Inc.*, IPR2024-00568 (PTAB filed Feb. 16, 2024). Paper 22, 1; Paper 28, 1.

D. The '081 Patent (Exhibit 1001)

The '081 patent, titled "Linear Vibration Modules and Linear-Resonant Vibration Modules," issued on June 14, 2016, from an application filed on August 26, 2014, as a continuation of an application filed on

January 6, 2012. Ex. 1001, codes (22), (45), (54), (63). The 2012 application is a continuation-in-part of an application filed on May 18, 2010. *Id.* at code (63). The 2010 application claims the benefit of priority to a provisional application filed on May 18, 2009. *Id.* at 1:7–11; *see id.* at code (60).

The '081 patent states that the disclosure relates to "vibration-generating devices and, in particular, to vibration modules that can be incorporated into a wide variety of different types of electromechanical devices and systems to produce vibrations of selected amplitudes and frequencies over a wide range of amplitude/frequency space." Ex. 1001, 1:15–20; *see id.* at 3:7–21, 4:13–17, code (57). The patent discloses various embodiments of linear vibration modules (LVMs), including various types of linear-resonant vibration modules (LRVMs). *See id.* at 4:13–17, code (57). LRVMs employ feedback control to "maintain the vibrational frequency" at or near the module's resonant frequency. *Id.* at 3:13–17, code (57). LVMs and LRVMs "are linear in the sense that the vibrational forces are produced by a linear oscillation of a weight or component within the LVM or LRVM" in contrast to the vibrational forces produced by "currently employed unbalanced electric motors." *Id.* at 4:17–23.

The '081 patent describes problems with "currently employed unbalanced electric motors" used to produce vibrational forces. *See* Ex. 1001, 2:12–63. As an example, "unbalancing the shaft of an electric motor not only produces useful vibrations that can be harnessed for various applications, but also produces destructive, unbalanced forces within the motor that contribute to rapid deterioration of motor parts." *Id.* at 2:16–20. As another example, unbalanced electric motors "are relatively inefficient at

producing vibrational motion." *Id.* at 2:32–33. Hence, "many hand-held devices that employ unbalanced electric motors for generating vibrations quickly consume batteries during use." *Id.* at 2:37–39. As yet another example, "only a very limited portion of the total vibrational force/frequency space is accessible to unbalanced electric motors" because the "bulk of energy consumed by an unbalanced electric motor is used to spin the shaft and unbalanced weight and to overcome frictional and inertial forces within the motor." *Id.* at 2:47–51, 2:59–62.

To overcome problems with "currently employed unbalanced electric motors," the '081 patent endeavors to provide "more efficient and capable vibration-generating units for incorporation into many consumer appliances, devices, and systems." Ex. 1001, 2:64–3:3, 4:23–26; *see id.* at 3:7–21, code (57). Among other things, an "oscillating linear motion" in LVMs and LRVMs "does not produce destructive forces that quickly degrade and wear out an unbalanced electric motor." *Id.* at 4:26–28. Moreover, LVMs and LRVMs may "produce vibrational amplitude/frequency combinations throughout a large region of amplitude/frequency space." *Id.* at 3:17–21, code (57); *see id.* at 5:35–42.

The '081 patent's Figure 4A (reproduced below) depicts an embodiment of an LRVM:

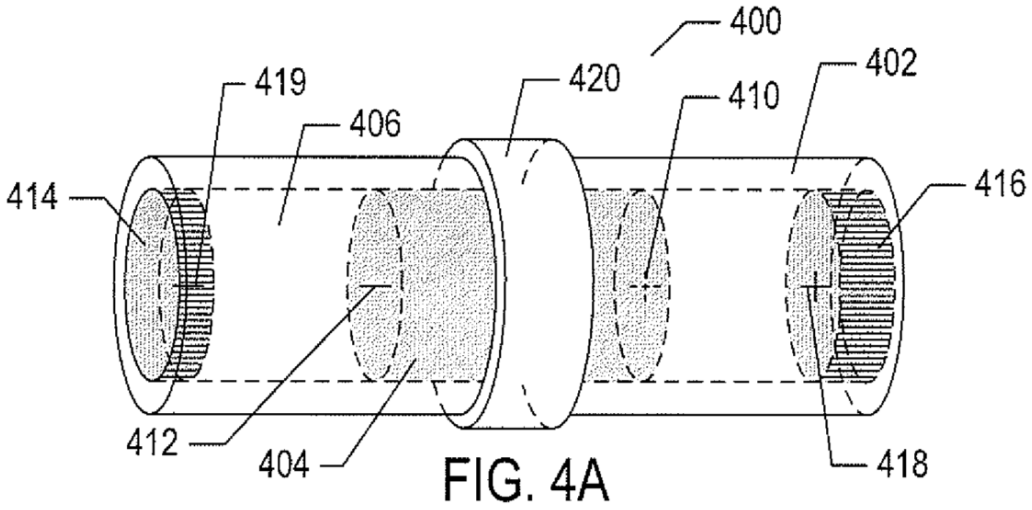

FIG. 4A

Figure 4A illustrates LRVM 400 including the following components:

- cylindrical housing or tube 402 forming cylindrical chamber 406;
- cylindrical weight (magnet) 404 that moves linearly within cylindrical chamber 406 and has positive polarity 410 (the "+" sign") on its right end and negative polarity 412 (the "–" sign) on its left end;
- disk-like magnet 414 having negative polarity 419 (the "–" sign) and capping the left end of cylindrical chamber 406;
- disk-like magnet 416 having positive polarity 418 (the "+" sign") and capping the right end of cylindrical chamber 406; and
- a coil of conductive wire 420 encircling cylindrical housing or tube 402 at "approximately the mid-point of the cylindrical housing."

See Ex. 1001, 4:44–59, 5:2–4, Fig. 4A.

Disk-like magnets 414 and 416 "are magnetically oriented opposite from the magnetic orientation of" weight (magnet) 404 "so that when the

weight moves to either the extreme left or extreme right sides of the cylindrical chamber, the weight is repelled by one of the disk-like magnets at the left or right ends of the cylindrical chamber." Ex. 1001, 4:59–65. Depending on the direction of an electric current applied to the coil of conductive wire, a magnetic force drives weight (magnet) 404 to the left toward disk-like magnet 414 or to the right toward disk-like magnet 416. *See id.* at 5:5–27, Figs. 4B–4G.

By a combination of (1) "a magnetic field with rapidly reversing polarity, generated by alternating the direction of current applied to the coil," and (2) "the repulsive forces between the weight magnet and the disk-like magnets at each end of the hollow, cylindrical chamber," the weight magnet "linearly oscillates back and forth within the cylindrical housing 402, imparting a directional force at the ends of the cylindrical chamber with each reversal in direction." Ex. 1001, 5:27–34.

The '081 patent's Figure 6 (reproduced below) depicts a block diagram of an LRVM having internal components as depicted in Figure 4A and various electrical components:

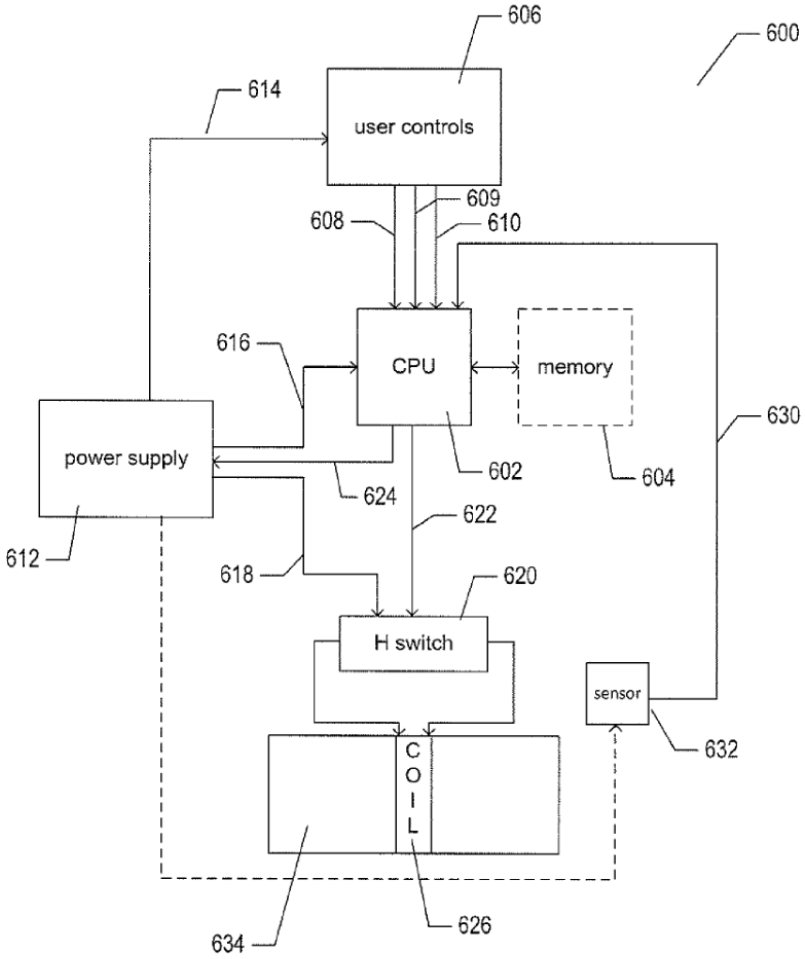

FIG. 6

Figure 6 illustrates LRVM 600 including the following components:

- microprocessor (CPU) 602 executing a control program;
- memory chip 604 storing, among other things, the control program;
- user controls 606 that may include "any of various dials, pushbuttons, switches, or other electromechanical-control devices," such as "a dial to select a strength of vibration, which corresponds to the current applied to the coil,"

"a switch to select one of various different operational modes," and "a power button";

- power supply 612;
- coil 626;
- weight (magnet) 634;
- H-bridge switch 620 that receives "a control-signal input" from microprocessor (CPU) 602 and controls the current supplied to coil 626; and
- "one or more electromechanical sensors 632 that generate a signal corresponding to the strength of vibration currently being produced by the linearly oscillating" weight (magnet) 634, such as "accelerometers, piezoelectric devices, pressure-sensing devices, or other types of sensors that can generate signals corresponding to the strength of desired vibrational force."

See Ex. 1001, 6:11–42, Fig. 6.

The H-bridge switch "change[s] the direction of current applied to the coil that drives linear oscillation within" the LRVM. Ex. 1001, 5:45–49; *see id.* at 3:36–40, Figs. 5A–5B. The H-bridge switch "is but one example of various different types of electrical and electromechanical switches that can be used to rapidly alternate the direction of current within the coil of an LRVM." *Id.* at 5:61–65.

E. The Challenged Claims

Petitioner challenges independent apparatus claim 1 and claims 2–9, 11, and 14–17 that depend directly or indirectly from claim 1. Pet. 1, 3–4, 9–93.

Claim 1 exemplifies the challenged claims and reads as follows (with bracketed letters added for reference purposes):[1]

1. [pre] A linear vibration module comprising:

[a] a housing;

[b] a moveable component;

[c] a power supply;

[d] user-input features;

[e] a driving component that drives the moveable component in each of two opposite directions within the housing; and

[f] a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features.

Ex. 1001, 15:36–48.

F. The Asserted References

For its challenges, Petitioner relies on the following references:

Name	Reference	Exhibit
Fukumoto	US 7,292,227 B2, issued November 6, 2007 (based on an application filed August 3, 2001)	1005
Grant	US 2006/0284849 A1, published December 21, 2006 (based on an application filed December 8, 2003)	1006
Barton	US 2006/0248183 A1, published November 2, 2006 (based on an application filed April 28, 2005)	1007
Ueda	US 2004/0169480 A1, published September 2, 2004 (based on an application filed July 15, 2003)	1008

[1] We use the same reference letters that Petitioner uses to identify the claim language. *See* Pet. vii (Listing of Challenged Claims).

Name	Reference	Exhibit
Erixon	US 2008/0174187 A1, published July 24, 2008 (based on an application filed March 15, 2006)	1009
Fuller	US 2008/0001484 A1, published January 3, 2008 (based on an application filed July 3, 2006)	1010
Dong	CN 101488697A, published July 22, 2009 (based on an application filed February 20, 2009)	1011
Saiki	US 7,006,641 B1, issued February 28, 2006 (based on an application filed April 12, 2000)	1013
Masahiko	US 8,917,486 B2, issued December 23, 2014 (based on an application filed July 26, 2011)	1014
Ogusu	JP H8-196053A, published July 30, 1996 (based on an application filed January 12, 1995)	1015

Pet. 2–4, 9–93.

Petitioner asserts that:

(1) Dong qualifies as prior art under § 102(a);

(2) Fukumoto, Grant, Barton, Ueda, Fuller, Saiki, and Ogusu qualify as prior art under § 102(b); and

(3) Erixon and Masahiko qualify as prior art under § 102(e).

Pet. 2; *see* 35 U.S.C. § 102(a), (b), (e) (2006).[2]

Patent Owner does not dispute that each reference qualifies as prior art. *See, e.g.*, Resp. 18–66; Sur-reply 7–21.

[2] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 102 and § 103 effective March 16, 2013. Because the effective filing date of the challenged claims predates the AIA's amendments to § 102 and § 103, this decision refers to the pre-AIA versions of § 102 and § 103. But our patentability analysis would not change if the current versions of § 102 and § 103 applied.

G. The Asserted Challenges to Patentability

Petitioner asserts the following challenges to patentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 7–9, 15, 17	103(a)	Fukumoto
1–3, 7–9, 15, 17	103(a)	Fukumoto, Grant
1–3, 7–9, 15, 17	103(a)	Fukumoto, Barton
3–6	103(a)	Fukumoto, Ueda
3–6	103(a)	Fukumoto, Grant, Ueda
3–6	103(a)	Fukumoto, Barton, Ueda
7, 8	103(a)	Fukumoto, Erixon
7, 8	103(a)	Fukumoto, Grant, Erixon
7, 8	103(a)	Fukumoto, Barton, Erixon
8	103(a)	Fukumoto, Fuller
8	103(a)	Fukumoto, Grant, Fuller
8	103(a)	Fukumoto, Barton, Fuller
14	103(a)	Fukumoto, Dong, Ogusu
14	103(a)	Fukumoto, Grant, Dong, Ogusu
14	103(a)	Fukumoto, Barton, Dong, Ogusu
15	103(a)	Fukumoto, Saiki
15	103(a)	Fukumoto, Grant, Saiki
15	103(a)	Fukumoto, Barton, Saiki
16	103(a)	Fukumoto, Saiki, Masahiko
16	103(a)	Fukumoto, Grant, Saiki, Masahiko
16	103(a)	Fukumoto, Barton, Saiki, Masahiko
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto, Grant
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto, Barton
3–6	103(a)	Ogusu, Fukumoto, Ueda
3–6	103(a)	Ogusu, Fukumoto, Grant, Ueda
3–6	103(a)	Ogusu, Fukumoto, Barton, Ueda
7, 8	103(a)	Ogusu, Fukumoto, Erixon
7, 8	103(a)	Ogusu, Fukumoto, Grant, Erixon
7, 8	103(a)	Ogusu, Fukumoto, Barton, Erixon

Pet. 3–4, 9–93.

H. Testimonial Evidence

To support its challenges, Petitioner relies on the Declaration of Andrew Wolfe, Ph.D. (Exhibit 1003) and the Supplemental Declaration of Andrew Wolfe, Ph.D. (Exhibit 1047). Dr. Wolfe states, "I received the Ph.D. degree in Computer Engineering from Carnegie Mellon University" in 1992 and "have taught at some of the world's leading institutions in the fields of processor technology, computer systems, consumer electronics, software, design tools, data security, cryptography and intellectual property issues." Ex. 1003 ¶¶ 7–8. Dr. Wolfe also states, "I have been retained by [Petitioner] as an independent expert consultant in this proceeding" and "have been asked to consider whether certain references disclose or suggest the features recited in the claims of" the '081 patent. *Id.* ¶¶ 1, 4.

To support its positions, Patent Owner relies on the Declaration of Keith W. Goossen, Ph.D. (Exhibit 2008). Dr. Goossen states, "I received my Ph.D. from Princeton University in 1988," "am a Senior Member of the

Institute of Electrical and Electronic Engineers (IEEE)," and "am the inventor (or co-inventor) on 87 issued U.S. patents." Ex. 2008 ¶¶ 10–11, 13. Dr. Goossen also states, "I have been retained as a technical expert by [Patent Owner] in this proceeding." *Id.* ¶ 1.

Additionally, Petitioner submits Dr. Goossen's deposition testimony, and Patent Owner submits Dr. Wolfe's deposition testimony. *See* Ex. 1048 (July 3, 2024, Goossen Dep. Tr.); Ex. 2010 (Mar. 28, 2024, Wolfe Dep. Tr.); Ex. 2017 (Aug. 21, 2024, Wolfe Dep. Tr.).

I. Burden

In an *inter partes* review, a petitioner bears the burden of persuasion to prove "unpatentability by a preponderance of the evidence." *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (quoting 35 U.S.C. § 316(e)); *see* 37 C.F.R. § 42.1(d) (2024).

III. PATENTABILITY ANALYSIS

A. Legal Principles: Obviousness

A patent may not be obtained "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103(a) (2006). An obviousness analysis involves underlying factual inquiries including (1) the scope and content of the prior art; (2) differences between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) where in evidence, objective indicia of nonobviousness, such as commercial success, long-felt but unsolved needs,

and failure of others.[3] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18, 35–36 (1966); *Apple Inc. v. Samsung Elecs. Co.*, 839 F.3d 1034, 1047–48 (Fed. Cir. 2016) (en banc). When evaluating a combination of references, an obviousness analysis should address "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).

We analyze the obviousness issues according to these principles.

B. Level of Ordinary Skill in the Art

Factors pertinent to determining the level of ordinary skill in the art include (1) the educational level of the inventor; (2) the type of problems encountered in the art; (3) prior-art solutions to those problems; (4) the rapidity with which innovations are made; (5) the sophistication of the technology; and (6) the educational level of workers active in the field. *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–97 (Fed. Cir. 1983). Not all factors may exist in every case, and one or more of these or other factors may predominate in a particular case. *Id.* These factors are not exhaustive, but merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007). Moreover, the prior art itself may reflect an appropriate skill level. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Petitioner asserts that a person of ordinary skill in the art at the time of the alleged invention "would have had a bachelor's degree in electrical engineering, mechanical engineering, computer science, or a similar field and two years of experience related to electronic consumer product design."

[3] The parties do not provide evidence or argument regarding objective indicia of nonobviousness. *See, e.g.*, Pet. 9–93; Resp. 18–66.

Pet. 6. Petitioner also asserts that an ordinarily skilled artisan "could have also obtained similar knowledge and experience through other means." *Id.* Dr. Wolfe's testimony supports Petitioner's assertions. *See* Ex. 1003 ¶ 30.

Patent Owner asserts that a person of ordinary skill in the art at the time of the alleged invention "would have had (1) a bachelor's degree in electrical engineering, mechanical engineering, or a comparable field of study, and (2) at least two years of professional experience with electro-mechanical control systems, or other similarly relevant industry experience." Resp. 3. Patent Owner also asserts that "[a]dditional relevant industry experience may compensate for lack of formal education or vice versa." *Id.* Dr. Goossen's testimony supports Patent Owner's assertions. *See* Ex. 2008 ¶ 16.

Regarding an ordinarily skilled artisan's educational level, Petitioner and Patent Owner agree on a "bachelor's degree" and the general field of study. *See* Pet. 6; Resp. 3. Regarding an ordinarily skilled artisan's experience level, Patent Owner's description requires more experience ("at least two years") than Petitioner's description ("two years"). *See* Pet. 6; Resp. 3. Regarding the area of experience, Patent Owner's description specifies a somewhat different area ("experience with electro-mechanical control systems") than Petitioner's description ("experience related to electronic consumer product design"). *See* Pet. 6; Resp. 3.

We adopt Petitioner's description of an ordinarily skilled artisan because it comports with the technology and claims in the '081 patent as well as the asserted references. *See, e.g.*, Ex. 1001, 1:15–3:21, 15:36–17:27; *infra* §§ III.D.1, III.F.1, III.H.1, III.I.1–III.I.2. We note that our analysis would not change if we adopted Patent Owner's description of an ordinarily

skilled artisan, which requires more experience ("at least two years") than Petitioner's description ("two years"). *See* Pet. 6; Resp. 3. Someone with a higher skill level will understand the technology at least as well as someone with a lower skill level. *See Innovention Toys, LLC v. MGA Ent., Inc.*, 637 F.3d 1314, 1323 (Fed. Cir. 2011); *Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d 1358, 1369 (Fed. Cir. 2011). Hence, "it is generally easier to establish obviousness under a higher level of ordinary skill." *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1366 (Fed. Cir. 2012).

C. Claim Construction

1. BACKGROUND

We construe claim terms "using the same claim construction standard" that district courts use to construe claim terms in civil actions under 35 U.S.C. § 282(b). *See* 37 C.F.R. § 42.100(b). Under that standard, claim terms "are given their ordinary and customary meaning, which is the meaning the term would have to a person of ordinary skill in the art at the time of the invention." *Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc.*, 904 F.3d 965, 971 (Fed. Cir. 2018) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc)). The meaning of claim terms may be determined by "look[ing] 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).

2. MEANS-PLUS-FUNCTION CLAIMING

The patent statute provides that "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112 ¶ 6 (2006). The absence of the word "means" in a claim limitation creates a rebuttable presumption that § 112's means-plus-function provision does not apply. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc in relevant part).

When a claim limitation lacks the word "means," a party may rebut the presumption that § 112's means-plus-function provision does not apply by demonstrating that "the claim term fails to 'recite[] sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Williamson*, 792 F.3d at 1348 (alteration by the court) (quoting *Watts v. XL Sys., Inc.*, 232 F.3d 877, 880 (Fed. Cir. 2000)).

Construing a means-plus-function limitation involves two steps: first, identify the claimed function or functions; and second, determine what structure, if any, disclosed in the patent's specification corresponds to the claimed function or functions. *Williamson*, 792 F.3d at 1351; *see Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc.*, 248 F.3d 1303, 1311 (Fed. Cir. 2001). For the second step, a person of ordinary skill in the art must "recognize the structure in the specification and associate it with the corresponding function in the claim." *All-Voice Computing PLC v. Nuance Commc'ns, Inc.*, 504 F.3d 1236, 1241 (Fed. Cir. 2007). The "duty to link or associate structure to function is the *quid pro quo* for the convenience" of

using means-plus-function claiming. *B. Braun Med., Inc., v. Abbott Lab'ys*, 124 F.3d 1419, 1424 (Fed. Cir. 1997).

When a limitation recites two or more functions, the specification "must disclose adequate corresponding structure to perform *all* of the claimed functions." *Media Rights Techs., Inc. v. Capital One Fin. Corp.*, 800 F.3d 1366, 1374 (Fed. Cir. 2015) (emphasis by the court); *see Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1318–19 (Fed. Cir. 2012) (considering means-plus-function limitation specifying two functions).

For a computer-implemented function, the "corresponding structure" for a means-plus-function limitation "may differ from more traditional, mechanical structure." *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1298 (Fed. Cir. 2014), overruled on other grounds by *Williamson*, 792 F.3d at 1349. In particular, "there must be some explanation of how the computer performs the claimed function." *Blackboard, Inc. v. Desire2Learn, Inc.*, 574 F.3d 1371, 1384 (Fed. Cir. 2009). Hence, a patent's specification must disclose more than a general-purpose computer or microprocessor because those devices "can be programmed to perform very different tasks in very different ways," and merely disclosing one of those devices as structure for performing a claimed function does not limit claim scope. *Aristocrat Techs. Austl. Pty Ltd. v. Int'l Game Tech.*, 521 F.3d 1328, 1333 (Fed. Cir. 2008).

For a computer-implemented function, an algorithm "for performing the claimed function" supplies the necessary disclosure. *Williamson*, 792 F.3d at 1352. "Requiring disclosure of an algorithm properly defines the scope of the claim and prevents pure functional claiming." *Ergo Licensing, LLC v. CareFusion 303, Inc.*, 673 F.3d 1361, 1364 (Fed. Cir. 2012). A patent's specification may disclose an algorithm "for

performing the claimed function" as "a mathematical formula, in prose, as a flow chart, or in any other manner that provides sufficient structure." *Williamson*, 792 F.3d at 1352; *see Function Media, L.L.C. v. Google, Inc.*, 708 F.3d 1310, 1318 (Fed. Cir. 2013).

3. OVERVIEW OF THE ISSUES

Petitioner contends that § 112's means-plus-function provision applies to the following "component" limitations in claims 1, 3, and 4 even though each limitation lacks the word "means":

(1) "a moveable component" (limitation 1b);

(2) "a driving component that drives the moveable component in each of two opposite directions within the housing" (limitation 1e);

(3) "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features" (limitation 1f);

(4) "the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors" (claim 3); and

(5) "the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the linear vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters" (claim 4).

Pet. 6–8 (emphases omitted); *see* Reply 1–6.

Petitioner contends that § 112's means-plus-function provision applies to the "component" limitations in claims 1, 3, and 4 because each limitation "combines a function with the nonce word 'component' and would have been understood" by an ordinarily skilled artisan to "lack sufficiently definite structure." Reply 1–2; *see* Pet. 6 (citing Manual of Patent Examining Procedure § 2181). Further, Petitioner identifies for each limitation the claimed function or functions and the corresponding structure described in the '081 patent's specification. Pet. 7–8 (citing Ex. 1001, 7:10–24, 7:32–8:20, Figs. 4A–4G, 6, 7A–7C, 13).

Patent Owner disagrees with Petitioner that § 112's means-plus-function provision applies to a "moveable component" (limitation 1b). *See* Resp. 7–8; Sur-reply 1–2. Patent Owner agrees with Petitioner that § 112's means-plus-function provision applies to a "driving component" (limitation 1e) and a "control component" (limitation 1f, claim 3, and claim 4). *See* Resp. 7–8; Sur-reply 2–6. But Patent Owner disagrees with Petitioner regarding the corresponding structure described in the '081 patent's specification for the "driving component" and the "control component." *See* Resp. 8–17; Sur-reply 2–6.

4. LIMITATION 1B: "MOVEABLE COMPONENT"

Claim 1 recites "a moveable component." Ex. 1001, 15:38 (limitation 1b).

(a) Petitioner's Contentions

For limitation 1b, Petitioner contends that "[t]he 'movable component' provides no structural information because essentially any physical component can perform the function of being moved." Reply 2.

According to Petitioner, the '081 patent "discloses embodiments with highly disparate moving components." *Id.* (citing Ex. 1001, Figs. 4A–4G, 14–17).

For limitation 1b, Petitioner identifies the claimed function as "moveable," i.e., "a component that moves." Pet. 7 (emphasis omitted). Petitioner identifies the corresponding structure described in the '081 patent's specification as "[a] moving weight." *Id.* In particular, Petitioner identifies weight 404 in Figures 4A–4G and oscillating mass 634 in Figure 6. *Id.*

(b) Patent Owner's Contentions

Patent Owner contends that Petitioner attempts to rewrite limitation 1b as "a component that moves." Resp. 7 (quoting Pet. 7); *see* Sur-reply 2. Patent Owner then contends that Petitioner "provides no authority why means-plus-function treatment can or should be decided based on a counterfactual rewriting of the claim, rather than the original claim language which includes no functional phrase." Resp. 7.

Further, Patent Owner asserts that limitation 1b "does not recite a 'moving component' but rather 'moveable component,' reflecting the reality that the moveable component does not move on its own" but instead "is capable of being moved, i.e. being driven within the housing by the driving component." Resp. 7–8 (emphases omitted) (citing Ex. 2008 ¶ 55). Patent Owner also asserts that "the requirement that the component be 'moveable' is fundamentally a requirement of structure, namely that the component be structured so as to be moveable, rather than having a shape that made it immovable or being in some way rigidly fixed to the housing, for example." Sur-reply 1–2.

Additionally, Patent Owner contends that "there is likely no material difference between" (1) an ordinarily skilled artisan's understanding of "the plain and ordinary meaning of 'moveable component' within the context of the patent" and (2) Petitioner's proposed means-plus-function construction as applied in the Petition. Resp. 8 (citing Ex. 2008 ¶ 56). Patent Owner also contends that "none of Patent Owner's merits arguments depend on the construction of this term." *Id.* Therefore, according to Patent Owner, "the Board's construction of 'moveable component' is not necessary to the determination of any dispute between" Patent Owner and Petitioner. *Id.*

(c) Analysis

We agree that there is no need to determine whether § 112's means-plus-function provision applies to limitation 1b to decide whether Petitioner satisfies the "preponderance of the evidence" standard for proving unpatentability. *See* Resp. 8; *infra* §§ III.D.2(c), III.K.1(c).

5. LIMITATION 1E: "DRIVING COMPONENT"

Claim 1 recites "a driving component that drives the moveable component in each of two opposite directions within the housing." Ex. 1001, 15:41–42 (limitation 1e).

(a) Petitioner's Contentions

For limitation 1e, Petitioner contends that "[t]he 'driving component' provides no structural information because the claimed function of 'drives the moveable component in each of two opposite directions within the housing' describes only the result to be achieved by the operation of the driving component without any information about the operation or structure of the component." Reply 2.

For limitation 1e, Petitioner identifies the claimed function as "drives the moveable component in each of two opposite directions within the housing." Pet. 7 (emphasis omitted). Petitioner identifies the corresponding structure described in the '081 patent's specification as "[o]ne or more electromagnetic coils." *Id.* In particular, Petitioner identifies coil 420 in Figures 4A–4G, coil 626 in Figure 6, and coils 1302 and 1304 in Figure 13. *Id.*

Regarding a difference between a "coil" and an "electromagnet" as alleged by Patent Owner, Petitioner asserts that the '081 patent discloses a "coil" as the only specific structure for an "electromagnet" even though the patent occasionally refers to "electromagnets" without specifying that they are "coils." Reply 4 (citing Ex. 1001, 9:39–40, Figs. 10, 15–16).

(b) Patent Owner's Contentions

Patent Owner contends that limitation 1e includes "functional terms without an explicit recitation of structure." Resp. 7; *see* Sur-reply 2. Patent Owner also contends that limitation 1e lacks elements that an ordinarily skilled artisan "would recognize as structures for performing the recited functions." Resp. 7 (citing Ex. 2008 ¶¶ 59, 62).

For limitation 1e, Patent Owner does not dispute Petitioner's identification of the claimed function. *See* Resp. 8–9; Sur-reply 2–3. Patent Owner identifies the corresponding structure described in the '081 patent's specification as "[o]ne or more coils or electromagnets." Resp. 8 (emphasis omitted); *see* Sur-reply 2–3. In particular, Patent Owner identifies coil 420 in Figures 4A–4G, coil 514 in Figure 5A, coil 626 in Figure 6, the electromagnet in Figure 10, the electromagnet in Figure 11, coil 1206 in Figure 12, coils 1302 and 1304 in Figure 13, coils 1412 and 1414 in

Figure 14, coil 1510 in Figures 15 and 16, and the stator coils in Figures 24A, 24B, and 25. Resp. 8–9.

Patent Owner contends that Petitioner's identification of corresponding structure as "[o]ne or more electromagnetic coils" omits "numerous examples of driving components" in the specification and "improperly limits" claim scope to only "electromagnet coils." Resp. 9; *see* Sur-reply 3. Patent Owner also contends that the specification's disclosure of some embodiments that use "coils" is an inadequate reason to exclude from claim scope other embodiments that "refer to the broader class of 'electromagnets.'" Sur-reply 3.

Patent Owner notes that claim 8 specifies that "the driving component is an electromagnetic coil." Resp. 9 (quoting Ex. 1001, 16:40). Patent Owner then contends that construing limitation 1e as limited to "electromagnetic coils" would make the quoted language in claim 8 superfluous. *Id.*

(c) Analysis

We agree with the parties that § 112's means-plus-function provision applies to limitation 1e. *See* Pet. 6; Resp. 7; Reply 1–2; Sur-reply 2. The presumption that this provision does not apply is overcome because limitation 1e recites "function without reciting sufficient structure for performing that function." *See* Ex. 1001, 15:41–42; *Williamson*, 792 F.3d at 1348. Specifically, as the parties agree, limitation 1e recites the following function without reciting sufficient structure for performing that function: "drives the moveable component in each of two opposite directions within the housing." Ex. 1001, 15:41–42; *see* Pet. 6–7; Resp. 7–9; Reply 1–2.

Regarding the corresponding structure described in the '081 patent's specification for limitation 1e, that structure includes one or more coils, as each party argues. *See* Ex. 1001, 5:2–4, 5:54–59, 6:32–35, 9:28–41, 10:7–9, 10:19–22, Figs. 4A–4G (coil 420), Fig. 5A (coil 514), Fig. 6 (coil 626), Fig. 12 (coil 1206), Fig. 13 (coils 1302 and 1304), Fig. 14 (coils 1412 and 1414), Fig. 15 (coil 1510); Pet. 7; Resp. 8–9. Additionally, the parties agree that we need not decide whether that structure is "[o]ne or more electromagnetic coils" as Petitioner proposes or "[o]ne or more coils or electromagnets" as Patent Owner proposes because the asserted references disclose one or more coils. *See* Reply 3–4; Sur-reply 2. Hence, we decline to construe limitation 1e further than necessary to resolve the dispute.

6. LIMITATION 1F: "CONTROL COMPONENT"

Claim 1 recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." Ex. 1001, 15:44–48 (limitation 1f).

(a) Petitioner's Contentions

For limitation 1f, Petitioner contends that "[t]he 'control component' provides no structural information because the claimed function is disclosed to be implemented by a general-purpose CPU." Reply 2. According to Petitioner, a "general-purpose CPU is insufficient corresponding structure." *Id.* (citing *Aristocrat Techs.*, 521 F.3d at 1333).

For limitation 1f, Petitioner identifies the claimed function as "controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an

amplitude specified by user input received from the user-input features." Pet. 7 (emphasis omitted); Reply 5. Petitioner identifies the corresponding structure described in the '081 patent's specification as a "Processor and H Bridge Switch" where the "processor is programmed with an algorithm to perform the following steps: (1) set the mode and strength to values represented by selections made by user input to the user input features, (2) provide a corresponding output to the power supply, and (3) provide a corresponding output to the H-bridge switch." Pet. 7, 21. As support, Petitioner cites the flow charts in Figures 7A and 7C and the related descriptions in the specification. *Id.* at 7 (citing Ex. 1001, 7:10–24, 8:10–20, Figs. 7A, 7C); *see* Reply 5–6 (citing Ex. 1001, 7:13–17, 8:10–20, Fig. 7A).

Regarding the identification of a "Processor and H Bridge Switch" as the corresponding structure, Petitioner asserts that limitation 1f's claimed function includes controlling both frequency and amplitude and that the specification "makes clear that controlling the current to the driving component is insufficient to control both frequency and amplitude." Reply 5. Petitioner also asserts that the specification discloses:

(1) controlling amplitude by changing the control output "p" for the power supply so that the power supply provides "an appropriate current to the coil"; and

(2) controlling frequency by changing the control output "d" for the H-bridge switch.

Id. at 5–6 (citing Ex. 1001, 7:13–17, 8:10–20, Fig. 7A).

Therefore, according to Petitioner, the "correct corresponding structure thus requires an output both to the power supply to control the current (output 'p') and to the H-bridge to control the frequency (output 'd')." Reply 6.

(b) Patent Owner's Contentions

Patent Owner contends that limitation 1f includes "functional terms without an explicit recitation of structure." Resp. 7; *see* Sur-reply 4–5. Patent Owner also contends that limitation 1f lacks elements that an ordinarily skilled artisan "would recognize as structures for performing the recited functions." Resp. 7 (citing Ex. 2008 ¶¶ 59, 62).

For limitation 1f, Patent Owner does not dispute Petitioner's identification of the claimed function. *See* Resp. 9–16, 18–19, 52; Sur-reply 3–6. Patent Owner identifies the corresponding structure described in the '081 patent's specification as an "oscillator circuit; microcontroller with internal or external memory; processor; CPU; microprocessor; and equivalents thereof." Resp. 10; *see id.* at 19, 52.

Additionally, Patent Owner explains that where "the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm" comprising the following steps for limitation 1f: "(a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component." Resp. 10 (bracketed words by Patent Owner) (emphasis omitted). As support, Patent Owner cites the flow charts in Figures 7A and 7C and the related descriptions in the specification. *Id.* (citing Ex. 1001, 7:10–24, 8:10–20, Figs. 7A, 7C).

Patent Owner contends that Petitioner's identification of a "Processor and H Bridge Switch" as the corresponding structure improperly excludes a preferred embodiment. Resp. 10–11. Patent Owner explains that the

"specification discloses an embodiment with an oscillator circuit that is expressly sufficient to perform the claimed functions." *Id.* at 11 (citing Ex. 1001, 11:43–13:2; Ex. 2008 ¶ 64.) Patent Owner also explains that claim 2 depends from claim 1 and specifies that claim 1's "control component" may comprise a "variable oscillator circuit with additional control circuitry." *Id.* Patent Owner then contends that an "algorithm is not required where the corresponding structure is the oscillator circuit" disclosed in the specification. *Id.* (citing *HTC Corp. v. IPCom GmbH & Co.*, 667 F.3d 1270, 1279–80 (Fed. Cir. 2012)).

Patent Owner also contends the Petitioner's identification of a "Processor and H Bridge Switch" as corresponding structure improperly disregards the specification's disclosure of a "microcontroller" as corresponding structure. Resp. 12. According to Patent Owner, a "microcontroller" differs from a general-purpose computer and provides "more specific functionality sufficient to perform the claimed function" without requiring an algorithm to perform the claimed function. *Id.*

Further, Patent Owner asserts that Petitioner fails to explain why an H-bridge switch "corresponds to any portion" of limitation 1f's claimed function. Resp. 15. For "control[ling] supply of power from the power supply to the driving component" according to limitation 1f, Patent Owner asserts that the specification "discloses that a processor configured with an algorithm can perform that function by outputting a value to the power supply so that the power supply provides a corresponding output (e.g., current) to the driving component." *Id.* (emphasis omitted) (citing Ex. 1001, 8:16–20).

Referencing the H-bridge switch disclosed in the '081 patent's specification, Patent Owner asserts that the H-bridge switch does not form part of the "control component" because the H-bridge switch "receives an output from the control component rather than forming part of the control component." Resp. 15–16. Patent Owner further asserts that the claimed function in limitation 1f requires oscillation at a specified frequency but "does not require that the claimed control component itself control that frequency." Sur-reply 5.

Where the corresponding structure is a processor, CPU, or microprocessor, Patent Owner notes that the parties agree that the algorithm includes the following step: "provide a corresponding output to the power supply." Resp. 13.

Where the corresponding structure is a processor, CPU, or microprocessor, Patent Owner asserts that Petitioner's proposed algorithm includes the following "unnecessary third step": "provide a corresponding output to the H-bridge switch." Resp. 14; *see* Pet. 7. Patent Owner also asserts that its proposed algorithm "omits this unnecessary step but is still sufficient for performing the claimed function." Resp. 14.

(c) Analysis

We agree with the parties that § 112's means-plus-function provision applies to limitation 1f. *See* Pet. 6; Resp. 7; Reply 1–2; Sur-reply 5. The presumption that this provision does not apply is overcome because limitation 1f recites "function without reciting sufficient structure for performing that function." *See* Ex. 1001, 15:44–48; *Williamson*, 792 F.3d at 1348. Specifically, as the parties agree, limitation 1f recites the following function without reciting sufficient structure for performing that function:

"controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." Ex. 1001, 15:44–48; *see* Pet. 6–7; Resp. 7, 9–16, 18–19, 52; Reply 1–2.

Regarding the corresponding structure described in the '081 patent's specification for limitation 1f, we need not decide whether that structure includes an "oscillator circuit" or "microcontroller with internal or external memory" as Patent Owner proposes because Petitioner does not rely on those structures or their equivalents to establish unpatentability. *See* Pet. 18–27, 36–37, 39–44, 46–53, 82–84, 91–92; Resp. 11–12.

Regarding the corresponding structure described in the '081 patent's specification for limitation 1f, we agree with Patent Owner that the structure includes a "processor," "CPU," and "microprocessor." *See* Resp. 10. For example, the specification discloses that a linear-resonant vibration module may include "a central processing unit ('CPU'), generally a small, low-powered microprocessor." Ex. 1001, 6:2–8. The specification also discloses that "a processor or microcontroller within a linear-resonant vibration module allows for a very large number of different processor-controlled vibration patterns and modes to be exhibited by the linear-resonant vibration module." *Id.* at 10:53–57.

We agree with Patent Owner that where "the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm" comprising the following steps for limitation 1f: "(a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power

supply provides a corresponding output to the driving component." *See* Resp. 10; Ex. 2008 ¶¶ 63–64. For the reasons explained below, we adopt these steps as the algorithmic structure required by limitation 1f.

Specifically, the '081 patent includes as Figures 7A–7C "control-flow diagrams" or algorithms that "illustrate the control program, executed by the CPU, that controls operation of an LRVM." Ex. 1001, 3:45–49, 6:43–47, Figs. 7A–7C. Figure 7A "provides a control-flow diagram for the high-level control program." *Id.* at 6:47–48, Fig. 7A. Figure 7B "provides a control-flow diagram for the routine 'monitor,' called in" Figure 7A. *Id.* at 7:32–33, Fig. 7B. Figure 7C "provides a control-flow diagram for the routine 'control,' called in" Figure 7A. *Id.* at 8:10–11, Fig. 7C.

The '081 patent's Figure 7A is reproduced below:

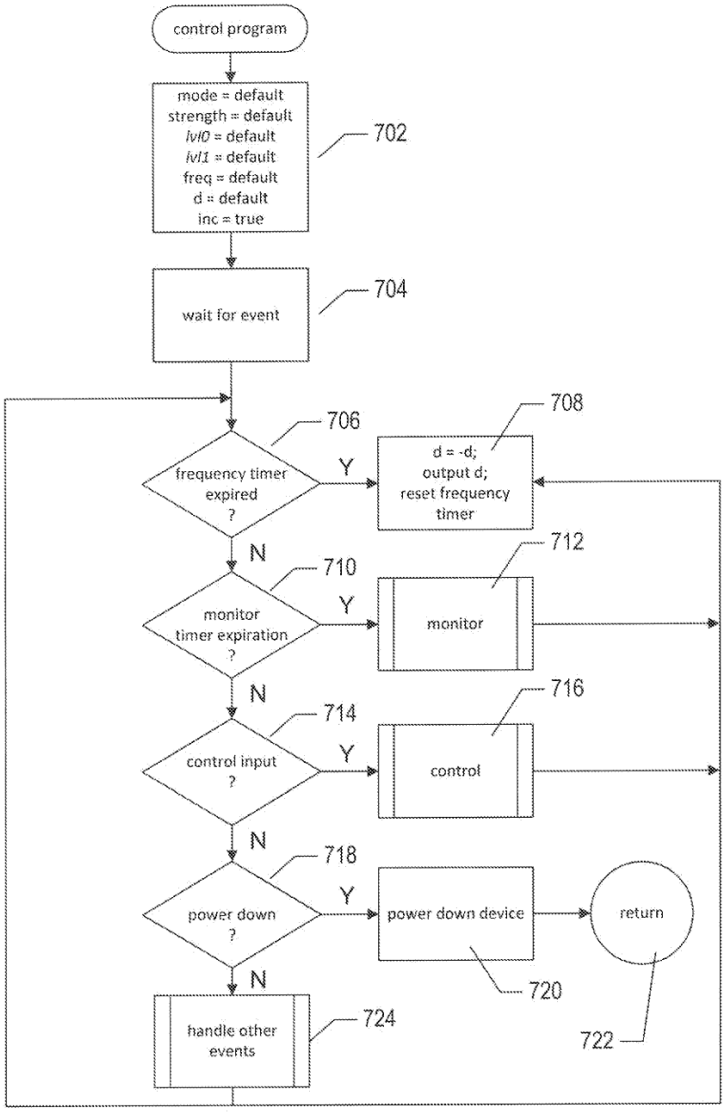

FIG. 7A

Figure 7A illustrates steps 702 through 722 in a "control program" for controlling an LRVM. *See* Ex. 1001, 6:47–7:31, Fig. 7A.

In step 702, the program sets several variables to default values, including (1) the mode variable indicating "the current operational mode of the device," (2) the strength variable indicating "the current user-selected strength of operation" and "the electrical current applied to the coil," (3) the lvl0 variable indicating "a previously sensed vibrational strength" used by

Figure 7B's "monitor" routine, (4) the lvl1 variable indicating "a currently sensed vibrational strength" used by Figure 7B's "monitor" routine, and (5) the control output "d" for the H-bridge switch. Ex. 1001, 6:50–61, Figs. 7A–7B.

In step 704, the "program waits for a next event." Ex. 1001, 6:61–62, Fig. 7A. The "remaining steps represent a continuously executing loop, or event handler, in which each event that occurs is appropriately handled by the control program." *Id.* at 6:62–65.

In step 706, the program determines whether a timer (or similar mechanism for repeatedly measuring time) related to the LRVM's frequency has expired. Ex. 1001, 7:2–14, 7:17–18, Fig. 7A. If so, in step 708 the program changes the control output "d" for the H-bridge switch from high to low or from low to high so that current through the H-bridge switch reverses direction, thus reversing direction of current through the coil. *Id.* at 5:50–61, 6:32–33, 7:3–4, 7:13–16, Figs. 5A–5B, 7A. After changing the control output "d" for the H-bridge switch, the program resets the frequency-related timer to "trigger a next frequency-related event." *Id.* at 7:15–17, Fig. 7A.

In step 710, the program determines whether a timer (or similar mechanism for repeatedly measuring time) related to the LRVM's interval for monitoring the vibrational strength or force has expired. Ex. 1001, 7:2–10, 7:19–20, Fig. 7A. If so, in step 712 the program calls a "monitor" routine with the steps depicted in Figure 7B. *Id.* at 7:20–21, Fig. 7A.

In step 714, the program determines whether "the event corresponds to a change in the user input through the user interface." Ex. 1001, 7:21–23, Fig. 7A. If so, in step 716 the program calls a "control" routine with the steps depicted in Figure 7C. *Id.* at 7:22–24, Fig. 7A.

The '081 patent's Figure 7C is reproduced below:

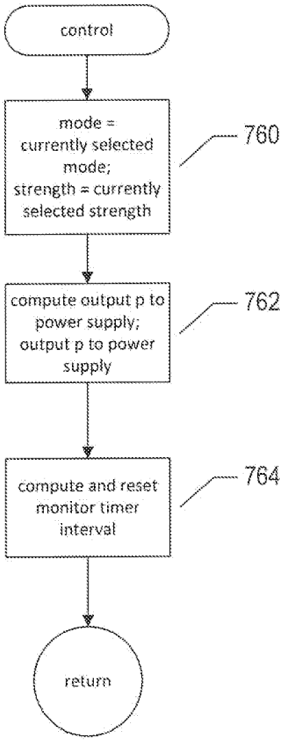

FIG. 7C

Figure 7C illustrates steps 760 through 764 in a "control" routine "invoked when a change in the user controls has occurred." *See* Ex. 1001, 8:10–22, Fig. 7C.

In step 760, the routine sets the mode variable and the strength variable to "the currently selected mode and vibrational strength, represented by the current states of control features in the user interface." Ex. 1001, 8:12–15, Fig. 7C. In step 762, the routine "computes an output value p corresponding to the currently selected strength, stored in the variable strength, and outputs the value p to the power supply so that the power supply outputs an appropriate current to the coil." *Id.* at 8:16–20, Fig. 7C. The power supply receives the control output "p" to "control the current supplied to the H-bridge switch" for "transfer to the coil." *Id.* at 6:33–35.

In step 764, the routine "computes a new monitor timer interval" and resets the monitoring-interval timer. *Id.* at 8:20–22, Fig. 7C.

Thus, the '081 patent's specification links the algorithmic structure in Figures 7A and 7C and the related descriptions to the function recited in limitation 1f. In particular, Figure 7A's steps 702, 714, and 716, Figure 7C's steps 760 and 762, and the related descriptions support the following steps for limitation 1f that Patent Owner proposes and we adopt: "(a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component." Ex. 1001, 6:33–35, 6:50–61, 7:21–24, 8:10–20, Figs. 7A, 7C; *see* Ex. 2008 ¶¶ 63–64; Resp. 10.

We disagree with Petitioner's proposed construction of limitation 1f for several reasons. First, Petitioner's identification of a "Processor and H Bridge Switch" as the corresponding structure excludes a preferred embodiment. *See* Pet. 7, 21; Resp. 10–11. In particular, the '081 patent discloses a preferred embodiment for a lower-cost LRVM with "a simpler oscillator circuit with additional control circuitry" instead of a processor or CPU. Ex. 1001, 11:43–47; *see id.* at 11:47–13:2. For instance, "an oscillator-controlled linear vibration module" may include "a variable-frequency oscillator circuit" that "can be controlled by user input to drive the H switch or other H-switch-like circuit to operate the linear vibration module at different frequencies." *Id.* at 11:59–63. A construction excluding a preferred embodiment is "rarely, if ever correct." *PPC Broadband, Inc. v. Corning Optical Commc'ns RF, LLC*, 815 F.3d 747, 755 (Fed. Cir. 2016);

see Google LLC v. EcoFactor, Inc., 92 F.4th 1049, 1058–59 (Fed. Cir. 2024).

Second, Petitioner's identification of a "Processor and H Bridge Switch" as the corresponding structure renders language in claim 2 "void, meaningless, or superfluous." *See* Pet. 7, 21; Resp. 11. Claim 2 depends from claim 1 and specifies that "the control component is one of" a "variable oscillator circuit with additional control circuitry" and a "microprocessor." Ex. 1001, 15:49–54. Petitioner's identification of a "Processor and H Bridge Switch" as the corresponding structure negates the "variable oscillator circuit" option in claim 2. Preferably, a claim construction does not render claim language "void, meaningless, or superfluous." *Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017); *see Ortho-McNeil Pharm., Inc. v. Mylan Lab'ys, Inc.*, 520 F.3d 1358, 1362 (Fed. Cir. 2008).

Third, as Patent Owner asserts, the claimed function in limitation 1f requires oscillation at a specified frequency but "does not require that the claimed control component itself control that frequency." *See* Ex. 1001, 15:44–48; Sur-reply 5. In particular, limitation 1f requires the "control component" to "control[] supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." Ex. 1001, 15:44–48. Thus, the "control component" must "control[] supply of power from the power supply to the driving component," i.e., control the voltage or current provided by the power supply for delivery to the "driving component." *Id.* Once the power supply provides the voltage or current for delivery to the "driving component," the

"control component" or another component may then "cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." *Id.* Hence, contrary to Petitioner's contention, the "control component" does not necessarily include the H-bridge switch that receives the control output "d" related to frequency. *See* Reply 5–6 (citing Ex. 1001, 7:13–17, 8:10–20, Fig. 7A).

Consistent with our determination regarding the two-step algorithmic structure required by limitation 1f, the district court in the Sony litigation has construed limitation 1f as requiring the same two-step algorithmic structure where the corresponding hardware structure is a microcontroller, processor, CPU, or microprocessor. Ex. 1054, 15–16. The district court did not include an H-bridge switch as hardware structure according to limitation 1f. *Id.*

But a different district court has construed a limitation similar to limitation 1f as requiring "Steps 706 through 716 in Figure 7A, with reference to all steps shown in Figure 7B other than Step 734 and all steps shown in Figure 7C, or the algorithm described in the corresponding text . . . and equivalents thereof." Ex. 1053, 37. That district court did so, however, based on different arguments by the parties and a different record. *Id.* at 33–37. Nevertheless, that district court did not include an H-bridge switch as hardware structure according to the limitation. *Id.* at 37.

Also, a different Board panel has construed limitation 1f as requiring a two-step algorithmic structure, but those two steps differ somewhat from the two steps that Patent Owner proposes in this proceeding and we adopt. Ex. 1055, 20 (*Sony Interactive Ent. Inc. v. Resonant Systems, Inc.*, IR2024-

00568, Paper 9 (PTAB Aug. 26, 2024)). That panel did so, however, based on different arguments by the parties and a different record. *Id.* at 11–20.

7. CLAIM 3: "CONTROL COMPONENT"

Claim 3 reads as follows:

> 3. The linear vibration module of claim 1 wherein the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.

Ex. 1001, 15:62–67.

(a) Petitioner's Contentions

Petitioner contends that claim 3 fails to recite sufficient structure for the reasons that limitation 1f fails to recite sufficient structure. *See* Pet. 6–7; Reply 1–2.

For claim 3, Petitioner identifies the language following the initial recitation of "control component" as the claimed function. Pet. 7–8. Petitioner identifies the corresponding structure described in the '081 patent's specification as follows: "Claim 1 structure with the processor further programmed with an algorithm to perform the following steps: (1) convert the received output signal into an integer, (2) compare that integer to a specific value, (3) adjust one or more operational control outputs based on that comparison." *Id.* As support, Petitioner cites the flow charts in Figures 7A and 7B and the related descriptions in the specification. *Id.* at 8 (citing Ex. 1001, 7:13–18, 7:32–8:9, Figs. 7A–7B).

Petitioner notes that Patent Owner proposes a three-step algorithm for claim 3 including the following first step: "receive the value of an output signal." Reply 6 (emphasis omitted) (quoting Resp. 16). Petitioner then

contends that the specification "does not disclose receiving 'the value' of an output signal" but instead "discloses receiving the output signal itself, followed by converting the output signal to an integer suitable for comparison." *Id.* (citing Ex. 1001, 7:33–36).

(b) Patent Owner's Contentions

Patent Owner contends that claim 3 fails to recite sufficient structure for the reasons that limitation 1f fails to recite sufficient structure. *See* Resp. 7.

For claim 3, Patent Owner does not dispute Petitioner's identification of the claimed function. *See* Resp. 16–17; Sur-reply 6. Patent Owner identifies the corresponding structure described in the '081 patent's specification in the same way for claim 3 as for limitation 1f, i.e., an "oscillator circuit; microcontroller with internal or external memory; processor; CPU; microprocessor; and equivalents thereof." Resp. 10, 16.

Additionally, Patent Owner explains that where "the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/ microprocessor is programmed with an algorithm" comprising the following steps for claim 3: "(a) receive the value of an output signal; (b) compare that value to a different value, which could be a previous value; and (c) adjust one or more operational control outputs based on that comparison." Resp. 16 (emphases omitted). As support, Patent Owner cites the flow charts in Figures 7A and 7B and the related descriptions in the specification. Ex. 2012, 35–36 (citing Ex. 1001, 7:13–18, 7:32–8:9, Figs. 7A–7B) (cited at Resp. 16).[4]

[4] For Exhibit 2012 (Joint Claim Construction Chart), we cite to the header page numbers.

Where the corresponding structure is a processor, CPU, or microprocessor, Patent Owner "agrees that Petitioner's algorithm would be sufficient to perform the claimed function." Resp. 17.

(c) Analysis

We agree with the parties that § 112's means-plus-function provision applies to claim 3. *See* Pet. 6–7; Resp. 7; Reply 1–2. The presumption that this provision does not apply is overcome because claim 3 recites "function without reciting sufficient structure for performing that function." *See* Ex. 1001, 15:62–67; *Williamson*, 792 F.3d at 1348. Specifically, as the parties agree, claim 3 recites the following functions without reciting sufficient structure for performing those functions: "receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors." Ex. 1001, 15:62–67; *see* Pet. 6–8; Resp. 16–17; Reply 1–2.

Based on Patent Owner's "agree[ment] that Petitioner's algorithm would be sufficient to perform the claimed function" where the corresponding structure is a processor, CPU, or microprocessor, we adopt Petitioner's proposed algorithm as the algorithmic structure required by claim 3. *See* Pet. 7–8; Resp. 17.

8. CLAIM 4: "CONTROL COMPONENT"

Claims 4 reads as follows:

> 4. The linear vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the linear vibration module produces desired

> outputs from the one or more sensors corresponding to one or more operational control parameters.

Ex. 1001, 16:1–7.

(a) Petitioner's Contentions

Petitioner contends that claim 4 fails to recite sufficient structure for the reasons that limitation 1f fails to recite sufficient structure. *See* Pet. 6–7; Reply 1–2.

For claim 4, Petitioner identifies the language following the initial recitation of "control component" as the claimed function. Pet. 8. Petitioner identifies the corresponding structure described in the '081 patent's specification as follows: "Claim 1 structure with the processor further programmed with the same claim 3 algorithm." *Id.*

(b) Patent Owner's Contentions

Patent Owner contends that claim 4 fails to recite sufficient structure for the reasons that limitation 1f fails to recite sufficient structure. *See* Resp. 7.

For claim 4, Patent Owner does not dispute Petitioner's identification of the claimed function. *See* Resp. 16–17; Sur-reply 6. Patent Owner identifies the corresponding structure described in the '081 patent's specification in the same way for claim 4 as for limitation 1f and claim 3, i.e., an "oscillator circuit; microcontroller with internal or external memory; processor; CPU; microprocessor; and equivalents thereof." Resp. 10, 16. Additionally, Patent Owner explains that where "the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm" comprising the same steps for claim 4 as for claim 3. *Id.* at 16.

(c) Analysis

We agree with the parties that § 112's means-plus-function provision applies to claim 4. *See* Pet. 6–7; Resp. 7; Reply 1–2. The presumption that this provision does not apply is overcome because claim 4 recites "function without reciting sufficient structure for performing that function." *See* Ex. 1001, 16:1–7; *Williamson*, 792 F.3d at 1348. Specifically, as the parties agree, claim 4 recites the following function without reciting sufficient structure for performing that function: "adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the linear vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters." Ex. 1001, 16:1–7; *see* Pet. 6–8; Resp. 16–17; Reply 1–2.

Additionally, as the parties also agree, the '081 patent describes the same algorithmic structure for claim 4 as for claim 3 when employing a processor, CPU, or microprocessor. Ex. 1001, 6:36–39, 7:19–21, 7:33–36, 7:50–8:7, Figs. 7A–7B; *see* Pet. 7–8; Resp. 16–17.

9. CLAIM 4: ANTECEDENT-BASIS ISSUE

Although claim 4 depends directly from claim 1, Petitioner notes that claim 1 lacks an antecedent basis for the following terms in claim 4: "the one or more operational control outputs of the control component," "the sensors," and "the one or more sensors." Pet. 8, 51; *see* Ex. 1001, 15:36–48 (claim 1), 16:1–7 (claim 4). To address the ambiguity in claim 4, Petitioner proposes two alternatives to clarify claim 4. Pet. 8, 51. First, interpret "the one or more operational control outputs of the control component" as "one or more operational control outputs of the control component" and interpret

"the sensors" as "sensors." *Id.* Second, interpret claim 4 as depending from claim 3 instead of claim 1. *Id.*

Patent Owner contends that claim 4 "contains a clear typographical error" and "should be interpreted as depending from claim 3." Resp. 17–18. Patent Owner explains that claim 3 "introduces limitations of 'sensors' and 'one or more operational control outputs of the control component'" and claim 4 "then refers to 'the sensors' and 'the one or more operational control outputs.'" *Id.* at 17. Patent Owner contends that the "natural conclusion is that these terms in claim 4 are meant to refer to the corresponding terms in claim 3." *Id.* at 18.

During the oral hearing, Petitioner's counsel agreed that we may consider claim 4 as depending from claim 3 for purposes of this proceeding. Tr. 18:4–22. Hence, for purposes of this proceeding, we consider claim 4 as depending from claim 3. We note that two district courts have resolved the same antecedent-basis issue in the same claim or in a similar claim by modifying claim dependency this way. *See* Ex. 1053, 50; Ex. 1054, 22.

10. SUMMARY

"[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy." *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *see Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Above, we discussed issues concerning the "component" limitations in claims 1, 3, and 4 and an ambiguity in claim 4. *See supra* §§ III.C.4(c), III.C.5(c), III.C.6(c), III.C.7(c), III.C.8(c), III.C.9. We determine that no other claim language requires a discussion of scope or

an explicit construction to decide whether Petitioner satisfies the "preponderance of the evidence" standard for proving unpatentability.

D. Alleged Obviousness over Fukumoto: Claims 1–3, 7–9, and 17

Petitioner contends that claims 1–3, 7–9, and 17 are unpatentable under § 103(a) because the claims would have been obvious over Fukumoto. *See* Pet. 9–35; Reply 16–22. Patent Owner disputes Petitioner's contentions. *See* Resp. 18–27; Sur-reply 7–14.

Below, we provide an overview of Fukumoto. Then, we consider the obviousness issues. For the reasons explained below, we agree with Petitioner that claims 1, 2, 7, and 17 are unpatentable under § 103(a) because the claims would have been obvious over Fukumoto but disagree that claims 3, 8, and 9 are unpatentable based on Fukumoto.

1. OVERVIEW OF FUKUMOTO (EXHIBIT 1005)

Fukumoto is a U.S. patent titled "Electronic Device, Vibration Generator, Vibration-Type Reporting Method, and Report Control Method," filed on August 3, 2001, and issued on November 6, 2007. Ex. 1005, codes (12), (22), (45), (54). Fukumoto states that the invention "relates to a user interface and vibration generation mechanism of an electronic device." *Id.* at 1:8–9; *see id.* at code (57). As examples of electronic devices, Fukumoto identifies the following:

- "PDAs (personal digital assistants), personal computers, [and] ATMs (automatic teller machines)";
- "a mobile phone, electronic notebook, mobile computer, wristwatch, electronic calculator, remote controller of an electronic device, and other various types of portable electronic devices"; and
- "a stationary type computer or a vending machine, cash register, car navigation system, household electric

> appliance, or other of various types of electronic devices not having portability."

Id. at 1:13–14, 32:52–53, 50:50–59.

Fukumoto endeavors to provide "an electronic device, a vibration generator, a vibration-type reporting method, and a report control method enabling a user to easily confirm without viewing a screen receipt of an input operation or a response of the electronic device with respect to an operation input." Ex. 1005, 1:45–50. To achieve those objectives, Fukumoto employs the following:

- "a vibration generator for imparting vibration to a hand-touched portion of the electronic device"; and
- "vibration control means for causing the vibration generator to generate vibration when it is detected that an operation input in the operating unit has been received."

Id. at 1:51–58. Hence, "the electronic device reports to a user that an operation input has been received, by causing the hand-touched portion of the electronic device to vibrate." *Id.* at 1:64–67.

Fukumoto's Figure 1 (reproduced below) depicts an example electronic device, i.e., a PDA:

FIG. 1

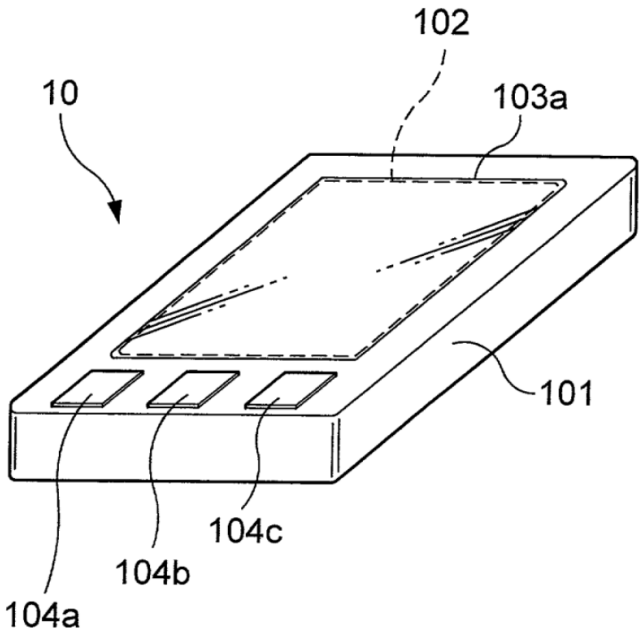

Figure 1 illustrates PDA 10 including main case 101, transparent touch panel 102, display panel 103a covering an opening in main case 101, and push-button-type operation keys 104a, 104b, and 104c on the upper surface of main case 101. Ex. 1005, 13:41–51, Fig. 1.

A "user inputs operation instructions to" PDA 10 by (1) "touching the touch panel 102 by his or her fingertip" or (2) "using a pen or other operation tools." Ex. 1005, 13:45–49. A user may also employ operation keys 104a, 104b, and 104c "for inputting operation instructions to" PDA 10, such as "for turning the main power on or off." *Id.* at 13:49–53.

Fukumoto's Figure 2 (reproduced below) depicts a hardware configuration for PDA 10 in Figure 1:

FIG. 2

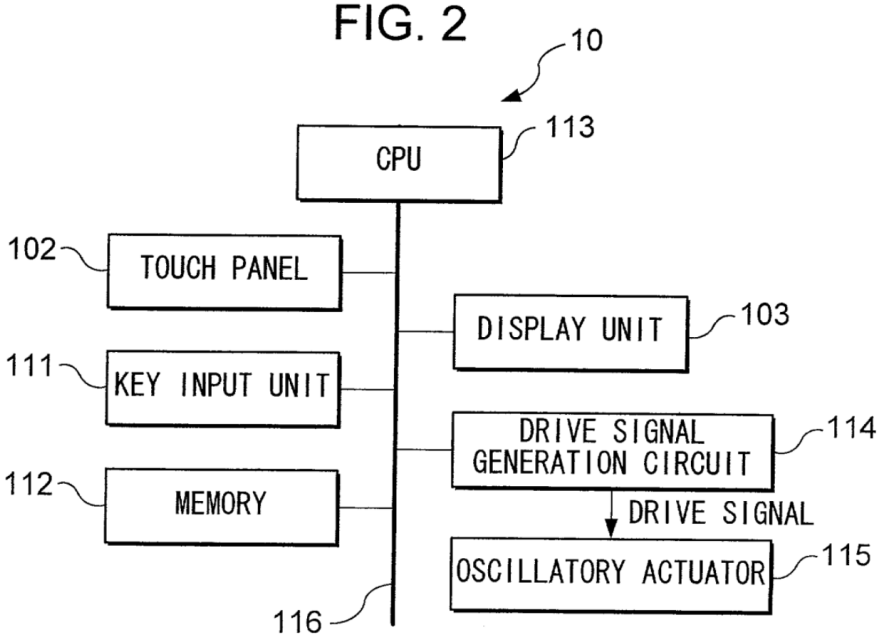

Figure 2 illustrates the following hardware components in PDA 10:

- touch panel 102;
- display unit 103;
- key input unit 111;
- memory 112;
- CPU 113;
- drive signal generation circuit 114;
- oscillatory actuator 115; and
- bus 116.

Ex. 1005, 13:54–59, Fig. 2.

In response to a touch operation, touch panel 102 outputs to CPU 113 "a signal showing a touched position on the touch panel 102." Ex. 1005, 13:60–62. Key input unit 111 outputs to CPU 113 "a key operation signal in response to the pressing operation of the operation keys 104a to 104c by the

user." *Id.* at 13:65–14:1. Memory 112 stores (1) "programs, data, etc. for controlling" PDA 10 and (2) "waveform data of the drive signal for driving" oscillatory actuator 115. *Id.* at 14:1–4.

CPU 113 executes a "vibration control processing" program. Ex. 1005, 14:7–8; *see id.* at 10:4–6, 16:60–19:3, Fig. 5. For instance, when CPU 113 detects "an operation input from the touch panel 102 or any one of operation keys 104a to 104c," CPU 113 drives oscillatory actuator 115 through drive signal generation circuit 114 "to cause the touch panel 102 or one of the operation keys 104a to 104c to vibrate." *Id.* at 14:8–13. Drive signal generation circuit 114 "generates a drive signal for driving" oscillatory actuator 115 according to waveform data supplied by CPU 113 and then applies the drive signal to oscillatory actuator 115 according to instructions from CPU 113. *Id.* at 14:14–19.

Oscillatory actuator 115 "is a linear oscillatory actuator" that (1) "uses a permanent magnet as a movable weight" and (2) "causes the movable weight to linearly reciprocate by electromagnetic force to cause generation of vibration." Ex. 1005, 14:20–24. Oscillatory actuator 115 "is driven by a drive signal applied from" drive signal generation circuit 114. *Id.* at 14:24–26.

Fukumoto's Figure 3 (reproduced below) is a sectional view of oscillatory actuator 115 relative to main case 101 of PDA 10:

FIG. 3

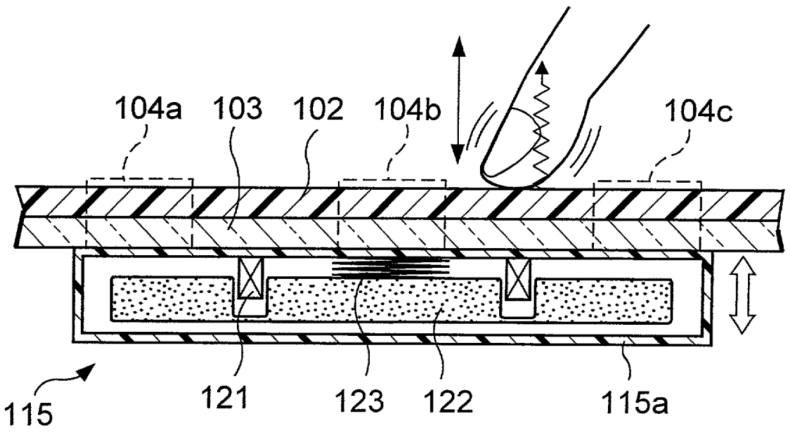

Figure 3 illustrates oscillatory actuator 115 including the following components:

- case 115a contacting display panel 103a (with display panel 103a adjacent to touch panel 102);
- "cylindrical coil 121 fixed to the top surface of the case 115a";
- "columnar movable weight 122 made of permanent magnet and having an annular space in which the coil 121 fits"; and
- "spring 123 for supporting the movable weight 122."

Ex. 1005, 14:27–37, Fig. 3.

Spring 123 supports movable weight 122 "in a state where the weight 122 is able to linearly reciprocate in the vertical direction" in Figure 3 "in the space formed inside the case 115a of the oscillatory actuator 115." Ex. 1005, 14:45–48, Fig. 3. Movable weight 122 "linearly reciprocates in the vertical direction" in Figure 3 "by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal)

is applied to the coil 121." *Id.* at 14:57–60. "By the counter force of the reciprocation of the movable weight 122, vibrational acceleration occurs at the portion of the case 115a to which the spring 123 is connected." *Id.* at 14:60–63.

2. INDEPENDENT CLAIM 1

(a) Preamble 1pre

Claim 1 recites "[a] linear vibration module." Ex. 1001, 15:36.

Petitioner contends that Fukumoto teaches claim 1's preamble because Fukumoto discloses that "[a]n electronic device drives an oscillatory actuator to cause generation of vibration . . . in a direction perpendicular to their respective front surfaces." Pet. 12–13 (alterations by Petitioner) (quoting Ex. 1005, code (57)). Further, Petitioner asserts that "Fukumoto's oscillatory actuator is linear in the same way as the '081 patent." *Id.* at 13 (citing Ex. 1001, 3:9–21; Ex. 1005, 14:20–24, Fig. 3).

Patent Owner makes no arguments specific to claim 1's preamble. *See, e.g.*, Resp. 18–27; Sur-reply 7–14. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Generally, a preamble does not limit a claim. *Allen Eng'g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1346 (Fed. Cir. 2002). We need not decide whether claim 1's preamble limits the claim because, for the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches claim 1's preamble. *See* Pet. 12–13; Ex. 1003 ¶¶ 161–164.

(b) Limitation 1a

Claim 1 recites "a housing." Ex. 1001, 15:37 (limitation 1a).

Petitioner contends that Fukumoto teaches limitation 1a because Fukumoto discloses that "the components of the oscillatory actuator are 'housed inside the case 115a,'" e.g., as depicted in Fukumoto's Figure 3. Pet. 13–14 (quoting Ex. 1005, 15:58–59) (citing Ex. 1003 ¶ 165; Ex. 1005, 15:56–59, Fig. 3). Further, Petitioner asserts that case 115a corresponds to the claimed "housing." *Id.* at 14. Petitioner also asserts that Fukumoto's PDA 10 includes main case 101 and that main case 101 corresponds to the claimed "housing" according to Patent Owner's infringement contentions in the Samsung litigation. *Id.* (citing Ex. 1022, 2–6).

Patent Owner makes no arguments specific to limitation 1a. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches limitation 1a. *See* Pet. 13–14; Ex. 1003 ¶ 165.

(c) Limitation 1b

Claim 1 recites "a moveable component." Ex. 1001, 15:38 (limitation 1b).

Petitioner contends that Fukumoto teaches limitation 1b because Fukumoto discloses "a 'columnar movable weight 122 made of permanent magnet,'" e.g., as depicted in Fukumoto's Figure 3. Pet. 14–15 (quoting Ex. 1005, 14:34–35) (citing Ex. 1005, 14:32–37, Fig. 3). Further, Petitioner asserts that "movable weight 122 linearly reciprocates in the vertical direction" in Figure 3. *Id.* at 15 (quoting Ex. 1005, 14:57–58).

Except for disputing that § 112's means-plus-function provision applies to limitation 1b, Patent Owner makes no arguments specific to limitation 1b. *See, e.g.*, Resp. 7–8, 18–27; Sur-reply 1–2, 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches limitation 1b. *See* Pet. 14–15; Ex. 1003 ¶¶ 166–168.

(d) Limitation 1c

Claim 1 recites "a power supply." Ex. 1001, 15:39 (limitation 1c).

Petitioner contends that Fukumoto teaches limitation 1c because Fukumoto discloses that "movable weight 122 linearly reciprocates in the vertical direction in the figure by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal) is applied to the coil 121." Pet. 15 (quoting Ex. 1005, 14:57–60). Petitioner also contends that Fukumoto discloses operating oscillatory actuator 115 at a resonant frequency with a "small drive power" to reduce power consumption. *Id.* at 15–16 (citing Ex. 1005, 16:44–50); *see* Reply 19–20. Further, Petitioner asserts that an ordinarily skilled artisan "would have understood and found it obvious that 'small power' is supplied to the coil using a power supply." Pet. 16 (citing Ex. 1003 ¶ 169).

Patent Owner does not dispute that Fukumoto teaches a "power supply" according to limitation 1c. *See, e.g.*, Resp. 21–25; Sur-reply 7–11. Instead, as explained below, Patent Owner disputes that Fukumoto's power supply receives an output from a "control component" according to limitation 1f. Resp. 21–25; Sur-reply 7–11; *infra* § III.D.2(g)(ii).

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches limitation 1c. *See* Pet. 15–16; Ex. 1003 ¶ 169.

(e) Limitation 1d

Claim 1 recites "user-input features." Ex. 1001, 15:40 (limitation 1d).

Petitioner contends that Fukumoto teaches limitation 1d because Fukumoto's PDA 10 includes touch panel 102 and operation keys 104a, 104b, and 104c. Pet. 16–17 (citing Ex. 1005, 13:40–14:13, 30:48–53, 31:27–29, Figs. 1–2, 41). Petitioner contends that touch panel 102 and operation keys 104a, 104b, and 104c correspond to the claimed "user-input features." *Id.* at 17.

Patent Owner makes no arguments specific to limitation 1d. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches limitation 1d. *See* Pet. 16–17; Ex. 1003 ¶¶ 170–172.

(f) Limitation 1e

Claim 1 recites "a driving component that drives the moveable component in each of two opposite directions within the housing." Ex. 1001, 15:41–42 (limitation 1e).

Petitioner contends that Fukumoto teaches limitation 1e because Fukumoto discloses that "movable weight 122 linearly reciprocates in the vertical direction in the figure by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal) is applied to the coil 121." Pet. 17 (quoting Ex. 1005, 14:57–60) (citing Ex. 1003 ¶¶ 170–172). Petitioner identifies coil 121 as the claimed "driving component." *Id.* at 18. According to Petitioner, coil 121 "drives the moveable component in each of two opposite directions within the housing," and therefore performs the claimed function. *Id.*

Patent Owner makes no arguments specific to limitation 1e. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches limitation 1e. *See* Pet. 17–18; Ex. 1003 ¶¶ 173–175.

(g) Limitation 1f

Claim 1 recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." Ex. 1001, 15:44–48 (limitation 1f).

(i) Petitioner's Contentions

Depending on whether § 112's means-plus-function provision applies to limitation 1f, Petitioner presents two alternative mappings for Fukumoto's drive signal generation circuit 114 related to limitation 1f. *See* Pet. 20–22; Reply 20–22. If limitation 1f is not a means-plus-function limitation, Petitioner maps drive signal generation circuit 114 to the "control component" required by limitation 1f. *See* Pet. 20; Reply 20–21. If limitation 1f is a means-plus-function limitation, Petitioner maps drive signal generation circuit 114 to the "power supply" required by limitation 1c. *See* Pet. 21–22; Reply 21–22. When mapping drive signal generation circuit 114 to the "power supply" required by limitation 1c, Petitioner explains that (1) the "power supply" produces "drive power" by generating an AC drive signal supplied to a coil and (2) drive signal generation circuit 114 generates an AC drive signal supplied to coil 121. Reply 22 (citing Ex. 1005, 14:14–16, 14:57–60, 16:44–50).

If, as we determine, limitation 1f is a means-plus-function limitation, Petitioner contends that Fukumoto teaches limitation 1f for several related

reasons. *See* Pet. 18–23; Reply 19–22; *supra* § III.C.6(c). First, Petitioner asserts that Fukumoto's CPU 113 executes a program stored in memory for "vibration control processing" and accesses a table containing waveform data for a drive signal applied to oscillatory actuator 115. Pet. 18–20 (citing Ex. 1005, 13:54–14:26, 16:60–19:3, Figs. 5, 33); *see id.* at 23–24. Petitioner asserts that CPU 113 uses the waveform data read from memory to generate a drive signal at drive signal generation circuit 114 and then drive signal generation circuit 114 applies the drive signal to oscillatory actuator 115. *Id.* at 18–20.

Petitioner explains that a user's input produces a CPU-driven sequence of events causing oscillatory actuator 115 to vibrate at a particular amplitude and frequency as follows:

(1) a user "touches a button or location of the touch panel";

(2) the CPU "detects the touch location/button";

(3) the CPU "reads the corresponding waveform data"; and

(4) the CPU "generates a drive signal sent to the oscillatory actuator to vibrate at the amplitude and frequency specified by the waveform."

Pet. 20–21 (citing Ex. 1003 ¶ 177; Ex. 1005, 13:54–14:25, 29:15–18, 48:42–47). Therefore, according to Petitioner, Fukumoto's CPU 113 performs the function recited in limitation 1f: "controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." *Id.* at 21 (citing Ex. 1003 ¶¶ 177–178).

Second, Petitioner asserts that Fukumoto discloses hardware structure according to limitation 1f because Fukumoto's CPU 113 is a "processor."

Pet. 22. Petitioner also asserts that an ordinarily skilled artisan would have recognized well-known "H-bridge switches, oscillator circuits, and inverters" as mechanisms for converting input power, e.g., from "the battery in the electronic device," to an AC drive signal supplied to coil 121. *Id.* (citing Ex. 1003 ¶¶ 180–188; Ex. 1005, 14:57–60).

Third, Petitioner asserts that Fukumoto discloses algorithmic structure according to limitation 1f because "in Fukumoto, when 'at least one of the touch signal or key operation signal has been input,' the CPU 'reads from the memory 112 the waveform data of the drive signal to be applied to the oscillatory actuator 115.'" Pet. 22 (quoting Ex. 1005, 17:8–11). According to Petitioner, "[d]oing so would 'set the mode and strength to values represented by selections made by user input to the user input features.'" *Id.* (citing Ex. 1003 ¶ 189).

Petitioner also asserts that "Fukumoto's CPU provides a corresponding output to the power supply when it 'instructs the drive signal generation circuit 114 to generate a drive signal,' and in response, 'the drive signal generation circuit 114 generates a drive signal using the waveform data supplied from the CPU 113.'" Pet. 22 (quoting Ex. 1005, 17:22–26). Petitioner explains that "providing an output to the drive signal generation circuit effectively provides an output to the power supply." Reply 22.

Petitioner summarizes by asserting that Fukumoto "discloses or suggests" the following:

(1) "a processor";

(2) "circuitry to convert power supplied from, for example, the battery in the electronic device to the AC drive signal (equivalent to the '081 patent's disclosed H-bridge switch)"; and

(3) "an algorithm to perform the claimed function with at least equivalent steps to those disclosed in the '081 specification."

Pet. 23 (citing Ex. 1003 ¶¶ 190–191).

(ii) Patent Owner's Contentions

Patent Owner disputes that Fukumoto teaches limitation 1f. *See* Resp. 19–25; Sur-reply 7–11. In particular, Patent Owner contends that:

(1) the "control component" required by limitation 1f must provide an output to the "power supply" required by limitation 1c; and

(2) Petitioner fails to show how Fukumoto's "control component" provides an output Fukumoto's "power supply."

Resp. 21–24; *see* Sur-reply 8–11.

Patent Owner asserts that Fukumoto's Figure 3 shows a personal digital assistant (PDA) and "PDAs of that time indeed used batteries." Resp. 21–22. Patent Owner asserts that Petitioner fails to identify "any prior art battery that would have been capable of receiving an output from a processor." *Id.* at 22.

Regarding Petitioner's two alternative mappings for Fukumoto's drive signal generation circuit 114 depending on whether § 112's means-plus-function provision applies to limitation 1f, Patent Owner contends that the Petition "never identifies" drive signal generation circuit 114 as part of the "power supply" required by limitation 1c. Sur-reply 8. Patent Owner also contends that the Petition "fails to mention any specific component in Fukumoto as the claimed 'power supply.'" *Id.* (citing Pet. 15–16).

Further, Patent Owner asserts that the Petition "makes clear that its theory is that the output to the power supply occurs when the drive signal

generation circuit 114 generates a drive signal, not when the CPU instructs the drive signal generation circuit 114." Sur-reply 9. As support, Patent Owner quotes the following statement in the Petition about CPU 113 and drive signal generation circuit 114: "Fukumoto's CPU provides a corresponding output to the power supply when it 'instructs the drive signal generation circuit 114 to generate a drive signal,' ***and in response***, 'the drive signal generation circuit 114 generates a drive signal using the waveform data supplied from the CPU 113.'" *Id.* (emphasis by Patent Owner) (quoting Pet. 22). Patent Owner asserts that if "the Petition really contended that drive signal generation circuit 114 was part of the power supply and that instruction from the CPU to this circuit constituted providing an output to the power supply," then "there would have been no reason to include the second half of the sentence quoted above." *Id.*

Patent Owner notes that the Petition discusses converting "power supplied from, for example, the battery in the electronic device to the AC drive signal." Sur-reply 9–10 (quoting Pet. 23). Patent Owner then contends that "[t]he only natural interpretation of a statement that power is 'supplied' from a battery is that the battery is (at least an example of) the 'power supply' in the Petition's mapping of the claims." *Id.* at 10.

(iii) Analysis

We agree with Petitioner that Fukumoto teaches limitation 1f. *See* Pet. 20–23; Reply 21–22; Ex. 1003 ¶¶ 90–91, 177–191. As discussed above, Petitioner presents two alternative mappings for Fukumoto's drive signal generation circuit 114 depending on whether § 112's means-plus-function provision applies to limitation 1f. *See* Pet. 20–22; Reply 20–22; *supra* § III.D.2(g)(i). As discussed above, we determine that § 112's means-plus-

function provision applies to limitation 1f. S*upra* § III.C.6(c). Hence, our analysis employs Petitioner's means-plus-function mapping for drive signal generation circuit 114 with that circuit as part of the "power supply" required by limitation 1c. *See* Pet. 21–22; Reply 21–22.

In particular, Fukumoto discloses PDA 10 and a hardware configuration for PDA 10 including CPU 113. Ex. 1005, 13:41–59, Figs. 1–2; *see* Ex. 1003 ¶¶ 90–91. As discussed above, the corresponding hardware structure for limitation 1f includes a "processor," "CPU," and "microprocessor." *Supra* § III.C.6(c).

Fukumoto's CPU 113 performs the function recited in limitation 1f: "controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." *See* Ex. 1003 ¶¶ 91, 177; Ex. 1005, 13:54–14:26, 17:1–36, 29:15–31, 48:42–47, Fig. 5.

Specifically, as Petitioner explains, a user's input produces a CPU-driven sequence of events causing oscillatory actuator 115 to vibrate at a particular amplitude and frequency as follows:

(1) a user "touches a button or location of the touch panel";

(2) the CPU "detects the touch location/button";

(3) the CPU "reads the corresponding waveform data"; and

(4) the CPU "generates a drive signal sent to the oscillatory actuator to vibrate at the amplitude and frequency specified by the waveform."

See Ex. 1003 ¶¶ 91, 177; Ex. 1005, 13:54–14:26, 17:1–36, 29:15–31, 48:42–47, Fig. 5; Pet. 20–21.

Further, Fukumoto's CPU 113 performs the steps in algorithmic structure according to limitation 1f: "(a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component." *See* Ex. 1003 ¶¶ 91, 179, 189; Ex. 1005, 14:14–19, 17:1–4, 17:7–11, 17:20–26, 17:28–30, 17:32–36, Fig. 5; Pet. 21–2; *supra* § III.C.6(c).

Specifically, CPU 113 "determines whether a touch signal has been input from the touch panel 102 and whether a key operation signal has been input from the key input unit 111." Ex. 1005, 17:1–4, Fig. 5 (step S101); *see* Ex. 1003 ¶¶ 91, 189. When CPU 113 "determines that at least one of the touch signal or key operation signal has been input," CPU 113 "reads from the memory 112 the waveform data of the drive signal to be applied to the oscillatory actuator 115." Ex. 1005, 17:7–11, Fig. 5 (step S102); *see* Ex. 1003 ¶¶ 91, 189.

When CPU 113 reads the waveform data of the drive signal to be applied to the oscillatory actuator, CPU 113 "set[s] the mode and strength to . . . values representing selections made by user input to the user input features" according to algorithmic structure step (a). Ex. 1003 ¶ 189.

Next, CPU 113 "outputs the waveform data read from the memory 112" and "instructs the drive signal generation circuit 114 to generate a drive signal." Ex. 1005, 17:20–23, Fig. 5 (step S103); *see* Ex. 1003 ¶¶ 91, 189. In response to the instruction from CPU 113, "the drive signal generation circuit 114 generates a drive signal using the waveform data supplied from the CPU 113." Ex. 1005, 17:24–26, Fig. 5

(step S103); *see id.* at 14:14–16; Ex. 1003 ¶¶ 91, 189. Then, "the drive signal generation circuit 114 applies a drive signal to the oscillatory actuator 115 in accordance with instructions from the CPU 113." Ex. 1005, 14:16–19, 17:28–30, 17:32–36, Fig. 5 (step S105); *see* Ex. 1003 ¶¶ 91, 189.

When CPU 113 instructs drive signal generation circuit 114 to generate a drive signal so that drive signal generation circuit 114 applies a drive signal to the oscillatory actuator, CPU 113 "provide[s] a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component" according to algorithmic structure step (b). *See* Ex. 1003 ¶ 189.

We disagree with Patent Owner that the Petition "never identifies" drive signal generation circuit 114 as part of the "power supply" required by limitation 1c. *See* Pet. 21–22; Sur-reply 8. When assuming that § 112's means-plus-function provision applies to limitation 1f, the Petition sets forth algorithmic structure for limitation 1f. Pet. 21–22. Then, the Petition explains how "Fukumoto discloses an equivalent algorithm." *Id.* at 22.

In particular, the Petition includes the following statement about CPU 113 and drive signal generation circuit 114: "Fukumoto's CPU provides a corresponding output to the power supply when it 'instructs the drive signal generation circuit 114 to generate a drive signal,' and in response, 'the drive signal generation circuit 114 generates a drive signal using the waveform data supplied from the CPU 113.'" Pet. 22 (quoting Ex. 1005, 17:22–26). Hence, the Petition indicates that Fukumoto's CPU provides a corresponding output to drive signal generation circuit 114 as part of the "power supply" required by limitation 1c, i.e., when CPU 113

"instructs the drive signal generation circuit 114 to generate a drive signal." *Id.*

Additionally, during the oral hearing, Patent Owner's counsel agreed that the claimed "power supply" could be met by an element that is "part of the power supply, and that there's something else involved in the supply of power, some further upstream source of power, be it a battery or wall plug or something like that." Tr. 46:24–47:8 (arguing that the Petition lacks such a contention).

Further, as discussed above, Patent Owner references the Petition's statement about CPU 113 and drive signal generation circuit 114 quoted in the preceding paragraph and asserts that if "the Petition really contended that drive signal generation circuit 114 was part of the power supply and that instruction from the CPU to this circuit constituted providing an output to the power supply," then "there would have been no reason to include the second half of the sentence quoted above." Sur-reply 9 (quoting Pet. 22); *see supra* § III.D.2(g)(ii). We disagree.

The "second half of the sentence quoted above" addresses algorithmic structure step (b): "provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component." *See* Pet. 22. According to that step, the "power supply" not only receives an output from the "control component," the "power supply" also provides an output to the "driving component." The "second half of the sentence quoted above" indicates that drive signal generation circuit 114 provides an output to the "driving component," i.e., provides an output to coil 121 in oscillatory actuator 115. *See id.* at 17–18, 22.

As Patent Owner notes, when addressing limitation 1c the Petition does not identify drive signal generation circuit 114 as part of the "power supply" required by limitation 1c. *See* Pet. 15–16; Sur-reply 8. But Petitioner does not contend that § 112's means-plus-function provision applies to limitation 1c. *See* Pet. 6–9, 15–16. When addressing limitation 1f, however, the Petition presents two alternative mappings for drive signal generation circuit 114 depending on whether § 112's means-plus-function provision applies to limitation 1f. *See* Pet. 20–22. When explaining how Fukumoto teaches limitation 1f if it is a means-plus-function limitation, the Petition identifies the unpatentability theory with adequate particularity, e.g., that the "power supply" required by limitation 1c includes drive signal generation circuit 114. *See* Pet. 21–22; 35 U.S.C. § 312(a)(3).

(h) Conclusion About Obviousness/Nonobviousness

For the reasons discussed above, Fukumoto teaches claim 1's subject matter. *See supra* §§ III.D.2(a)–(g). Hence, Petitioner has shown by a preponderance of the evidence that claim 1 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto.

3. DEPENDENT CLAIM 2

Claim 2 reads as follows (with bracketed letters added for reference purposes):[5]

> 2. [pre] The linear vibration module of claim 1 wherein the control component is one of:
>
> [a] an variable oscillator circuit with additional control circuitry; and
>
> [b.i] a control component that includes a microprocessor,

[5] We use the same reference letters that Petitioner uses to identify the claim language. *See* Pet. vii (Listing of Challenged Claims).

> [b.ii] a control program, stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features.

Ex. 1001, 15:49–61.

Petitioner contends that Fukumoto teaches claim 2's subject matter because Fukumoto discloses a "microprocessor" according to limitation 2b.i and a "control program" according to limitation 2b.ii. *See* Pet. 23–24. Specifically, Petitioner asserts that Fukumoto's CPU 113 executes a program stored in memory for "vibration control processing." *Id.* at 23 (citing Ex. 1005, 14:2–13). Petitioner also asserts that an ordinarily skilled artisan would have understood that the program for "vibration control processing" would be "stored in an electronic memory within, or separate from, the microprocessor" according to limitation 2b.ii "so that CPU 113 could execute it." *Id.* at 23–24 (citing Ex. 1003 ¶ 193).

Additionally, Petitioner contends that Fukumoto teaches "control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features" according to limitation 2b.ii for the reasons Fukumoto teaches limitation 1f. Pet. 24 (citing Ex. 1003 ¶ 193).

Patent Owner makes no arguments specific to claim 2. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches claim 2's subject

matter. *See* Pet. 20–24; Reply 21–22; Ex. 1003 ¶¶ 90–91, 177–193. Hence, Petitioner has shown by a preponderance of the evidence that claim 2 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto.

4. DEPENDENT CLAIM 3

Claim 3 depends directly from claim 1 and further requires that "the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors." Ex. 1001, 15:62–67.

Petitioner contends that Fukumoto teaches claim 3's subject matter if § 112's means-plus-function provision does not apply to claim 3. *See* Pet. 24–27. Petitioner does not contend that Fukumoto teaches claim 3's subject matter if § 112's means-plus-function provision applies to claim 3. *See id.*

As discussed above, we determine that § 112's means-plus-function provision applies to claim 3. *Supra* § III.C.7(c). Because Petitioner does not contend that Fukumoto teaches claim 3's subject matter if § 112's means-plus-function provision applies to claim 3, Petitioner has not shown by a preponderance of the evidence that claim 3 is unpatentable under § 103(a) based on Fukumoto.

5. DEPENDENT CLAIM 7

Claim 7 depends directly from claim 1 and specifies that "the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component." Ex. 1001, 16:29–33.

Petitioner contends that Fukumoto teaches claim 7's subject matter because Fukumoto discloses "coil 121 used to drive movable weight 122." Pet. 27–28 (citing Ex. 1005, 14:57–60, Fig. 3). Further, Petitioner asserts that an ordinarily skilled artisan "would have recognized the magnetic fields are generated parallel to the direction of moveable weight 112's vibrational movement (i.e., so that moveable weight 112 moves up and down)." *Id.* at 28 (citing Ex. 1003 ¶¶ 198–200).

Patent Owner makes no arguments specific to claim 7. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Fukumoto teaches claim 7's subject matter. *See* Pet. 27–28; Ex. 1003 ¶¶ 198–200. Hence, Petitioner has shown by a preponderance of the evidence that claim 7 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto.

6. DEPENDENT CLAIM 8

Claim 8 reads as follows (with bracketed letters added for reference purposes):[6]

> 8. [a] The linear vibration module of claim 1 wherein the housing is a linear tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets;
>
> [b] wherein the movable component is a magnet shaped to slide within the linear tube; and
>
> [c] wherein the driving component is an electromagnetic coil.

Ex. 1001, 16:34–40.

[6] We use the same reference letters that Petitioner uses to identify the claim language. *See* Pet. ix (Listing of Challenged Claims).

(a) Petitioner's Contentions

Petitioner contends that Fukumoto teaches claim 8's subject matter for several related reasons. *See* Pet. 29–31. First, Petitioner asserts that Patent Owner argued in the Samsung litigation that a "linear tube" may have a rectangular cross-section. *Id.* at 29 (citing Ex. 1022, 61). Petitioner asserts that Fukumoto discloses a linear vibration module where "the housing is a linear tube" because oscillatory actuator 115 in Fukumoto's Figure 3 includes case 115a with a rectangular cross-section. *Id.* (citing Ex. 1005, 14:26–44, Fig. 3). To support its assertion, Petitioner presents an annotated and highlighted version of Figure 3 as reproduced below (*id.*):

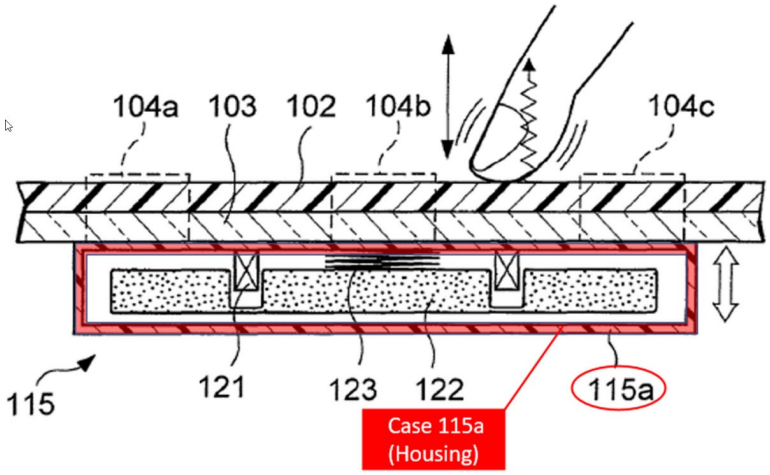

Figure 3 illustrates oscillatory actuator 115 including case 115a, coil 121, movable weight 122, and spring 123. Ex. 1005, 14:27–37, Fig. 3. The above annotated and highlighted version of Figure 3 includes red highlighting over case 115a and the annotation "Case 115a (Housing)" with a line leading to highlighted case 115a. *See* Pet. 29; Ex. 1003 ¶ 202.

Second, Petitioner asserts that oscillatory actuator 115 has "one end of case 115a capped by spring 123" and Fukumoto's Figure 83 shows an oscillatory actuator with both ends of the case (housing) capped by springs. Pet. 30; *see* Reply 23. To support its assertion, Petitioner presents an

annotated and highlighted version of Figure 83 as reproduced below (Pet. 30):

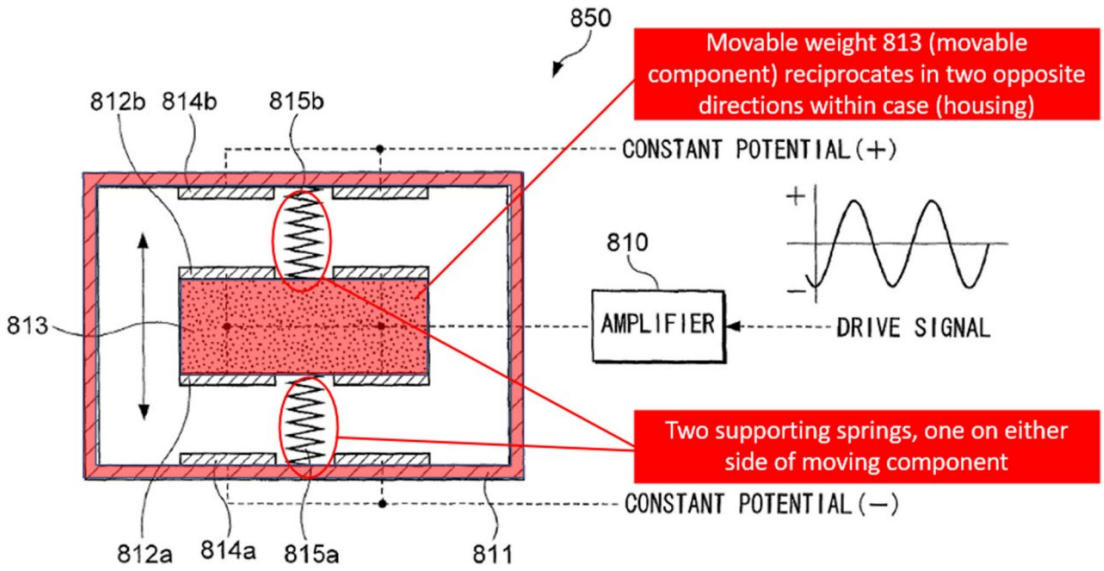

Figure 83 illustrates an electrostatic-type oscillatory actuator with case 811, movable weight 813, electrode 812a arranged on the bottom of movable weight 813, counter electrode 814a arranged on case 811 opposite electrode 812a, electrode 812b arranged on the top of movable weight 813, counter electrode 814b arranged on case 811 opposite electrode 812b, spring 815a connected between case 811 and the bottom of movable weight 813, and spring 815b connected between case 811 and the top of movable weight 813. *See* Ex. 1005, 13:22–24, 49:66–50:7, Fig. 83. The above annotated and highlighted version of Figure 83 includes:

- red highlighting over case 811;
- red highlighting over movable weight 813;
- the annotation "Movable weight 813 (movable component) reciprocates in two opposite directions within case (housing)" with a line leading to highlighted movable weight 813; and

- the annotation "Two supporting springs, one on either side of moving component" with lines leading to springs 815a and 815b.

See Pet. 30; Ex. 1003 ¶ 202.

Third, Petitioner asserts that an ordinarily skilled artisan would have been motivated to modify Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to include springs on both the top and bottom of movable weight 122 in Figure 3 because "using multiple springs" would:

(1) "dampen the vibration forces without damaging other components (e.g., the screen)"; and

(2) "double the force of vibration created for greater effect while requiring less power."

Pet. 30 (citing Ex. 1003 ¶¶ 199, 202; Ex. 1005, 50:1–13, Fig. 83); *see* Reply 24 (citing Ex. 1003 ¶ 202; Ex. 1005, 50:1–13; Ex. 2010, 46:23–47:6).

Although Petitioner provides this motivation to modify Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator, Petitioner argues that it "is not required to provide a motivation to combine the express disclosures of a single reference." Reply 23 (citing *Gen. Elec. Co. v. Raytheon Techs. Corp.*, 983 F.3d 1334, 1351–52 (Fed. Cir. 2020)). Petitioner also argues that Fukumoto includes "express language" that "explicitly suggests" modifying Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator. *Id.* (citing Ex. 1005, 48:53–55, 49:65–50:1, 50:9–13).

Fourth, Petitioner asserts that "when the 'movable-component-repelling components' are mechanical springs," an ordinarily skilled artisan "would not have understood 'capped' to require the springs to act as end

caps." Pet. 30–31 (citing Ex. 1003 ¶ 203). Petitioner asserts that because "mechanical springs have open space," an ordinarily skilled artisan "would have understood that such springs would have been attached to a surface of the housing." *Id.* at 31 (citing Ex. 1003 ¶ 203).

Fifth, Petitioner asserts that oscillatory actuator 115 in Figure 3 includes movable weight 122 as a "movable component [that] is a magnet shaped to slide within the linear tube" according to limitation 8b. Pet. 31 (citing Ex. 1005, 14:20–37).

Sixth, Petitioner asserts that oscillatory actuator 115 in Figure 3 includes coil 121 as a "driving component [that] is an electromagnetic coil" according to limitation 8c. Pet. 31; *see id.* at 17–18 (citing Ex. 1003 ¶¶ 170–175; Ex. 1005, 14:57–60, Fig. 3).

(b) Patent Owner's Contentions

Patent Owner contends that Petitioner fails to provide "an adequate motivation to modify" Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to yield claim 8's subject matter. *See* Resp. 25–27; Sur-reply 11–14.

Regarding the rationale that "using multiple springs" would "dampen the vibration forces without damaging other components (e.g., the screen)," Patent Owner asserts that Figure 3's oscillatory actuator "already has structures between the weight 122 and the screen 103, including the spring 123, coil 121, and case 115a." Resp. 25–26 (citing Ex. 2008 ¶ 92). Patent Owner further asserts that Petitioner fails to explain:

(1) "how the weight could damage the screen or other components in spite of these structures keeping them separate"; and

(2) "how the addition of a second spring would make damage less likely."

Id. at 26 (citing Ex. 2008 ¶ 93).

Regarding the rationale that "using multiple springs" would "double the force of vibration created for greater effect while requiring less power," Patent Owner asserts that Petitioner fails to provide "any evidence or explanation for how increasing the force and effect of vibration would reduce the power required." Resp. 26. Patent Owner asserts that "there is no reason to expect that increasing forces will *decrease* power requirements" because "doubling the force on an object while keeping the distance and speed it moves the same is going to roughly double power consumption." *Id.* at 26–27 (emphasis by Patent Owner) (citing Ex. 2008 ¶ 94).

Regarding the rationale that "using multiple springs" would "double the force of vibration created for greater effect while requiring less power," Patent Owner asserts that Fukumoto attributes doubling the force in Figure 83's oscillatory actuator to "doubling the electrostatic force by doubling the number of electrodes," not doubling the number of springs. Resp. 27 (citing Ex. 1005, 50:4–13; Ex. 2008 ¶ 95). According to Patent Owner, "[d]oubling the number of springs without changing the force that drives the oscillations is not likely to increase the vibrations." *Id.* (citing Ex. 2008 ¶ 95).

Additionally, Patent Owner disputes that Petitioner "is not required to provide a motivation to combine the express disclosures of a single reference." Sur-reply 11–12. Regarding the *General Electric* decision cited by Petitioner, Patent Owner asserts that it stands for the proposition that "there is no need to show a motivation to combine elements in the way that a

prior art reference has already combined them, by including them within a single embodiment." *Id.* at 12 (emphasis omitted) (citing *Gen. Elec.*, 983 F.3d at 1352). According to Patent Owner, "the Federal Circuit has clearly stated that both a motivation to combine and reasonable expectation of success must be demonstrated, when seeking to combine multiple embodiments from the same reference." *Id.*

Patent Owner also disputes that Fukumoto includes "express language" that "explicitly suggests" modifying Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator. Sur-reply 13.

(c) Analysis

We agree with Patent Owner that Petitioner fails to provide an "apparent reason" to modify Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to yield claim 8's subject matter. *See* Pet. 29–30; Resp. 25–27; Reply 22–24; Sur-reply 11–14; Ex. 1003 ¶ 202; Ex. 2008 ¶¶ 92–95; *KSR*, 550 U.S. at 418.

Petitioner argues erroneously that it "is not required to provide a motivation to combine the express disclosures of a single reference." *See* Reply 23. Whether a proposed combination rests on "combining disclosures from multiple references, combining multiple embodiments from a single reference, or selecting from large lists of elements in a single reference, there must be a motivation to make the combination and a reasonable expectation that such a combination would be successful." *In re Stepan Co.*, 868 F.3d 1342, 1346 n.1 (Fed. Cir. 2017).

The *General Electric* decision cited by Petitioner does not hold otherwise. In *General Electric*, the Federal Circuit considered an obviousness challenge based on combining disclosures from multiple

references, i.e., a primary reference called Wendus and a secondary reference called Moxon. *See Gen. Elec.*, 983 F.3d at 1339–40, 1344–52. The Federal Circuit criticized the Board for dissecting an embodiment disclosed in the primary reference into a collection of "individual elements" and requiring the patent challenger to "re-do the work already done" regarding that embodiment in the primary reference. *Id.* at 1351–52. The Federal Circuit did not consider an obviousness challenge based on combining multiple embodiments from a single reference. *See id.* at 1344–52.

Regarding the rationale that "using multiple springs" would "dampen the vibration forces without damaging other components (e.g., the screen)," Petitioner fails to explain how movable weight 122 in oscillatory actuator 115 could damage touch panel 102 or display panel 103a when various structures separate those panels from movable weight 122. *See* Pet. 29–30; Ex. 1003 ¶ 202; Ex. 2008 ¶¶ 92–93.

Regarding the rationale that "using multiple springs" would "double the force of vibration created for greater effect while requiring less power," adding another spring like spring 123 to oscillatory actuator 115 in Figure 3 would "roughly double power consumption" because "the power required to move an object equals the force on the object times its speed." Ex. 2008 ¶ 94.

Further, as Patent Owner asserts, Fukumoto attributes doubling the force in Figure 83's oscillatory actuator to "doubling the electrostatic force by doubling the number of electrodes," not doubling the number of springs. *See* Ex. 1005, 49:10–50:13, Figs. 82–83; Ex. 2008 ¶ 95; Resp. 27. Specifically, Fukumoto's Figure 82 shows an electrostatic-type oscillatory

actuator similar to Figure 83's oscillatory actuator except that Figure 82's oscillatory actuator includes only one pair of counter electrodes (electrodes 802 and 804) and only one spring (spring 805). Ex. 1005, 49:10–48, Fig. 82. When comparing Figure 83's oscillatory actuator to Figure 82's oscillatory actuator, Fukumoto explains that Figure 83's oscillatory actuator includes "two pairs of counter electrodes." *Id.* at 50:4–7. Hence, when "one pair of counter electrodes are in a repelling state, the other pair of counter electrodes are in an attracting state." *Id.* at 50:7–9. Thus, "the electrostatic force for causing the movable weight 813 [in Figure 83] to reciprocate becomes double and a greater vibration can be generated" compared to the movable weight in Figure 82. *Id.* at 50:9–13.

Additionally, we disagree with Petitioner that Fukumoto includes "express language" that "explicitly suggests" modifying Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator. *See* Reply 23. In particular, Petitioner points to Fukumoto's disclosure that "the vibrator generator [in Figure 3] is not limited to a linear oscillatory actuator." Ex. 1005, 48:53–55 (cited by Reply 23). That disclosure says nothing about modifying springs in a linear oscillatory actuator.

Petitioner also points to Fukumoto's comparison of Figure 83's oscillatory actuator to Figure 82's oscillatory actuator. *See* Ex. 1005, 49:65–50:1, 50:9–13 (cited by Reply 23). That comparison has no relationship to Figure 3's oscillatory actuator, e.g., because Figure 3's oscillatory actuator generates vibrations using electromagnetic force produced by a coil instead of electrostatic force produced by counter electrodes. *See id.* at 13:19–24, 14:20–24, 14:56–60, 49:20–48, 50:1–13.

Because Petitioner fails to provide "an adequate motivation to modify" Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to yield claim 8's subject matter, Petitioner has not shown by a preponderance of the evidence that claim 8 is unpatentable under § 103(a) based on Fukumoto.

7. Dependent Claim 9

Claim 9 reads as follows:

> 9. The linear vibration module of claim 1
>
> wherein the housing is a linear tube, capped at both ends by movable-component-repelling components; and
>
> wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.

Ex. 1001, 16:41–45.

Petitioner contends that Fukumoto teaches claim 9's subject matter for several related reasons. *See* Pet. 31–33; *see also id.* at 29–31.

For the limitation "wherein the housing is a linear tube, capped at both ends by movable-component-repelling components," Petitioner asserts that an ordinarily skilled artisan would have been motivated to modify Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to include springs on both the top and bottom of movable weight 122 in Figure 3 for the reasons discussed for claim 8. *See* Pet. 30–31; Ex. 1003 ¶¶ 202, 208. For example, Dr. Wolfe presents the annotated and highlighted version of Fukumoto's Figure 83 reproduced above when discussing the motivation to modify Figure 3's oscillatory actuator for claim 8 and the motivation to modify Figure 3's oscillatory actuator for claim 9. Ex. 1003 ¶¶ 202, 208.

For the reasons Petitioner fails to provide "an adequate motivation to modify" Figure 3's oscillatory actuator in view of Figure 83's oscillatory

actuator to yield claim 8's subject matter, Petitioner also fails to provide "an adequate motivation to modify" Figure 3's oscillatory actuator in view of Figure 83's oscillatory actuator to yield claim 9's subject matter. *See* Pet. 29–31; Resp. 25–27; Reply 22–24; Sur-reply 11–14; Ex. 1003 ¶¶ 202, 208; Ex. 2008 ¶¶ 92–95. Hence, Petitioner has not shown by a preponderance of the evidence that claim 9 is unpatentable under § 103(a) based on Fukumoto.

8. DEPENDENT CLAIM 17

Claim 17 depends directly from claim 1 and specifies that "the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features." Ex. 1001, 17:19–24.

Petitioner contends that Fukumoto teaches claim 17's subject matter because Fukumoto discloses the following:

(1) a user "touches a button or location of the touch panel";

(2) the CPU "detects the touch location/button";

(3) the CPU "reads the corresponding waveform data containing frequency and amplitude attributes from memory";

(4) the CPU "generates a drive signal sent to the oscillator actuator to vibrate according to the specified waveform's amplitude and frequency"; and

(5) the user "can also change only the amplitude of the drive signal in proportion to the value of the parameter and change the magnitude of the vibration."

Pet. 34–35 (citing Ex. 1003 ¶ 216; Ex. 1005, 13:54–14:25, 29:9–11, 29:15–18, 31:27–29).

Patent Owner makes no arguments specific to claim 17. *See, e.g.*, Resp. 18–27; Sur-reply 7–14.

We agree with Petitioner that Fukumoto teaches claim 17's subject matter. *See* Pet. 34–35; Ex. 1003 ¶¶ 91–92, 176–177, 216–217. Specifically, Fukumoto discloses assigning different frequency-amplitude pairings to different touch buttons and storing each pairing as waveform data in a table. *See, e.g.*, Ex. 1005, 14:2–4, 16:48–50, 28:60–29:44, Fig. 33; *see also* Ex. 1003 ¶¶ 91–92. Fukumoto's Figure 33 (reproduced below) depicts a table for storing waveform data:

FIG. 33

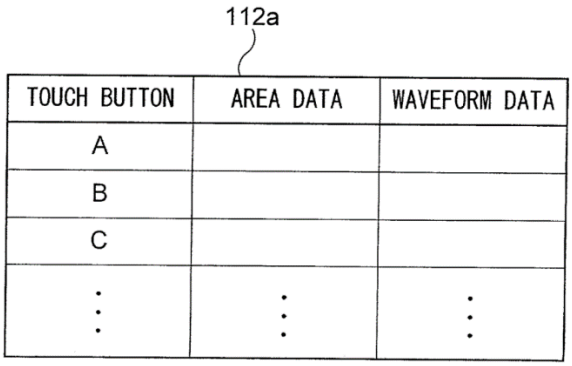

Figure 33 illustrates waveform data table 112a that stores "area data showing the area occupied by a touch button on the touch panel 102 using XY coordinates as well as waveform data of the drive signal to be applied to the oscillatory actuator 115 when that touch button is pressed." Ex. 1005, 29:1–8, Fig. 33; *see* Ex. 1003 ¶ 92.

Fukumoto explains that when a user presses a touch button, CPU 113 (1) "finds the XY coordinate data of a touched position based on the touch signal," (2) "refers to the waveform data table 112a," (3) "identifies the pressed touch button," (4) "reads from the waveform data table 112a the waveform data of the drive signal linked with the identified touch button,"

and (5) "outputs the read waveform data to" drive signal generation circuit 114. Ex. 1005, 29:19–29; *see id.* at 17:1–21, Fig. 5; Ex. 1003 ¶¶ 176, 216.

Fukumoto also discloses changing the frequency-amplitude pairing for a particular table entry based on user input, e.g., to "change the mode of vibration for reporting that a touch operation has been received according to the value of the parameter changed" by a user. *See* Ex. 1005, 30:48–31:54, Figs. 41–46. For instance, a user may manipulate a "knob" to adjust the value of a parameter and select one of the following:

(1) a first frequency-amplitude pairing when the parameter's value ranges between 0 and 25;

(2) a second frequency-amplitude pairing when the parameter's value ranges between 26 and 50;

(3) a third frequency-amplitude pairing when the parameter's value ranges between 51 and 75; and

(4) a fourth frequency-amplitude pairing when the parameter's value ranges between 76 and 100.

Id. at 30:48–31:11, Figs. 41–42. When changing a frequency-amplitude pairing, a user "can also change only the amplitude of the drive signal in proportion to the value of the parameter and change the magnitude of the vibration." *Id.* at 31:27–29.

Selecting a particular frequency-amplitude pairing from a plurality of discrete frequency-amplitude pairings and then "chang[ing] only the amplitude" teaches "independently" specifying "a frequency and an amplitude" according to claim 17. *See* Pet. 34–35; Ex. 1003 ¶¶ 216–217. Claim 17 does not require specifying "a frequency" value or "an amplitude" value from a continuous range of values. *See* Ex. 1001, 17:19–24.

Specifying "a frequency" value or "an amplitude" value from a plurality of discrete values suffices for claim 17.

For these reasons, we agree with Petitioner that Fukumoto teaches claim 17's subject matter. *See* Pet. 34–35; Ex. 1003 ¶¶ 91–92, 176–177, 216–217. Hence, Petitioner has shown by a preponderance of the evidence that claim 17 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto.

E. Alleged Obviousness over Fukumoto and Either Grant or Barton: Claims 1–3, 7–9, and 17

Petitioner contends that claims 1–3, 7–9, and 17 are unpatentable under § 103(a) because the claims would have been obvious over Fukumoto and either Grant or Barton. *See* Pet. 35–45. Patent Owner disputes Petitioner's contentions. *See* Resp. 28–30.

We need not decide whether claims 1, 2, 7, and 17 are unpatentable under § 103(a) based on Fukumoto and either Grant or Barton because other challenges resolve the patentability of those claims based on the asserted references. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8; *infra* §§ III.K.1–III.K.3, III.K.5. For instance, the challenge based on Fukumoto alone resolves the patentability of claims 1, 2, 7, and 17. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8.

As for claim 3, Petitioner asserts that "Fukumoto discloses or suggests" claim 3's limitations. Pet. 37, 44; *see id.* at 24–27. Petitioner does not rely on Grant or Barton for teaching claim 3's limitations. *See id.* at 37–38, 44. Because Petitioner does not rely on Grant or Barton for teaching claim 3's limitations, Petitioner fails to show how Grant or Barton cures Fukumoto's infirmities with respect to claim 3 for the challenge based

on Fukumoto alone. *See id.* at 35–45; *supra* §§ III.D.4. Hence, Petitioner has not shown by a preponderance of the evidence that claim 3 is unpatentable under § 103(a) based on Fukumoto and either Grant or Barton.

Additionally, Petitioner does not rely on Grant or Barton for teaching the limitations in claims 8 and 9. *See* Pet. 37–38, 44. Because Petitioner does not rely on Grant or Barton for teaching the limitations in claims 8 and 9, Petitioner fails to show how Grant or Barton cures Fukumoto's infirmities with respect to claims 8 and 9 for the challenge based on Fukumoto alone. *See id.* at 35–45; *supra* §§ III.D.6–III.D.7. Hence, Petitioner has not shown by a preponderance of the evidence that claims 8 and 9 are unpatentable under § 103(a) based on Fukumoto and either Grant or Barton.

F. Alleged Obviousness over Fukumoto and Ueda: Claims 3–6

Petitioner contends that claims 3–6 are unpatentable under § 103(a) because the claims would have been obvious over Fukumoto and Ueda. *See* Pet. 45–56; Reply 24–26. Patent Owner disputes Petitioner's contentions. *See* Resp. 30–31; Sur-reply 14–16.

Above, we provided an overview of Fukumoto. *See supra* § III.D.1. Below, we provide an overview of Ueda. Then, we consider the obviousness issues. For the reasons explained below, we disagree with Petitioner that claims 3–6 are unpatentable under § 103(a) because the claims would have been obvious over Fukumoto and Ueda.

1. OVERVIEW OF UEDA (EXHIBIT 1008)

Ueda is a U.S. patent application publication titled "Control System for a Linear Vibration Motor," filed on July 15, 2003, and published on September 2, 2004. Ex. 1008, codes (12), (22), (43), (54). Ueda states that

the invention "relates to motor driving apparatuses and, more particularly, to a motor driving apparatus for driving a linear vibration motor having a mover and a spring member for supporting the mover." *Id.* ¶ 1.

Ueda identifies deficiencies in conventional motor driving apparatuses for linear vibration motors. *See* Ex. 1008 ¶¶ 6–20. For example, "the maximum output of the linear vibration motor is restricted by the voltage level of the DC voltage applied to the motor driving apparatus." *Id.* ¶ 17. Ueda endeavors to address those deficiencies by disclosing motor driving apparatuses for linear vibration motors that employ feedback control. *See, e.g.*, *id.* ¶¶ 42–44, 77–80, 90, 97–101, 138–141, 164–165, Figs. 2, 3(a), 4(a).

Ueda's Figure 4(a) (reproduced below) depicts a motor driving apparatus for a linear vibration motor that employs feedback control:

Fig.4 (a)

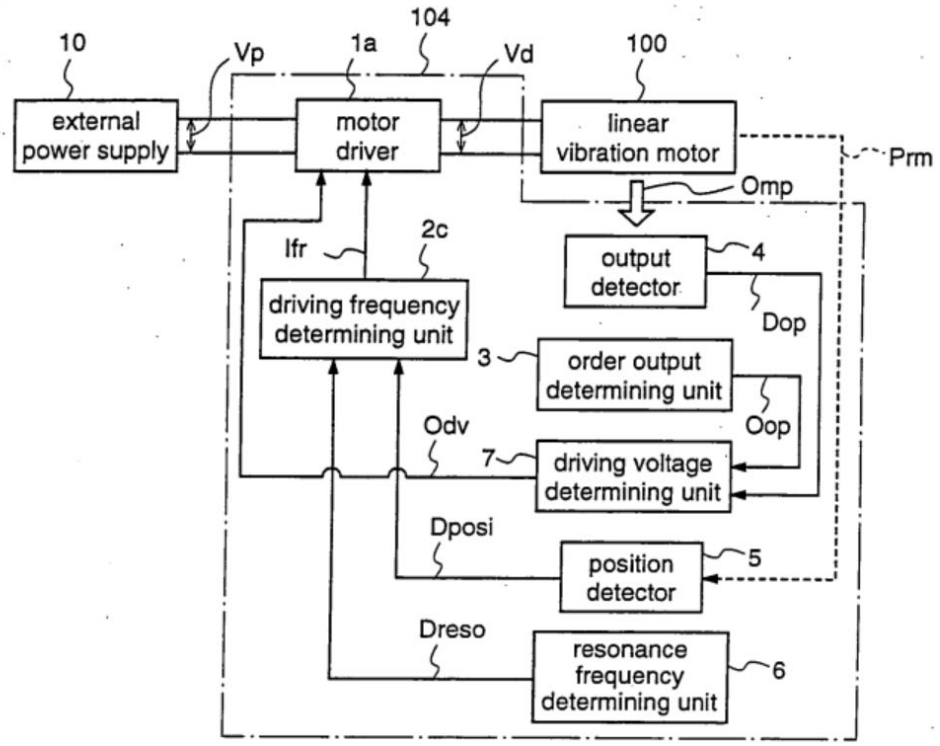

Figure 4(a) illustrates motor driving apparatus 104 receiving a DC voltage Vp from external power supply 10 and providing an AC voltage Vd to linear vibration motor 100. Ex. 1008 ¶¶ 139–140, 146, Fig. 4(a).

As Figure 4(a) shows, motor driving apparatus 104 includes the following components:

- motor driver 1a;
- driving frequency determining unit 2c;
- order output determining unit 3;
- output detector 4;
- position detector 5;
- resonance frequency determining unit 6; and
- driving voltage determining unit 7.

Ex. 1008 ¶¶ 141–143, 146, Fig. 4(a).

Output detector 4 detects "a motor output Omp from the linear vibration motor 100." Ex. 1008 ¶ 161, Fig. 4(a); *see id.* ¶ 141. Output detector 4 provides "an output detection signal Dop indicating the detected motor output" to driving voltage determining unit 7. *Id.* ¶¶ 141, 161, Fig. 4(a).

Position detector 5 detects "the position of the reciprocating mover of the linear vibration motor 100." Ex. 1008 ¶ 142, Fig. 4(a). Position detector 5 provides "a position detection signal Dposi indicating the detected mover position" to driving frequency determining unit 2c. *Id.* ¶¶ 142–143, Fig. 4(a).

Order output determining unit 3 determines "a target output as a motor output required of the linear vibration motor 100." Ex. 1008 ¶ 141. Order output determining unit 3 provides "an output order signal Oop

indicating the determined target output" to driving voltage determining unit 7. *Id.* ¶¶ 141, 149, 161, Fig. 4(a).

Resonance frequency determining unit 6 determines "a resonance frequency signal Dreso indicating the resonance frequency of the linear vibration motor 100." Ex. 1008 ¶ 142. Resonance frequency determining unit 6 provides the resonance frequency signal Dreso to driving frequency determining unit 2c. *Id.* ¶ 143, Fig. 4(a).

Driving frequency determining unit 2c determines "a driving frequency of the linear vibration motor 100" based on the position detection signal Dposi from position detector 5 and the resonance frequency signal Dreso from resonance frequency determining unit 6. Ex. 1008 ¶¶ 143, 159; *see id.* ¶¶ 152–153. Driving frequency determining unit 2c provides "a driving frequency signal Ifr indicating the determined driving frequency" to motor driver 1a. *Id.* ¶¶ 143, 159, Fig. 4(a).

Driving voltage determining unit 7 determines "an amplitude value of an AC voltage to be supplied as a driving voltage to the linear vibration motor 100," i.e., the amplitude value of the AC voltage Vd provided by motor driver 1a to linear vibration motor 100, based on the output detection signal Dop from output detector 4 and the output order signal Oop from order output determining unit 3. Ex. 1008 ¶¶ 141, 149, 162. Driving voltage determining unit 7 provides "a voltage amplitude signal Odv indicating the determined amplitude value" to motor driver 1a. *Id.* ¶¶ 141, 162, Fig. 4(a).

Motor driver 1a provides the AC voltage Vd having (1) "a frequency equal to the driving frequency determined by the driving frequency determining unit 2c" and (2) "the amplitude value determined by the driving

voltage determining unit 7" to linear vibration motor 100 based on "the driving frequency signal Ifr and the voltage amplitude signal Odv." Ex. 1008 ¶ 146, Fig. 4(a); *see id.* ¶ 163. Specifically, "the amplitude value of the AC voltage Vd is changed to a larger value when the detected output Dop is smaller than the order output Oop." *Id.* ¶ 162. Conversely, "the amplitude value of the AC voltage Vd is changed to a smaller value when the detected output Dop is larger than the order output Oop." *Id.*

2. DEPENDENT CLAIM 3

Claims 3 reads as follows:

> 3. The linear vibration module of claim 1 wherein the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.

Ex. 1001, 15:62–67.

(a) Petitioner's Contentions

Petitioner contends that the combined disclosures in Fukumoto and Ueda teach claim 3's limitations for several related reasons. *See* Pet. 46–51; Reply 24–26. In particular, regarding the functions recited in claims 3, Petitioner asserts that Ueda "discloses closed-loop feedback control for a linear vibration motor based on the output from multiple sensors." Pet. 46–47 (citing Ex. 1003 ¶ 240).

According to Petitioner, Ueda's motor driving apparatus 104 includes the following components for controlling linear vibration motor 100 and performing the functions recited in claim 3:

(1) "output detector 4 for detecting the motor output generated by the linear vibration motor 100" and

"outputting an output detection signal Dop indicating the detected motor output";

(2) "position detector 5 for detecting the position of the reciprocating mover of the linear vibration motor 100" and "outputting a position detection signal Dposi indicating the detected mover position";

(3) order output determining unit 3 outputting an output order signal Oop;

(4) resonance frequency determining unit 6 outputting a resonance frequency signal Dreso;

(5) driving frequency determining unit 2c that determines "a driving frequency of the linear vibration motor 100" based on the position detection signal Dposi from position detector 5 and the resonance frequency signal Dreso from resonance frequency determining unit 6;

(6) driving voltage determining unit 7 that determines "an amplitude value of the driving voltage of the linear vibration motor 100" based on the output detection signal Dop from output detector 4 and the output order signal Oop from order output determining unit 3; and

(7) motor driver 1a that receives a driving frequency signal Ifr from driving frequency determining unit 2c and a voltage amplitude signal Odv from driving voltage determining unit 7.

Pet. 47–49, 51–52 (citing Ex. 1003 ¶ 240; Ex. 1008 ¶¶ 140–143, 149, 156–162, 169–175, Fig. 4(a)); *see* Reply 25 n.2 (citing Ex. 1008 ¶ 152). For the "operational control outputs" required by claim 3, Petitioner identifies the (1) the "frequency" of the AC voltage Vd corresponding to the driving frequency signal Ifr from driving frequency determining unit 2c and (2) the "amplitude" of the AC voltage Vd corresponding to the voltage amplitude signal Odv from driving voltage determining unit 7. Pet. 49–50, 52.

Additionally, Petitioner contends that based on a comparison of the output detection signal Dop and the output order signal Oop by driving voltage determining unit 7, the amplitude value of the AC voltage Vd "is changed to a larger value when the detected output Dop is smaller than the order output Oop," and conversely "the amplitude value of the AC voltage Vd is changed to a smaller value when the detected output Dop is larger than the order output Oop." Pet. 47 (quoting Ex. 1008 ¶ 162) (citing Ex. 1003 ¶ 240). Petitioner also contends that:

(1) when "the position detection signal Dposi indicates 'the detected position does not exceed a predetermined reference position, the driving frequency of the linear vibration motor 100 is set at the resonance frequency'"; and

(2) when "the position detection signal Dposi exceeds the reference position 'the driving frequency of the linear vibration motor 100 is set at a frequency higher than the resonance frequency.'"

Id. at 49 (quoting Ex. 1008 ¶ 160) (citing Ex. 1003 ¶ 241).

Further, Petitioner asserts that Ueda teaches adjusting "one or more operational control outputs of the control component according to the received output signals from the sensors" according to claim 3 because Ueda discloses "adjusting amplitude based on Dop and adjusting frequency based on Dposi." Pet. 49–50 (citing Ex. 1003 ¶ 242).

Additionally, Petitioner contends that "Ueda teaches a processor programmed with" following algorithmic steps:

(1) "convert the received output signal into an integer";

(2) "compare that integer to a specific value"; and

(3) "adjust one or more operational control outputs based on that comparison."

Pet. 50–51.

For the "convert" step (1), Petitioner asserts that "Ueda teaches converting Dop (the received output signal from output detector 4) into an amplitude value and converting Dposi (the received output signal from position detector 5) into a frequency." Pet. 50 (citing Ex. 1003 ¶ 246; Ex. 1008 ¶¶ 149, 152). Petitioner also asserts that an ordinarily skilled artisan "would have readily understood that Ueda converts the Dop and Dposi signals to integers" because "Ueda discloses that the 'magnitude' of Dop is used for comparison against another specific value (i.e., the 'magnitude' of Oop)." Reply 25 (citing Ex. 1008 ¶ 149). According to Petitioner, the "conversion, from the Dop signal to a 'magnitude' value is a conversion to an integer." *Id.* (citing Ex. 1003 ¶¶ 245–246).

For the "compare" step (2), Petitioner asserts that "Ueda compares each of those converted values against a specific value (amplitude [Dop] against Oop and frequency [Dposi] against Dreso)." Pet. 50 (citing Ex. 1003 ¶ 246; Ex. 1008 ¶¶ 149, 152–153); *see* Reply 25 (discussing a comparison of the output detection signal Dop from output detector 4 and the output order signal Oop from order output determining unit 3).

For the "adjust" step (3), Petitioner asserts that "Ueda adjusts driving voltage and frequency (operational control outputs) based on those comparisons." Pet. 50 (citing Ex. 1003 ¶ 246; Ex. 1008 ¶¶ 149, 152–153).

In the Reply, Petitioner argues that the proposed Fukumoto-Ueda system would "implement Ueda's algorithm in a general-purpose processor" and that an ordinarily skilled artisan would have understood that "the raw input from the sensors of Ueda must be converted to digital values to be

processed and compared." Reply 26 (citing Ex. 1003 ¶¶ 245, 340; Ex. 1047 ¶¶ 16–17).

(b) Patent Owner's Contentions

Patent Owner disputes that Ueda teaches algorithmic structure according Petitioner's proposed algorithm for claim 3 that we adopt. *See* Resp. 30–31; Sur-reply 14–16; *supra* § III.C.7(c). In particular, Patent Owner disputes that Ueda teaches "convert[ing] the received output signal into an integer." *See* Resp. 30–31; Sur-reply 14–16.

Patent Owner contends that Ueda "never mentions any integer, nor suggests that any of the values relied on by [Petitioner] is an integer." Resp. 30 (citing Ex. 2008 ¶ 109); *see* Sur-reply 15. Patent Owner contends that Ueda "never mentions or suggests digital signals," "integers, digital values, or processors." Sur-reply 15. According to Patent Owner, "Ueda's specification contains the word 'voltage' 369 times" and "consistently reads as an analog system, utilizing feedback control to control analog voltages." *Id.* Patent Owner also contends that comparing "the magnitude of the output signals Oop and Dop," as disclosed in Ueda, does not "require conversion to a digital value, let alone to an integer." Sur-reply 15.

Additionally, Patent Owner contends that Petitioner provides no evidence that an ordinarily skilled artisan would have been "motivated to modify Ueda's teachings to utilize an integer value." Resp. 30–31 (citing Pet. 50–51; Ex. 1003 ¶¶ 245–246; Ex. 2008 ¶ 109); *see* Sur-reply 16.

In the Sur-reply, Patent Owner asserts that Petitioner's argument in the Reply about "implement[ing] Ueda's algorithm in a general-purpose processor" is "a new argument." Sur-reply 15; *see id.* at 16; Reply 26. Patent Owner asserts that Petitioner argued in the Petition that "Ueda itself

taught a processor programmed with the necessary steps, including conversion to an integer." *Id.* (citing Pet. 50–51).

(c) Analysis

We agree with Patent Owner that Ueda does not teach "convert[ing] the received output signal into an integer." *See* Resp. 30–31; Sur-reply 14–16. As Petitioner admits, Ueda does not use the word "integer." *See* Ex. 2008 ¶¶ 109, 184; Reply 25. Instead, for "integer" conversion, Petitioner points to the comparison of "magnitude" values for Dop and Oop disclosed in Ueda's paragraph 149 and contends that the "conversion, from the Dop signal to a 'magnitude' value is a conversion to an integer." Reply 25 (citing Ex. 1003 ¶¶ 245–246; Ex. 1008 ¶ 149).

Ueda's paragraph 149 reads as follows:

> The driving voltage determining unit 7 receives the output order signal Oop from the order output determining unit 3 and the output detection signal Dop from the output detector 4, and determines an amplitude value of the driving voltage of the linear vibration motor 100, i.e., an amplitude value of the AC voltage Vd to be supplied from the motor driver 1a to the linear vibration motor 100, on the basis of a result of comparison between the magnitude of the order output indicated by the output order signal Oop and the magnitude of the detection output indicated by the output detection signal Dop.

Ex. 1008 ¶ 149.

Dr. Goossen testifies that the comparison of "magnitude" values for Dop and Oop disclosed in paragraph 149 involves analog signals, not integers or digital signals. Ex. 1048, 77:15–79:4, 79:20–81:1, 82:5–10. Dr. Goossen also testifies that such a comparison "would generally be done in some sort of hard-wired circuit like a comparator." *Id.* at 82:5–15.

Dr. Wolfe does not testify that the comparison of "magnitude" values for Dop and Oop disclosed in paragraph 149 involves integers. *See, e.g.*, Ex. 1003 ¶¶ 244–246, 340; Ex. 1047 ¶¶ 16–17. Instead, Dr. Wolfe testifies that (1) "Ueda teaches the additional limitations" in claim 3 and (2) "Ueda teaches a processor programmed with" the algorithmic steps required by claim 3. Ex. 1003 ¶¶ 245–246, 340. Specifically, for the "convert" step (1), Dr. Wolfe testifies that "Ueda teaches converting Dop (the received output signal from output detector 4) into an amplitude value and converting Dposi (the received output signal from position detector 5) into a frequency." *Id.* ¶ 246 (citing Ex. 1008 ¶¶ 149, 152). At best, Dr. Wolfe states that an ordinarily skilled artisan would have understood that "the raw sensor input from the 'output detector 4' and the 'position detector 5' of Ueda must be converted to digital values to be processed and compared" when "implement[ing] Ueda's algorithm in a general-purpose processor." Ex. 1047 ¶ 16.

As Patent Owner asserts, however, Ueda "consistently reads as an analog system, utilizing feedback control to control analog voltages." Ex. 1008 ¶¶ 140–168; *see id.* ¶¶ 58–76, 79–97, 100–121; Ex. 1048, 77:15–79:4, 79:20–81:1, 82:5–15; Ex. 2008 ¶¶ 109, 184; Sur-reply 15.

As for Petitioner's argument in the Reply about "implement[ing] Ueda's algorithm in a general-purpose processor," Petitioner did not in the Petition rely on Fukumoto's processor when asserting that the combined disclosures in the references teach claim 3's limitations under a means-plus-function interpretation. Pet. 50–51; *see* Ex. 1003 ¶¶ 245–246. Instead, Petitioner contended that "Ueda teaches a processor programmed with" the algorithmic steps required by claim 3. Pet. 50–51; *see* Ex. 1003 ¶¶ 245–246.

In the Reply, Petitioner changed its unpatentability theory. *See* Pet. 50–51; Reply 26; Sur-reply 15–16; Ex. 1003 ¶¶ 245–246; Ex. 1047 ¶ 16.

Moreover, even if an ordinarily skilled artisan would have understood that "the raw input from the sensors of Ueda must be converted to digital values to be processed and compared" when "implement[ing] Ueda's algorithm in a general-purpose processor," as Petitioner argues in the Reply, converting to a "digital value" does not equate to converting to an "integer." *See* Reply 26.

For the reasons discussed above, Petitioner has not shown by a preponderance of the evidence that claim 3 is unpatentable under § 103(a) based on Fukumoto and Ueda.

3. DEPENDENT CLAIMS 4–6

For purposes of this proceeding, we consider claim 4 as depending from claim 3. *See* Tr. 18:4–22; *supra* § III.C.9. Claims 5 and 6 depend from claim 4. Ex. 1001, 16:8–28. Hence, claims 4–6 incorporate all the limitations of their respective base claims. 35 U.S.C. § 112 ¶ 4 (2006).

For the reasons discussed for claim 3, Petitioner has not shown by a preponderance of the evidence that claims 4–6 are unpatentable under § 103(a) based on Fukumoto and Ueda. *See supra* § III.F.2(c).

G. Alleged Obviousness over Fukumoto, Either Grant or Barton, and Ueda: Claims 3–6

Petitioner contends that claims 3–6 are unpatentable under § 103(a) because the claims would have been obvious over (1) Fukumoto, Grant, and Ueda and (2) Fukumoto, Barton, and Ueda. *See* Pet. 45–56. Patent Owner disputes Petitioner's contentions. *See* Resp. 30–32.

In the challenge based on Fukumoto and Grant, Petitioner relies on Grant for teaching limitation 1f and claim 17's limitations. *See* Pet. 35–39. Petitioner does not rely on Grant for teaching claim 3's limitations. *See id.*

In the challenge based on Fukumoto and Barton, Petitioner relies on Barton for teaching limitation 1f and claim 17's limitations. *See* Pet. 39–45. Petitioner does not rely on Barton for teaching claim 3's limitations. *See id.*

Because Petitioner does not rely on Grant or Barton for teaching claim 3's limitations, Petitioner fails to show how Grant or Barton cures the infirmities in Fukumoto and Ueda with respect to claim 3 for the challenge based on Fukumoto and Ueda. *See* Pet. 45–56. Hence, Petitioner has not shown by a preponderance of the evidence that claim 3 is unpatentable under § 103(a) based on (1) Fukumoto, Grant, and Ueda or (2) Fukumoto, Barton, and Ueda. For the same reason, Petitioner has not shown by a preponderance of the evidence that claims 4–6 are unpatentable under § 103(a) based on those combinations of references.

H. Alleged Obviousness over Fukumoto and Fuller: Claim 8

Petitioner contends that claim 8 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto and Fuller. *See* Pet. 64–67; Reply 9. Patent Owner disputes Petitioner's contentions. *See* Resp. 36–40; Sur-reply 17–18.

Above, we provided an overview of Fukumoto. *See supra* § III.D.1. Below, we provide an overview of Fuller. Then, we consider the obviousness issues. For the reasons explained below, we agree with Petitioner that claim 8 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto and Fuller.

1. OVERVIEW OF FULLER (EXHIBIT 1010)

Fuller is a U.S. patent application publication titled "Linear Electromechanical Vibrator with Axially Movable Magnet," filed on July 3, 2006, and published on January 3, 2008. Ex. 1010, codes (12), (22), (43), (54). Fuller states that the invention "relates generally to linear electromagnetic vibrators, and, more particularly, to a non-rotary electromagnetic vibrator having a movable magnet that oscillates axially under the influence of an axial field coil." *Id.* ¶ 1.

Fuller identifies deficiencies in vibrators with miniature rotary motors used in mobile phones. Ex. 1010 ¶ 3. Specifically, those vibrators are "relatively expensive and complicated to manufacture because the motor requires assembly of many small parts." *Id.* Additionally, those vibrators are "energy inefficient," while "energy efficiency" is critical in mobile phones and other portable electronic devices. *Id.* According to Fuller, "there is a need for an inexpensive, simple and energy efficient miniature vibrator" that "could be widely used in portable electronic devices," such as mobile phones. *Id.*

Fuller endeavors to address that need by providing "an electromagnetic vibrator having a movable magnet." Ex. 1010 ¶ 5, code (57). The movable magnet is "magnetized in the axial direction" and travels in the axial direction, i.e., "along a linear or curved axial pathway." *Id.* ¶¶ 5–6. Two bumper magnets are "disposed axially in-line with the movable magnet" and "oriented such that they magnetically repel the movable magnet." *Id.* ¶ 5. When excited by a field coil, "the movable magnet will oscillate between the bumper magnets and create vibrations." *Id.* ¶ 6; *see id.* ¶ 25.

The electromagnetic vibrator with bumper magnets is "simple to construct, does not require a large number of parts, and does not require significant amounts of power to operate," and thus is "energy efficient." Ex. 1010 ¶¶ 5, 53, code (57). The electromagnetic vibrator may be "small in size" or "scaled to very small or very large sizes." *Id.* ¶¶ 5, 53. The electromagnetic vibrator may be used in "[v]irtually any application where a vibrator is required," including "a variety of different electronic devices," such as mobile phones and other communication devices. *Id.* ¶ 5; *see id.* ¶ 25, code (57).

Fuller's Figure 1 (reproduced below) is a perspective view of an electromagnetic vibrator:

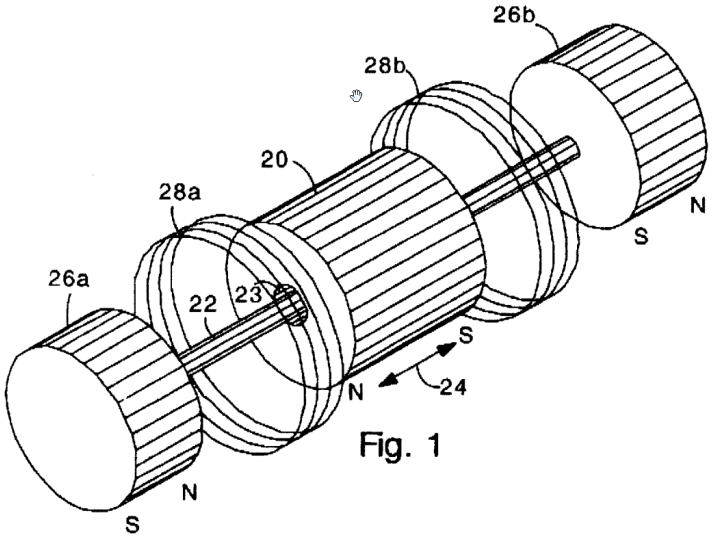

Fig. 1

Figure 1 illustrates an electromagnetic vibrator including the following components:

- movable magnet 20 that travels in an axial direction 24 and has central hole 23;
- axial shaft 22 extending through central hole 23 in movable magnet 20;

- two bumper magnets 26a and 26b "fixedly disposed at opposite ends of the axial shaft 22," "magnetized in the axial direction (i.e. parallel with the shaft 22)," and "oriented such that they magnetically repel the movable magnet 20 (i.e., they are oppositely poled to the end surface of the moveable magnet which is closest to the bumper magnet 26a or 26b)"; and
- two field coils 28a and 28b with inner diameters "large enough to accommodate" movable magnet 20 and "oriented such that they apply push and pull forces" to movable magnet 20 when receiving alternating current.

Ex. 1010 ¶¶ 27, 35, Fig. 1. Figure 1 does not show "an optional tubular enclosure" for the electromagnetic vibrator. *Id.* ¶ 27.

Preferably, bumper magnets 26a and 26b are "high strength rare earth magnets." Ex. 1010 ¶ 30. But "the magnets can be made of any magnetic material or magnetizable material." *Id.* Field coils 28a and 28b may comprise "conventional copper wire windings." *Id.* ¶ 31. But "other metal or metal alloy windings may be employed." *Id.*

Fuller's Figure 2 (reproduced below) is a schematic cross-sectional view of a vibrator device with an electromagnetic vibrator:

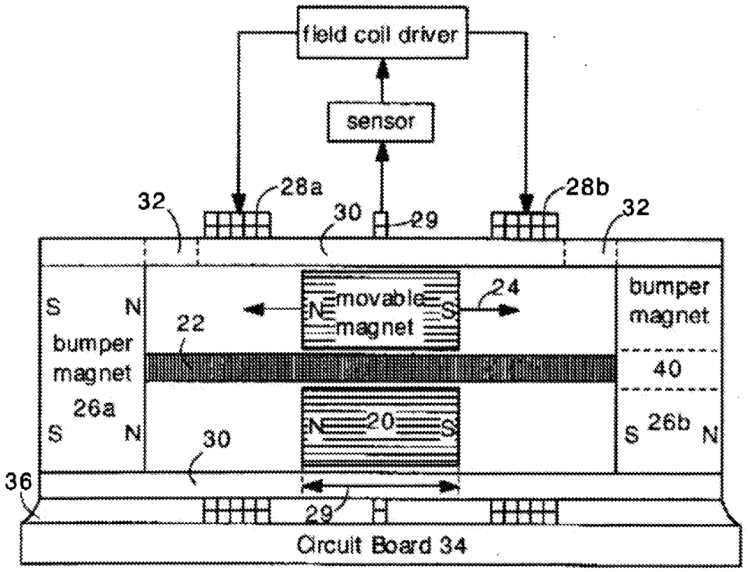

Fig. 2

Figure 2 illustrates an electromagnetic vibrator according to Figure 1 in tubular enclosure 30 and tubular enclosure 30 attached to circuit board 34 with adhesive 36. Ex. 1010 ¶¶ 28, 34, Fig. 2. Preferably, tubular enclosure 30 has air holes 32 that "reduce viscous friction losses" by "allowing air to escape and enter the enclosure as the movable magnet 20 oscillates." *Id.* ¶ 28. Figure 2 also illustrates bumper magnet 26b having optional air vent 40 that "allow[s] air to escape and enter the enclosure as the movable magnet 20 oscillates." *Id.* ¶ 29, Fig. 2.

Fuller identifies "mechanical compression springs" as alternatives to the bumper magnets. Ex. 1010 ¶¶ 7, 25, code (57); *see id.* ¶¶ 22, 48, Fig. 8.

2. Differences Between the Claimed Invention and the Prior Art

Claim 8 reads as follows (with bracketed letters added for reference purposes):[7]

> 8. [a] The linear vibration module of claim 1 wherein the housing is a linear tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets;
>
> [b] wherein the movable component is a magnet shaped to slide within the linear tube; and
>
> [c] wherein the driving component is an electromagnetic coil.

Ex. 1001, 16:34–40.

Petitioner contends that the combined disclosures in Fukumoto and Fuller teach claim 8's limitations for several related reasons. *See* Pet. 29, 64–66. Specifically, Petitioner asserts that Fukumoto discloses a linear vibration module where "the housing is a linear tube" because oscillatory actuator 115 in Fukumoto's Figure 3 includes case 115a with a rectangular cross-section. *Id.* at 29, 64 (citing Ex. 1005, 14:26–44, Fig. 3). Petitioner asserts that Fuller also discloses a linear vibration module where "the housing is a linear tube" because Fuller's Figure 2 illustrates an electromagnetic vibrator in a "tubular enclosure." *Id.* at 64–65 (citing Ex. 1010 ¶ 27, Figs. 1–2).

Further, Petitioner asserts that Fuller discloses "a linear tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets" according to limitation 8a because

[7] We use the same reference letters that Petitioner uses to identify the claim language. *See* Pet. ix (Listing of Challenged Claims).

Fuller's electromagnetic vibrator includes bumper magnets 26a and 26b "fixedly disposed at opposite ends" of the tubular enclosure "such that they magnetically repel the movable magnet 20." Pet. 65–66 (quoting Ex. 1010 ¶ 27).

Additionally, Petitioner asserts that Fuller discloses limitations 8b and 8c because Fuller's electromagnetic vibrator includes:

(1) movable magnet 20 as a "movable component [that] is a magnet shaped to slide within the linear tube" according to limitation 8b; and

(2) field coils 28a and 28b as a "driving component [that] is an electromagnetic coil" according to limitation 8c.

Pet. 65 (citing Ex. 1010 ¶¶ 27, 35). Petitioner asserts that Fukumoto also discloses limitations 8b and 8c. *Id.* at 64 (citing Ex. 1003 ¶ 268); *see id.* at 17–18, 31 (citing Ex. 1003 ¶¶ 170–175; Ex. 1005, 14:57–60, Fig. 3); *supra* § III.D.6(a).

Patent Owner does not dispute that the combined disclosures in Fukumoto and Fuller teach claim 8's limitations. *See, e.g.*, Resp. 36–40; Sur-reply 17–18.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that the combined disclosures in Fukumoto and Fuller teach claim 8's limitations. *See* Pet. 64–66; Ex. 1003 ¶¶ 268–270.

3. Alleged Reason to Combine the Teachings of the References

(a) Petitioner's Contentions

Petitioner contends that an ordinarily skilled artisan "would have been motivated to use Fuller's configuration with Fukumoto because doing so

would have amounted to nothing more than simple substitution of known components of a linear vibration actuator." Pet. 66 (citing Ex. 1003 ¶ 267). Petitioner also contends that "Fuller explicitly teaches that its motor may be scaled to any desired size." Reply 9 (citing Ex. 1010 ¶ 53).

Dr. Wolfe's testimony supports Petitioner's contentions. *See* Ex. 1003 ¶¶ 108, 267, 271. For instance, Dr. Wolfe testifies that an ordinarily skilled artisan "would have recognized that Fukumoto and Fuller are combinable because they are both directed to electromagnetic vibration generation in mobile devices using compact and energy efficient vibrators." *Id.* ¶ 267 (citing Ex. 1005, 14:38–15:4, 16:17–37, 50:48–59, Figs. 3, 16; Ex. 1010 ¶¶ 4–5, 26, 38, 53, Figs. 1–2); *see id.* ¶ 271. According to Dr. Wolfe:

> the proposed combination would have amounted to no more than applying a known technique (Fuller's vibrator driven by electromagnetic coils and using bumper magnets) to a known device ready for improvement (Fukumoto's mobile device including a linear oscillatory actuator driven by electromagnetic coils that uses a single spring) to yield predictable results (a mobile device with a smaller and more efficient vibration unit).

Id. ¶ 267.

Dr. Wolfe further testifies that an ordinarily skilled artisan "would also have been motivated to make this combination to reduce the size of the linear oscillatory actuator and efficiency, thus improving battery life of the mobile device." Ex. 1003 ¶ 267 (citing Ex. 1010 ¶¶ 4, 36, code (57)).

(b) Patent Owner's Contentions

Patent Owner contends that Petitioner fails to establish "a motivation to combine Fukumoto and Fuller" because the proposed combination would not have involved a "simple substitution" as Petitioner contends. Resp. 36

(citing Pet. 66); *see id.* at 39; Sur-reply 17–18. According to Patent Owner, the "designs of Fukomoto [sic] and Fuller are literally orthogonal" in different directions relative to a "screen" because:

(1) the vibration direction in Fukumoto's design is "perpendicular to the front surface of the touch panel 102 and matches with the direction by which the user presses the touch panel 102 or any one of the operation keys"; and

(2) the vibration direction in Fuller's design is "parallel to the screen, not perpendicular, resulting in a haptic sensation very different from that of pressing a button" because "the vibration will be equally transmitted" to the device's front, back, and sides instead of the device's screen.

Resp. 37–39 (citing Ex. 1005, 14:63–66, 15:7–16; Ex. 1010 ¶¶ 5; Ex. 2008 ¶¶ 127–128, 130).

Further, Patent Owner asserts that an ordinarily skilled artisan would not have been motivated to make the "simple substitution" that Petitioner proposes because incorporating Fuller's "tube-shaped structures into Fukumoto's PDA-type device would result in vibrations perpendicular to the direction necessary to provide the key-press haptic feedback required in Fukumoto." Sur-reply 17; *see* Resp. 38–39.

Regarding scaling Fuller's electromagnetic vibrator to fit within Fukumoto's personal digital assistant (PDA), Patent Owner asserts that a "very small" version of Fuller's electromagnetic vibrator would produce correspondingly "very small" vibrations that would not provide Fukumoto's desired key-press haptic feedback. Sur-reply 17–18.

(c) Analysis

We agree with Petitioner that an ordinarily skilled artisan would have been motivated to use Fuller's configuration with Fukumoto. *See* Pet. 66; 1003 ¶¶ 267, 271. Fuller explains that an electromagnetic vibrator with bumper magnets is "simple to construct, does not require a large number of parts, and does not require significant amounts of power to operate," and thus is "energy efficient." Ex. 1010 ¶¶ 5, 53, code (57); *see* Ex. 1003 ¶ 108. Fuller also explains that an electromagnetic vibrator with bumper magnets may be used in "[v]irtually any application where a vibrator is required," including "a variety of different electronic devices," such as mobile phones and other communication devices like Fukumoto's PDA. Ex. 1010 ¶ 5; *see id.* ¶ 25, code (57); Ex. 1003 ¶ 108.

"There is a motivation to combine when a known technique 'has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way,' using the 'prior art elements according to their established functions.'" *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380–81 (Fed. Cir. 2023) (citations omitted) (quoting *KSR*, 550 U.S. at 417; *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 799–800 (Fed. Cir. 2021)). Consistent with this, Dr. Wolfe testifies that:

> the proposed combination would have amounted to no more than applying a known technique (Fuller's vibrator driven by electromagnetic coils and using bumper magnets) to a known device ready for improvement (Fukumoto's mobile device including a linear oscillatory actuator driven by electromagnetic coils that uses a single spring) to yield predictable results (a mobile device with a smaller and more efficient vibration unit).

Ex. 1003 ¶ 267. We credit Dr. Wolfe's testimony.

Improved efficiency and, therefore, improved "battery life" would have prompted an ordinarily skilled artisan to combine Fuller's teachings with Fukumoto's teachings in the way Petitioner proposes. *See* Ex. 1003 ¶¶ 108, 267. An "implicit motivation to combine" may result from a desire to make a product or process "stronger, cheaper, cleaner, faster, lighter, smaller, more durable, or more efficient." *DyStar Textilfarben GmbH v. C.H. Patrick Co.*, 464 F.3d 1356, 1368 (Fed. Cir. 2006).

As for Patent Owner's contention that the "designs of Fukomoto [sic] and Fuller are literally orthogonal" in different directions relative to a "screen," claim 8 does not require a "linear vibration module" with a "screen" or specify a vibration direction relative to a "screen." Ex. 1001, 15:36–48, 16:34–40; *see* Resp. 37–39; Sur-reply 17. Rather, claim 8 requires a "linear vibration module" with a "housing [that] is a linear tube." Ex. 1001, 15:36–48, 16:34–40. Although Fukumoto's Figure 3 illustrates oscillatory actuator 115 with the vibration direction perpendicular to touch panel 102, Fukumoto also discloses that "[a]lternatively, the housing of the electronic device is made to vibrate." Ex. 1005, 14:45–48, code (57), Fig. 3. Fuller discloses a "housing [that] is a linear tube" and "made to vibrate" consistent with that disclosure in Fukumoto. Ex. 1010 ¶¶ 5, 27–28, 35, Fig. 2; *see* Ex. 1003 ¶¶ 108, 269–271.

Also, obviousness does not depend on "whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference." *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981). In both Fukumoto's oscillatory actuator 115 and Fuller's electromagnetic vibrator the movable magnet travels in the axial direction. *See* Ex. 1005, 14:27–60, Fig. 3; Ex. 1010 ¶¶ 5–6, 27, code (57), Figs. 1–2. Aligning

Fuller's axial direction with Fukumoto's axial direction to generate vibrations perpendicular to the front surface of Fukumoto's touch panel would not have exceeded the abilities of an ordinarily skilled artisan, who "would have had a bachelor's degree in electrical engineering, mechanical engineering, computer science, or a similar field and two years of experience related to electronic consumer product design." *See* Ex. 1003 ¶ 30; *supra* § III.B. A "person of ordinary skill is also a person of ordinary creativity, not an automaton," and would have been able to fit together the teachings of multiple references. *KSR*, 550 U.S. at 420–21.

As for Patent Owner's assertion that a "very small" version of Fuller's electromagnetic vibrator would produce correspondingly "very small" vibrations that would not provide Fukumoto's desired key-press haptic feedback, we disagree. *See* Sur-reply 17–18. Fuller explains that the electromagnetic vibrator may be used in "[v]irtually any application where a vibrator is required," including "a variety of different electronic devices," such as mobile phones and other communication devices, e.g., Fukumoto's PDA. Ex. 1010 ¶ 5; *see id.* ¶ 25, code (57); Ex. 1003 ¶ 108. A vibration strong enough for a mobile phone should suffice for Fukumoto's PDA. *See* Ex. 1003 ¶ 271.

4. CONCLUSION ABOUT OBVIOUSNESS/NONOBVIOUSNESS

For the reasons discussed above, the combined disclosures in Fukumoto and Fuller teach claim 8's limitations. *See supra* § III.H.2. Additionally, Petitioner provides a reason with rational underpinning as to why an ordinarily skilled artisan would have been motivated to combine Fuller's teachings with Fukumoto's teachings in the way Petitioner proposes and would have obtained a predictable result. *See supra* § III.H.3(c).

Hence, Petitioner has shown by a preponderance of the evidence that claim 8 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto and Fuller.

I. Alleged Obviousness over Fukumoto, Dong, and Ogusu: Claim 14

Petitioner contends that claim 14 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto, Dong, and Ogusu. *See* Pet. 66–70; Reply 10–16. Patent Owner disputes Petitioner's contentions. *See* Resp. 41–46; Sur-reply 18–19.

Above, we provided an overview of Fukumoto. *See supra* § III.D.1. Below, we provide overviews of Dong and Ogusu. Then, we consider the obviousness issues. For the reasons explained below, we disagree with Petitioner that claim 14 is unpatentable under § 103(a) because the claim would have been obvious over Fukumoto, Dong, and Ogusu.

1. OVERVIEW OF DONG (EXHIBIT 1011)

Dong is a Chinese patent application publication titled "Flat Linear Vibration Motor," filed on February 20, 2009, and published on July 22, 2009. Ex. 1011, codes (12), (22), (43), (54). Dong states that the invention "relates to a vibration motor, and in particular to a flat linear vibration motor used in portable consumer electronic products." *Id.* at 3.[8]

[8] For Exhibit 1011 (Dong), we follow Petitioner's practice and cite to the page numbers that Petitioner applied to the exhibit.

Dong's Figure 2 (reproduced below) is an exploded perspective view of a flat linear vibration motor:

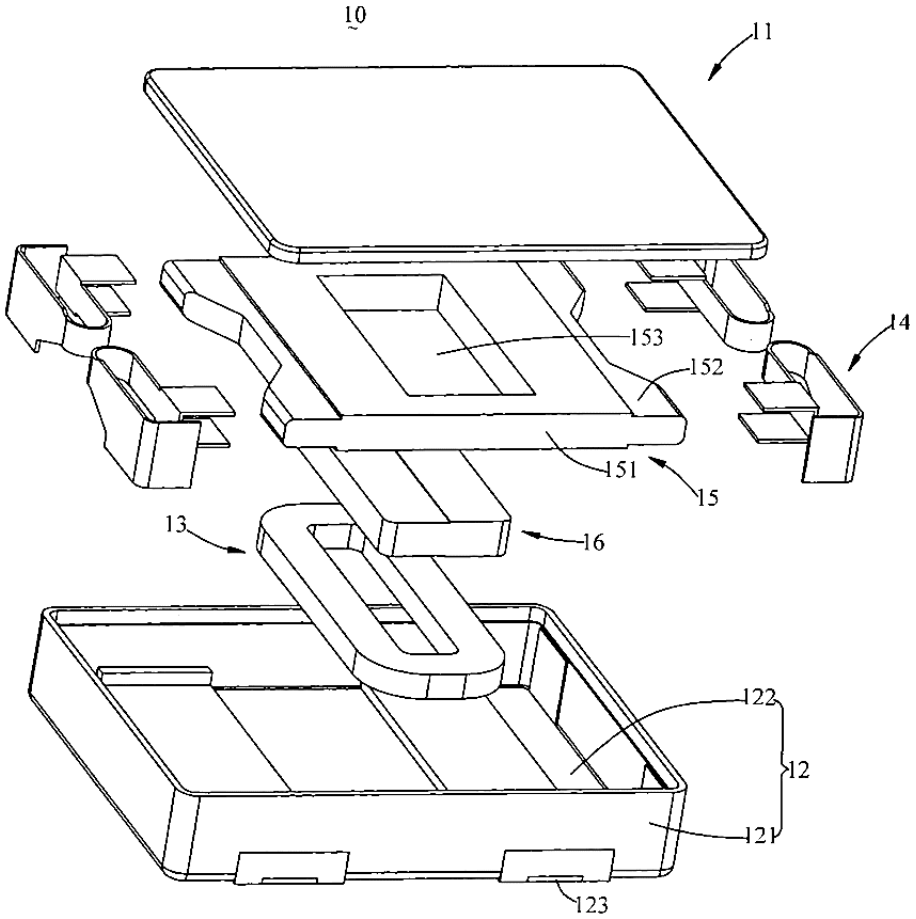

FIG. 2

Figure 2 illustrates flat linear vibration motor 10 including upper cover 11, base 12, coil 13, a plurality of elastic supports 14, counterweight 15, and permanent magnet 16. Ex. 1011, 5, Fig. 2. Counterweight 15 includes through hole 153 used for positioning permanent magnet 16. *Id.* at 5.

Dong's Figure 5 (reproduced below) is a cross-sectional view of the flat linear vibration motor illustrated in Figure 2:

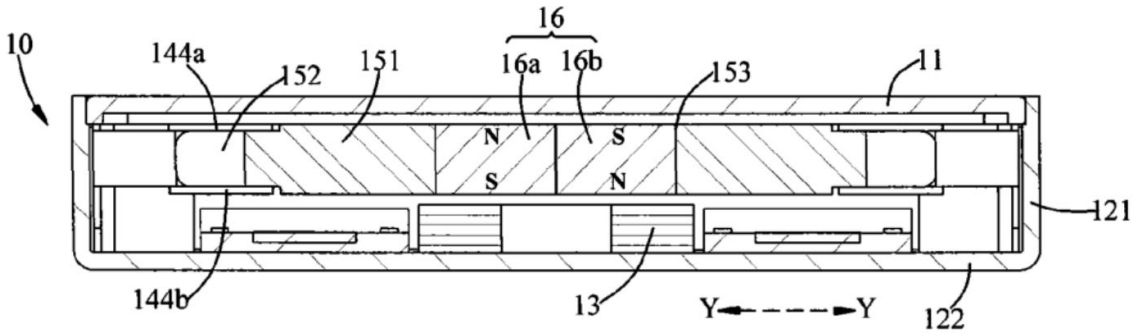

FIG. 5

Figure 5 illustrates flat linear vibration motor 10 with permanent magnet 16 positioned within through hole 153 in counterweight 15. Ex. 1011, 6, Fig. 5. Figure 5 also illustrates permanent magnet 16 magnetized such that the "magnetic poles of its one half (labeled 16a) are polarized opposite to magnetic poles of the other half (labeled 16b), and magnetic pole planes of the permanent magnet 16 are parallel to the bottom wall 122 of the base 12 (also parallel to the coil 13)." *Id.* at 6.

When an alternating current flows through coil 13, counterweight 15 and permanent magnet 16 move together "under the action of the magnetic field force." Ex. 1011, 6. Counterweight 15 and permanent magnet 16 move together from side to side in the housing formed by cover 11 and base 12 to produce "a vibration parallel to the bottom wall." *Id.* at 6, Figs. 5–6. Counterweight 15 "functions to strengthen the vibrating force, making the vibration stronger." *Id.* at 6. But counterweight 15 "may be omitted." *Id.*

Dong explains that when using counterweight 15 "it is preferable to use a material with a density of not less than 7.8 g/cm^3, such as nickel, tungsten and alloys thereof." Ex. 1011, 6.

2. Overview of Ogusu (Exhibit 1015)

Ogusu is a Japanese patent application publication titled "Vibration Actuator," filed on January 12, 1995, and published on July 30, 1996. Ex. 1015, codes (12), (22), (43), (54). Ogusu states that the invention "relates to a moving magnet-type vibration actuator, and more particularly to a moving magnet-type vibration actuator having low loss and high efficiency." *Id.* ¶ 1; *see id.* ¶ 47.

Ogusu's Figure 1 (reproduced below) is a cross-sectional view of a vibration actuator:

[FIG. 1]

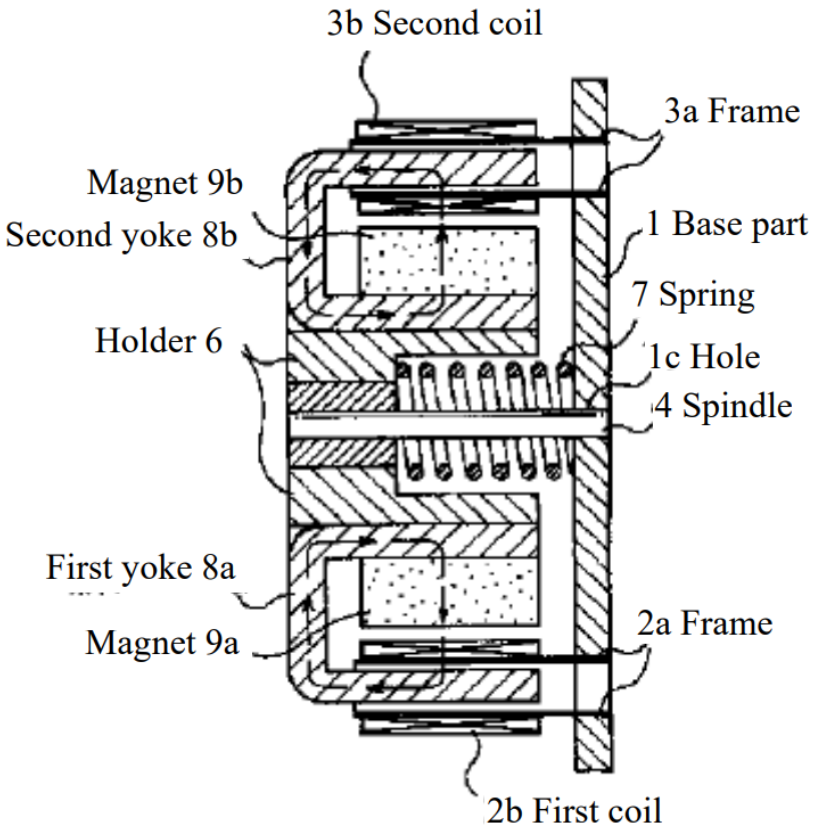

Figure 1 illustrates a vibration actuator including the following components:

- base part 1;

- frame 2a fixed at one end to base part 1;
- first coil 2b wound around frame 2a;
- frame 3a fixed at one end to base part 1;
- second coil 3b wound around frame 3a;
- spindle 4 mounted in hole 1c in base part 1;
- bearing 5 (not labeled in Figure 1) arranged around an end of spindle 4;
- holder 6 connected to bearing 5 and movable with bearing 5 in an axial direction along spindle 4;
- spring 7 to maintain holder 6 in a predetermined position when holder 6 does not vibrate;
- first yoke 8a "composed of a plate-shaped magnetic body" and mounted on holder 6 with one end part forming a core for first coil 2b and the other end part positioned opposite to a side surface of first coil 2b;
- second yoke 8b "composed of a plate-shaped magnetic body" and mounted on holder 6 with one end part forming a core for second coil 3b and the other end part positioned opposite to a side surface of second coil 3b;
- first magnet 9a arranged on first yoke 8a opposite to a side surface of first coil 2b; and
- second magnet 9b arranged on second yoke 8b opposite to a side surface of second coil 3b.

Ex. 1015 ¶¶ 24–29, Fig. 1. As shown by the broken lines representing magnetic flux in Figure 1, the vibration actuator forms two magnetic circuits as follows: (1) "the magnet opposing the first coil - the first coil - the first yoke" and (2) "the magnet opposing the second coil - the second coil - the second yoke." *Id.* ¶ 30, Fig. 1; *see id.* ¶¶ 16, 36.

When an alternating current flows through first coil 2b and second coil 3b, the movable elements (the holder, the bearing, the yokes, and the magnets) "generate vibration according to [the] current waveform." Ex. 1015 ¶ 32; *see id.* ¶¶ 37–41, 60, Figs. 4(a)–4(e). Because "the movable elements have magnets and a certain amount of weight, the base part 1 side also generates vibration in a direction opposite to that of the movable elements." *Id.* ¶ 32. The vibration actuator may generate "various sounds and vibrations" by changing the frequency and the amplitude of the alternating current or by "intermittently generating an electric current." *Id.* ¶ 36; *see id.* ¶¶ 11, 42, 50, 55, 60.

Ogusu explains that "loss is small and higher efficiency can be obtained compared to a conventional device" with Figure 1's vibration actuator since first yoke 8a and second yoke 8b each form a "magnetic loop having the shortest path." Ex. 1015 ¶ 47. Ogusu explains that "it is also possible to use various non-magnetic materials mixed with ferromagnetic powders as the material" for first yoke 8a and second yoke 8b. *Id.* ¶ 28.

Additionally, Ogusu discloses using Figure 1's vibration actuator as "vibration generation means for a pager." Ex. 1015 ¶ 2; *see id.* ¶¶ 33–35. Ogusu also discloses that "various vibrations can be switched at the user's choice by a selection in the pager's control unit." *Id.* ¶ 43.

3. WHETHER DONG QUALIFIES AS PRIOR ART FOR CLAIM 14

Petitioner contends that Dong qualifies as prior art for claim 14 because (1) Dong was published on July 22, 2009, and (2) claim 14 is "entitled to a priority date no earlier than January 6, 2012." Pet. 67.[9]

[9] The analysis for the benefit of priority proceeds on a claim-by-claim basis. *See Lucent Techs., Inc. v. Gateway, Inc.*, 543 F.3d 710, 718 (Fed. Cir. 2008);

Specifically, Petitioner asserts that Figures 24A, 24B, and 25 and the related descriptions in the '081 patent's specification constitute "the only potential written description support for claim 14" and that these disclosures "first appeared" in a January 6, 2012, continuation-in-part application for an ancestor patent. *Id.* (citing Ex. 1001, 13:52–14:38; Ex. 1003 ¶ 274; Ex. 1026).

Patent Owner does not dispute that Dong qualifies as prior art for claim 14. *See, e.g.*, Resp. 41–47; Sur-reply 18–19.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Dong qualifies as prior art for claim 14. *See* Pet. 67; Ex. 1003 ¶ 274.

4. WHETHER PETITIONER HAS PROVEN UNPATENTABILITY BY A PREPONDERANCE OF THE EVIDENCE

Claim 14 depends directly from claim 1 and further requires "flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the linear vibration module." Ex. 1001, 17:5–8.

(a) Petitioner's Contentions

Petitioner contends that the combined disclosures in Fukumoto, Dong, and Ogusu teach claim 14's limitations for several related reasons. *See* Pet. 68–70; Reply 11–15. Specifically, Petitioner asserts that Dong discloses that:

(1) counterweight 15 "can be composed of tungsten" that "was known as a paramagnetic material";

Waldemar Link, GmbH v. Osteonics Corp., 32 F.3d 556, 558 (Fed. Cir. 1994).

(2) counterweight 15 "circumscribes" magnet 16 in the linear vibration motor to arrange "paramagnetic materials at each end" of magnet 16; and

(3) counterweight 15 and magnet 16 move back and forth relative to coil 13 in the linear vibration motor.

Pet. 69 (citing Ex. 1003 ¶ 277; Ex. 1011, 6); Reply 11–12, 14–16 (citing Ex. 1003 ¶ 112; Ex. 1011, 6, Figs. 2, 6). Petitioner asserts that counterweight 15 forms a magnetic circuit when moving back and forth relative to coil 13 in the linear vibration motor. Reply 15 (citing Ex. 2010, 85:13–86:7).

To support its assertions, Petitioner presents an annotated and highlighted version of Dong's Figure 6 as reproduced below (Reply 12):

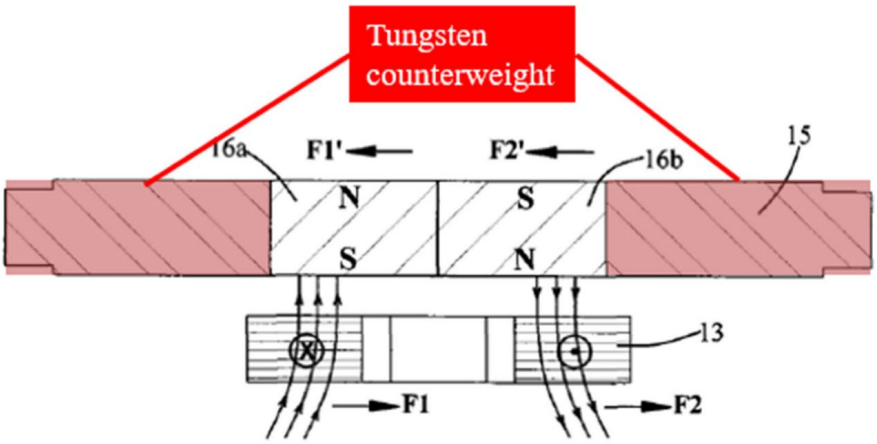

FIG. 6

Figure 6 illustrates coil 13, counterweight 15, and permanent magnet 16 magnetized such that the "magnetic poles of its one half (labeled 16a) are polarized opposite to magnetic poles of the other half (labeled 16b)." Ex. 1011, 6, Fig. 6. The above annotated and highlighted version of Figure 6 includes:

- red highlighting over the part of counterweight 15 arranged adjacent to magnet half 16a in the axial direction;

- red highlighting over the part of counterweight 15 arranged adjacent to magnet half 16b in the axial direction; and
- the annotation "Tungsten counterweight" with lines leading to the highlighted parts of counterweight 15.

See Reply 12.

Petitioner asserts that an ordinarily skilled artisan would have understood that "adding a paramagnetic material such as tungsten to Fukumoto's vibration module (as taught in Dong) would reduce the reluctance of the magnetic circuits within" Fukumoto's vibration module. Pet. 69 (citing Ex. 1003 ¶ 276). According to Petitioner, an ordinarily skilled artisan "would have understood from Dong's configuration that this placement of paramagnetic materials would reduce magnetic reluctance." Reply 12–13 (citing Ex. 1003 ¶ 277; Ex. 2010, 82:24–83:12).

Additionally, Petitioner asserts that Ogusu's teachings "further support" the proposed combination of Dong's tungsten counterweight with Fukumoto's oscillatory actuator because Ogusu discloses that "a yoke made of ferromagnetic material or non-ferromagnetic materials mixed with ferromagnetic powders is positioned between the electromagnetic coil and permanent magnet to form a magnetic circuit." Pet. 69 (citing Ex. 1003 ¶ 279; Ex. 1015 ¶¶ 28–29, 38, Fig. 1).

Regarding a reason to combine the teachings of the references, Petitioner asserts that an ordinarily skilled artisan:

(1) would have been motivated to apply Dong's teaching to use a tungsten (paramagnetic material) counterweight to Fukumoto's oscillatory actuator to "reduce magnetic reluctance" and achieve "better efficiency of the magnetic circuit in the vibration module"; and

(2) would have recognized that "non-magnetic materials mixed with ferromagnetic powders, as disclosed in Ogusu, would have weak magnetic attraction similar to paramagnetic materials and would reduce the reluctance of magnetic circuits in the same way."

Pet. 68–70 (citing Ex. 1001, 13:59–67; Ex. 1003 ¶¶ 276, 278–279; Ex. 1015 ¶ 47); Reply 10–11.

Additionally, Petitioner contends that Ogusu teaches "the advantages of reducing magnetic reluctance" because Ogusu discloses that "loss is small and higher efficiency can be obtained compared to a conventional device" with Figure 1's vibration actuator since first yoke 8a and second yoke 8b each form a "magnetic loop having the shortest path." Reply 10 (quoting Ex. 1015 ¶ 47). According to Petitioner, an ordinarily skilled artisan would have recognized that first yoke 8a and second yoke 8b were "designed to reduce magnetic reluctance," e.g., because they may consist of "non-magnetic materials mixed with ferromagnetic powders." *Id.* (citing Ex. 1003 ¶ 279).

Petitioner further asserts that an ordinarily skilled artisan would have had a reasonable expectation of success when combining the teachings of Fukumoto, Dong, and Ogusu because the proposed combination "would have required only minor changes to Fukumoto's disclosed structure." Pet. 69 (citing Ex. 1003 ¶ 278). Petitioner explains that those minor changes involve placing "paramagnetic materials at each end" of Fukumoto's movable magnet according to Dong's teachings. *See* Reply 11–12 (citing Ex. 1003 ¶ 112; Ex. 1011, Fig. 6). Petitioner also asserts that "there is no question of incorrect incorporation here because Dong teaches the very placement of paramagnetic materials contemplated by the '081 patent, i.e.,

at the leading edges of the moving magnet." *Id.* at 16 (citing Ex. 1001, Fig. 24B; Ex. 1003 ¶ 112).

(b) Patent Owner's Contentions

Patent Owner disputes that the combined disclosures in Fukumoto, Dong, and Ogusu teach claim 14's limitations. *See* Resp. 42; Sur-reply 18. In particular, Patent Owner contends that Petitioner "does not and cannot identify any mention of reluctance or paramagnetism in any of the three references." Resp. 42.

Patent Owner asserts that "Ogusu does not disclose paramagnetic materials." Resp. 43. Patent Owner asserts that Petitioner at best points to "Ogusu's disclosure to use ferromagnetic materials, potentially in conjunction with nonmagnetic materials, to form a 'yoke.'" *Id.* (emphasis omitted) (citing Pet. 67–70). According to Patent Owner, however, "a mix of ferromagnetic and nonmagnetic materials does not produce a paramagnetic material." *Id.* (citing Ex. 2008 ¶ 149).

Patent Owner asserts that "Dong does not refer to the reluctance of a magnetic circuit" and that Dong's counterweight 15 "is not part of Dong's magnetic circuit." Resp. 44 (citing Ex. 2008 ¶ 140); Sur-reply 18 (citing Ex. 2008 ¶¶ 140–141). According to Patent Owner, Dong "illustrates the magnetic field lines going through the magnet 16a and 16b, and specifically not going through the counterweight." Resp. 44 (citing Ex. 2008 ¶ 140). Patent Owner further asserts that Petitioner fails to show that Dong "discloses paramagnetic flux paths as claimed." *Id.*

Regarding a reason to combine the teachings of the references, Patent Owner asserts that there is "no evidence" that an ordinarily skilled artisan "would have had any reason to consider decreasing reluctance in order to

increase efficiency" other than "the *ipse dixit* of Dr. Wolfe." Resp. 42 (emphasis by Patent Owner); *see* Sur-reply 19. Patent Owner contends that "neither Ogusu or Dong shows the use of paramagnetic materials shaped and positioned to reduce reluctance of a magnetic circuit." Resp. 46. Therefore, according to Patent Owner, neither reference provides "any motivation to combine" its teachings with Fukumoto to achieve "reduced reluctance through the use of paramagnetic materials." *Id.*

Additionally, Patent Owner contends that "the Petition's entire discussion of paramagnetic materials, reluctance, and flux paths is based on the disclosure of the '081 patent itself." Resp. 42 (citing Pet. 67–68). According to Patent Owner, Petitioner uses "the challenged patent's own disclosures as a road map to the prior art" and relies on "impermissible hindsight." *Id.* at 42–43.

Patent Owner asserts that an ordinarily skilled artisan "reading Dong, even in conjunction with Ogusu and/or Fukumoto would not be motivated even to consider the reluctance or other magnetic properties of the counterweight." Resp. 44 (citing Ex. 2008 ¶ 140); *see* Sur-reply 19.

Further, Patent Owner asserts that Petitioner "fails to show how" an ordinarily skilled artisan would have incorporated "either Ogusu or Dong into Fukumoto's design, much less somehow combine all three references' different teachings." Resp. 45. Patent Owner asserts that "Ogusu's movable yoke could not be substituted for Fukumoto's fixed housing with any expectation for the combination working." *Id.* (citing Ex. 2008 ¶ 144).

Patent Owner asserts that Petitioner "fails to show that" an ordinarily skilled artisan "would find it straightforward" to "incorporate Dong's counterweights into Fukumoto." Resp. 45 (citing Ex. 2008 ¶ 145). Patent

Owner asserts that an ordinarily skilled artisan would have recognized that "incorrect incorporation of a paramagnetic mass into Fukumoto's design could in fact increase reluctance." *Id.* (citing Ex. 2008 ¶ 145).

Patent Owner also asserts that an ordinarily skilled artisan would have had "no expectation that combining Fukumoto with Dong would actually reduce reluctance, because neither Fukumoto nor Dong (unlike the '081 patent) includes any teaching of how to achieve reduced reluctance." Resp. 45–46 (emphasis omitted) (citing Ex. 2008 ¶ 145).

(c) Analysis

The record supports Patent Owner's motivation-to-combine arguments, e.g., that Ogusu's teachings do not support combining Fukumoto and Dong. Petitioner relies on Ogusu's "magnetic loop having the shortest path" to provide increased efficiency. Pet. 69–70 (citing Ex. 1001, 13:59–67; Ex. 1003 ¶ 279; Ex. 1015 ¶ 47). Yet Ogusu does not relate its "shortest path" magnetic loop to a paramagnetic material, or to any particular material added for the purpose of reducing magnetic reluctance. *See* Ex. 1015 ¶¶ 28, 30, 47.

Ogusu teaches that its efficiency advantages accrue regardless of whether its yokes are made from ferromagnetic materials or non-magnetic materials mixed with ferromagnetic powders. Ex. 1015 ¶ 28. Ogusu's "shortest path" magnetic loop results from the particular "C-shape" of its yokes where "the magnet and yoke are integrated in each magnetic circuit, so no non-excitation holding force is exerted." *See id.* ¶¶ 13, 16, 18, 20, 22, 47, Fig. 1. Thus, Ogusu does not teach any efficiency gains resulting specifically from paramagnetic (or lower-magnetic) materials that would lead to using paramagnetic materials in Fukumoto's oscillatory actuator.

Although Petitioner asserts that "Dr. Goossen admitted that the ferromagnetic materials in Ogusu's yoke would decrease reluctance," that testimony relates to a property of ferromagnetic materials, not paramagnetic materials. *See* Reply 10 (citing Ex. 1048, 104:3–6). Additionally, that testimony does not indicate that paramagnetic materials used in other configurations different from Ogusu's integrated magnet-and-yoke configuration would reduce magnetic reluctance. Moreover, Petitioner relies on Dr. Goossen's testimony rather than Ogusu's disclosures. Dr. Goossen's testimony does not indicate that Ogusu teaches advantages of paramagnetic materials used in a linear vibration module, only that he is aware of the reluctance-reducing properties of ferromagnetic materials. *See, e.g.*, Ex. 1048, 104:3–6. Hence, Dr. Goossen's testimony does not support Petitioner's assertion that Ogusu's teachings "further support" the proposed combination of Dong's tungsten counterweight with Fukumoto's oscillatory actuator. *See* Pet. 69.

As for Petitioner's reliance on Dong to support the proposed combination of Dong's tungsten counterweight with Fukumoto's oscillatory actuator, Petitioner asserts that an ordinarily skilled artisan "would have understood from Dong's configuration that this placement of paramagnetic materials would reduce magnetic reluctance." Reply 12–13 (citing Ex. 1003 ¶ 277; Ex. 2010, 82:24–83:12). That Dong's placement of a tungsten counterweight relative to a permanent magnet and a coil "would reduce magnetic reluctance," as Petitioner asserts, does not indicate that Dong teaches any benefit from this arrangement other than providing more mass that "functions to strengthen the vibrating force." Ex. 1011, 6.

Insofar as Petitioner relies on an ordinarily skilled artisan's knowledge to support the proposed combination of Dong's tungsten counterweight with Fukumoto's oscillatory actuator, Petitioner evidences that knowledge with citations to the '081 patent. *See* Pet. 67–70; Reply 13–16. Petitioner does not cite the '081 patent as simply summarizing what was known in the prior art (i.e., that free air increases magnetic reluctance), but also for its novel disclosures (i.e., that introducing paramagnetic materials that "decrease the portion of magnetic field lines passing through free air" can improve the efficiency of a linear vibration module). *See* Pet. 67–68 (citing Ex. 1001, 13:1–16 (sic (14:1–16)), 13:52–67, Figs. 24A–24B).

Although Petitioner relies on Dr. Wolfe's testimony to establish an ordinarily skilled artisan's knowledge, Dr. Wolfe relies on the same novel disclosures in the '081 patent as Petitioner. *See* Ex. 1003 ¶¶ 275–279 (citing Ex. 1001, 13:1–16 (sic (14:1–16)), 13:52–67, Figs. 24A–24B). Hence, when stating that an ordinarily skilled artisan "would have been motivated to use paramagnetic materials in" Fukumoto "because decreasing reluctance would increase efficiency," Dr. Wolfe's only basis for concluding that efficiency would be increased is his citation to the '081 patent. *Id.* ¶¶ 275–276.

"To draw on hindsight knowledge of the patented invention, when the prior art does not contain or suggest that knowledge, is to use the invention as a template for its own reconstruction—an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570 (Fed. Cir. 1996). Hence, Petitioner has identified no adequate reason why an ordinarily skilled artisan would have been motivated to increase efficiency by combining Dong's tungsten

counterweight with Fukumoto's oscillatory actuator. *See, e.g.*, Pet. 67–70; Ex. 1003 ¶¶ 275–279.

Petitioner quotes the following statement in *ZyXEL Communications Corp. v. UNM Rainforest Innovations*, 107 F.4th 1368, 1380 (Fed. Cir. 2024): "A prior art reference does not need to explicitly articulate or express why its teachings are beneficial so long as its teachings are beneficial and a [person of ordinary skill] would recognize that their application was beneficial." Reply 13 (emphasis by the court). Based on *ZyXEL*, Petitioner argues that "regardless of whether Dong explicitly discloses the reluctance-reducing properties of its design, [a person of ordinary skill] would have understood the effect of Dong's paramagnetic counterweight on magnetic reluctance." *Id.* (citing Ex. 1048, 102:20–103:5; Ex. 2008 ¶ 140).

But the issue is not whether an ordinarily skilled artisan would have recognized the effect of Dong's paramagnetic counterweight on magnetic reluctance, which is supported by the record and not at issue. Instead, the issue is whether an ordinarily skilled artisan, aware of Dong's paramagnetic counterweight, would have considered it beneficial to include that counterweight in Fukumoto's oscillatory actuator to reduce the reluctance of the magnetic circuit and increase efficiency. As discussed above, the record does not reflect that an ordinarily skilled artisan would have recognized the advantages of using a paramagnetic material to reduce the reluctance of a magnetic circuit and increase efficiency except by reading the '081 patent.

5. CONCLUSION ABOUT OBVIOUSNESS/NONOBVIOUSNESS

For the reasons discussed above, Petitioner has not identified an adequate reason why an ordinarily skilled artisan would have been motivated to combine the teachings in Fukumoto, Dong, and Ogusu to yield

claim 14's subject matter. *See supra* § III.I.4(c). Hence, Petitioner has not shown by a preponderance of the evidence that claim 14 is unpatentable under § 103(a) based on Fukumoto, Dong, and Ogusu.

J. Alleged Obviousness over Fukumoto, Either Grant or Barton, Dong, and Ogusu: Claim 14

Petitioner contends that claim 14 is unpatentable under § 103(a) because the claim would have been obvious over (1) Fukumoto, Grant, Dong, and Ogusu and (2) Fukumoto, Barton, Dong, and Ogusu. *See* Pet. 66–70. Patent Owner disputes Petitioner's contentions. *See* Resp. 41–46.

In the challenge based on Fukumoto and Grant, Petitioner relies on Grant for teaching limitation 1f and claim 17's limitations. *See* Pet. 35–39. Petitioner does not rely on Grant for teaching claim 14's limitations. *See id.*

In the challenge based on Fukumoto and Barton, Petitioner relies on Barton for teaching limitation 1f and claim 17's limitations. *See* Pet. 39–45. Petitioner does not rely on Barton for teaching claim 14's limitations. *See id.*

Because Petitioner does not rely on Grant or Barton for teaching claim 14's limitations, Petitioner fails to show how Grant or Barton cures the infirmities in Fukumoto, Dong, and Ogusu with respect to claim 14 for the challenge based on Fukumoto, Dong, and Ogusu. *See* Pet. 66–70. Hence, Petitioner has not shown by a preponderance of the evidence that claim 14 is unpatentable under § 103(a) based on (1) Fukumoto, Grant, Dong, and Ogusu or (2) Fukumoto, Barton, Dong, and Ogusu.

K. Alleged Obviousness over Ogusu and Fukumoto: Claims 1, 2, 7, 11, and 17

Petitioner contends that claims 1, 2, 7, 11, and 17 are unpatentable under § 103(a) because the claims would have been obvious over Ogusu and

Fukumoto. *See* Pet. 75–91; Reply 16–22. Patent Owner disputes Petitioner's contentions. *See* Resp. 52–59; Sur-reply 7–11.

Above, we provided overviews of Ogusu and Fukumoto. *See supra* §§ III.D.1, III.I.2. Below, we consider the obviousness issues. For the reasons explained below, we agree with Petitioner that claims 1, 2, 7, 11, and 17 are unpatentable under § 103(a) because the claims would have been obvious over Ogusu and Fukumoto.

1. INDEPENDENT CLAIM 1

(a) Preamble 1pre

Claim 1 recites "[a] linear vibration module." Ex. 1001, 15:36.

Petitioner contends that Ogusu teaches claim 1's preamble because Ogusu discloses "a 'vibration actuator' using a moving magnet." Pet. 77–78 (citing Ex. 1003 ¶ 305; Ex. 1015 ¶¶ 1–2). Further, Petitioner asserts that "Ogusu's vibration actuator is linear in the same way as the '081 patent." *Id.* at 78 (citing Ex. 1001, 2:17–23; Ex. 1015 ¶¶ 31–32, Figs. 1, 4).

Patent Owner makes no arguments specific to claim 1's preamble. *See, e.g.*, Resp. 52–58; Sur-reply 7–11. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Generally, a preamble does not limit a claim. *Allen Eng'g*, 299 F.3d at 1346. We need not decide whether claim 1's preamble limits the claim because, for the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches claim 1's preamble. *See* Pet. 77–78; Ex. 1003 ¶ 305.

(b) Limitation 1a

Claim 1 recites "a housing." Ex. 1001, 15:37 (limitation 1a).

Petitioner contends that the combined disclosures in Ogusu and Fukumoto teach limitation 1a. *See* Pet. 78. Specifically, Petitioner asserts that "Ogusu's vibration actuator is used as a 'vibration generating means for pager[s].'" *Id.* (alteration by Petitioner) (quoting Ex. 1015 ¶ 2). Petitioner acknowledges that "Ogusu does not explicitly depict a housing for its vibration actuator." *Id.* But Petitioner asserts that an ordinarily skilled artisan "would have found it obvious and beneficial to enclose Ogusu's vibration actuator in a housing to protect the components of the vibration actuator during pager assembly." *Id.* (citing Ex. 1003 ¶ 307).

Further, Petitioner asserts that Fukumoto's "vibration actuator for use in portable electronic devices" includes case 115a that corresponds to the claimed "housing" and additionally includes main case 101 that corresponds to the claimed "housing" according to Patent Owner's infringement contentions in the Samsung litigation. Pet. 78 (citing Ex. 1005, 1:13–19, 1:45–50, 13:20–26, Figs. 1, 3; Ex. 1018, 1–5); *see* Ex. 1022, 7–9, 60–61.

Patent Owner makes no arguments specific to limitation 1a. *See, e.g.*, Resp. 52–58; Sur-reply 7–11.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that the combined disclosures in Ogusu and Fukumoto teach limitation 1a. *See* Pet. 78; Ex. 1003 ¶¶ 306–307.

(c) Limitation 1b

Claim 1 recites "a moveable component." Ex. 1001, 15:38 (limitation 1b).

Petitioner contends that Ogusu teaches limitation 1b because Ogusu's vibration actuator includes bearing 5, holder 6, first yoke 8a, second yoke 8b, first magnet 9a, and second magnet 9b that collectively correspond

to the claimed "moveable component," i.e., a component that moves. Pet. 78–79.

Patent Owner makes no arguments specific to limitation 1b. *See, e.g.*, Resp. 52–58; Sur-reply 7–11.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches limitation 1b. *See* Pet. 78–79; Ex. 1003 ¶¶ 308–310.

(d) Limitation 1c

Claim 1 recites "a power supply." Ex. 1001, 15:39 (limitation 1c).

Petitioner contends that Ogusu teaches limitation 1c because Ogusu discloses (1) "current in a predetermined direction" applied to "the first coil 2b and the second coil 3b" to create resultant movement and (2) "an input power supplied to the coil." Pet. 79–80 (citing Ex. 1015 ¶¶ 30–31, 57–58). Further, Petitioner asserts that an ordinarily skilled artisan would have recognized that "applying electrical current to the coils to create resultant movement requires a supply of electric power." *Id.* at 80 (citing Ex. 1003 ¶ 312).

Patent Owner does not dispute that Ogusu teaches a "power supply" according to limitation 1c. *See, e.g.*, Resp. 52–58; Sur-reply 7–11. Instead, as explained below, Patent Owner disputes that a "power supply" according to the combined disclosures in Ogusu and Fukumoto receives an output from a "control component" according to limitation 1f. Resp. 54–58; Sur-reply 7–11; *infra* § III.K.1(g)(ii).

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches limitation 1c. *See* Pet. 79–80; Ex. 1003 ¶¶ 311–312.

(e) Limitation 1d

Claim 1 recites "user-input features." Ex. 1001, 15:40 (limitation 1d).

Petitioner contends that Ogusu teaches limitation 1d and alternatively that the combined disclosures in Ogusu and Fukumoto teach limitation 1d. *See* Pet. 80–81. Specifically, Petitioner asserts that Ogusu discloses that "various vibrations can be switched by the selection of the pager control section by the user's selection." *Id.* at 80 (citing Ex. 1015 ¶ 43). Petitioner asserts that an ordinarily skilled artisan would have recognized that the "user's selection" teaches the claimed "user-input features." *Id.* (citing Ex. 1003 ¶ 313).

Further, Petitioner asserts that Fukumoto's PDA 10 includes a touch panel and push-button-type operation keys for a user to input operation instructions. Pet. 80 (citing Ex. 1005, 13:40–14:13, Figs. 1–2). Petitioner asserts that the touch panel and the operation keys correspond to the claimed "user-input features." *Id.*

Patent Owner makes no arguments specific to limitation 1d. *See, e.g.*, Resp. 52–58; Sur-reply 7–11.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches limitation 1d and alternatively that the combined disclosures in Ogusu and Fukumoto teach limitation 1d. *See* Pet. 80–81; Ex. 1003 ¶¶ 313–314.

(f) Limitation 1e

Claim 1 recites "a driving component that drives the moveable component in each of two opposite directions within the housing." Ex. 1001, 15:41–42 (limitation 1e).

Petitioner contends that the combined disclosures in Ogusu and Fukumoto teach limitation 1e. *See* Pet. 81–82. Specifically, Petitioner asserts that Ogusu's vibration actuator includes first coil 2b and second coil 3b that drive the "movable component" (the holder, the bearing, the yokes, and the magnets) "in each of two opposite directions" when an alternating current flows through the coils. *Id.* at 81 (citing Ex. 1015 ¶¶ 31–32). According to Petitioner, first coil 2b and second coil 3b generate a force that drives the "movable component" according to a "waveform of the current," e.g., pushing in one direction and pulling in the opposite direction. *Id.* at 81–82 (citing Ex. 1003 ¶ 316; Ex. 1015, Figs. 4(a)–4(e)).

Further, Petitioner asserts that movement would occur "in each of two opposite directions within the housing" when combining Fukumoto's teachings with Ogusu's teachings. Pet. 82 (citing Ex. 1003 ¶¶ 317–319).

Patent Owner makes no arguments specific to limitation 1e. *See, e.g.*, Resp. 52–58; Sur-reply 7–11.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that the combined disclosures in Ogusu and Fukumoto teach limitation 1e. *See* Pet. 81–82; Ex. 1003 ¶¶ 316–319.

(g) Limitation 1f

Claim 1 recites "a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features." Ex. 1001, 15:44–48 (limitation 1f).

(i) Petitioner's Contentions

Petitioner contends that the combined disclosures in Ogusu and Fukumoto teach limitation 1f. *See* Pet. 82–84. In particular, regarding the function recited in limitation 1f, Petitioner asserts that Ogusu discloses a "pager control section" permitting a user to make a selection to switch between "various vibrations." *Id.* at 83 (citing Ex. 1015 ¶ 43). According to Petitioner, Ogusu's "various vibrations" result from applying "different currents to the coils according to different waveforms" where the "different waveforms each have different amplitudes and different frequencies." *Id.* (citing Ex. 1003 ¶ 321; Ex. 1015 ¶¶ 17, 19, 32, 37–42, 55, Figs. 4(a)–4(e)). Petitioner also asserts that a user may select "a waveform of a specific amplitude and frequency" to "cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features" according to limitation 1f. *Id.* (citing Ex. 1003 ¶ 321; Ex. 1015 ¶ 11, code (57)).

To show representative user-selected waveforms, Petitioner presents an annotated version of Ogusu's Figure 4 as reproduced below (Pet. 89):

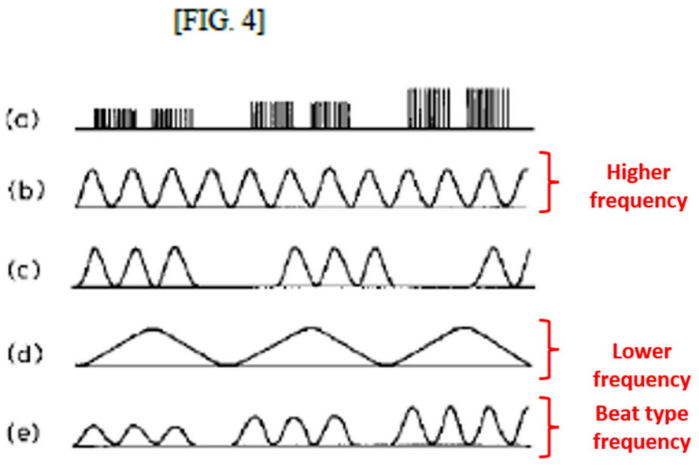

Figure 4 illustrates example current waveforms identified as waveforms (a) through (e) that a signal generator may supply to a vibration actuator's coils.

Ex. 1015 ¶¶ 32, 37–41, 61, Fig. 4. The above annotated version of Figure 4 includes the following annotations:

- the red annotation "Higher frequency" next to waveform (b);
- the red annotation "Lower frequency" next to waveform (d); and
- the red annotation "Beat type frequency" next to waveform (e).

See Pet. 89; Ex. 1003 ¶ 333.

Regarding hardware structure according to limitation 1f, Petitioner asserts that Fukumoto discloses a processor, i.e., CPU 113. Pet. 84; *see id.* at 22 (citing Ex. 1005, 14:57–60). Petitioner also asserts that an ordinarily skilled artisan "would have understood that Ogusu uses a processor to choose among the various possible waveforms and to control the supply of power from the power supply to the coils to achieve those waveforms." *Id.* at 84 (citing Ex. 1003 ¶¶ 322–323).

Regarding algorithmic structure according to limitation 1f, Petitioner asserts that Fukumoto discloses the necessary structure for the reasons discussed in the challenge based on Fukumoto alone. Pet. 84; *see id.* at 21–23. According to Petitioner, an ordinarily skilled artisan "would have found it obvious to use an algorithm such as that disclosed in Fukumoto to supply power according to the desired waveform in Ogusu." *Id.* at 84 (citing Ex. 1003 ¶¶ 322–323).

(ii) Patent Owner's Contentions

Patent Owner disputes that the combined disclosures in Ogusu and Fukumoto teach limitation 1f because Patent Owner disagrees that Fukumoto discloses algorithmic structure according to limitation 1f. *See*

Resp. 54–58; Sur-reply 7–11. Patent Owner makes essentially the same arguments regarding algorithmic structure for the challenge based on Ogusu and Fukumoto as for the challenge based on Fukumoto alone. *Compare* Resp. 54–58, *with id.* at 21–25; *see* Sur-reply 7–11.

(iii) Analysis

For (1) the reasons stated by Petitioner and supported by Dr. Wolfe's testimony and (2) the reasons discussed above for the challenge based on Fukumoto alone, we agree with Petitioner that the combined disclosures in Ogusu and Fukumoto teach limitation 1f. *See* Pet. 21–23, 82–84; Ex. 1003 ¶¶ 90–91, 116, 179–191, 320–325; *supra* § III.D.2(g)(iii). For the reasons discussed above for the challenge based on Fukumoto alone, we disagree with Patent Owner regarding Fukumoto's alleged failure to disclose algorithmic structure according to limitation 1f. *See* Resp. 54–58; Sur-reply 7–11; *supra* § III.D.2(g)(iii).

(h) Alleged Reason to Combine the Teachings of the References

Petitioner asserts that an ordinarily skilled artisan would have recognized that "Ogusu lacks certain implementation details that were well known as shown in Fukumoto" and "would have been motivated to apply those implementation details to Ogusu." Pet. 77 (citing Ex. 1003 ¶ 304); *see id.* at 78, 80, 86–87, 91. As an example, Petitioner asserts that an ordinarily skilled artisan "would have been motivated to incorporate user input features such as Fukumoto's into Ogusu's pager to allow the user to make selections in Ogusu's 'pager control section.'" *Id.* at 80 (citing Ex. 1003 ¶ 314).

Further, Petitioner asserts that incorporating Fukumoto's implementation details into Ogusu's pager would have amounted to "no more than applying":

(1) "a known technique (Fukumoto's CPU-controlled PDA vibration generation process) to a known device ready for improvement (Ogusu's pager control section vibration selection and generation process in a pager) to yield predictable results (a CPU-managed vibration generation process in Ogusu's pager providing a desired vibration output with a specific amplitude and frequency corresponding to a user input)"; and

(2) "a known technique (Fukumoto's process for converting a user input to a drive signal) to a known device ready for improvement (Ogusu's pager including its vibration actuator) to yield predictable results (a vibration actuator providing the desired vibration output with a specific amplitude and frequency corresponding to a user input)."

Pet. 86–87, 91 (citing Ex. 1003 ¶¶ 328, 336).

Dr. Wolfe's testimony supports Petitioner's assertions. *See* Ex. 1003 ¶¶ 304, 307, 314, 328, 336.

Patent Owner makes no arguments against combining Fukumoto's teachings with Ogusu's teachings. *See, e.g.*, Resp. 52–59; Sur-reply 7–11.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that an ordinarily skilled artisan would have had a reason to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes, i.e., to provide implementation details. *See* Pet. 77–78, 80, 86–87, 91; Ex. 1003 ¶¶ 304, 307, 314, 328, 336. For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we also agree with Petitioner that an ordinarily skilled artisan would have obtained predictable results when combining Fukumoto's teachings with Ogusu's teachings. *See* Pet. 86–87, 91; Ex. 1003 ¶¶ 328, 336.

(i) Conclusion About Obviousness/Nonobviousness

For the reasons discussed above, the combined disclosures in Ogusu and Fukumoto teach claim 1's subject matter. *See supra* §§ III.K.1(a)–(g). Additionally, Petitioner provides a reason with rational underpinning as to why an ordinarily skilled artisan would have been motivated to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes and would have obtained predictable results. *See supra* § III.K.1(h). Hence, Petitioner has shown by a preponderance of the evidence that claim 1 is unpatentable under § 103(a) because the claim would have been obvious over Ogusu and Fukumoto.

2. DEPENDENT CLAIM 2

Claim 2 reads as follows (with bracketed letters added for reference purposes):[10]

> 2. [pre] The linear vibration module of claim 1 wherein the control component is one of:
>
> [a] an variable oscillator circuit with additional control circuitry; and
>
> [b.i] a control component that includes a microprocessor,
>
> [b.ii] a control program, stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features.

Ex. 1001, 15:49–61.

[10] We use the same reference letters that Petitioner uses to identify the claim language. *See* Pet. vii (Listing of Challenged Claims).

Petitioner contends that the combined disclosures in Ogusu and Fukumoto teach claim 2's limitations. *See* Pet. 84–87. Specifically, Petitioner asserts that Fukumoto discloses limitation 2b.i and limitation 2b.ii because a user's input in Fukumoto produces a CPU-driven sequence of events causing oscillatory actuator 115 to vibrate at a particular amplitude and frequency. *Id.* at 84–86 (citing Ex. 1005, Figs. 2, 5); *see id.* at 20–21.

Further, Petitioner asserts that applying Fukumoto's implementation details to Ogusu would have amounted to:

> no more than applying a known technique (Fukumoto's CPU-controlled PDA vibration generation process) to a known device ready for improvement (Ogusu's pager control section vibration selection and generation process in a pager) to yield predictable results (a CPU-managed vibration generation process in Ogusu's pager providing a desired vibration output with a specific amplitude and frequency corresponding to a user input).

Pet. 86–87 (citing Ex. 1003 ¶ 328).

Patent Owner makes no arguments specific to claim 2. *See, e.g.*, Resp. 52–59; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that the combined disclosures in Ogusu and Fukumoto teach claim 2's limitations. *See* Pet. 84–87; Ex. 1003 ¶¶ 326–329. For the reasons discussed above, we agree with Petitioner that an ordinarily skilled artisan would have been motivated to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes and would have obtained predictable results. *See supra* § III.K.1(h). Hence, Petitioner has shown by a preponderance of the evidence that claim 2 is

unpatentable under § 103(a) because the claim would have been obvious over Ogusu and Fukumoto.

3. DEPENDENT CLAIM 7

Claim 7 depends directly from claim 1 and specifies that "the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component." Ex. 1001, 16:29–33.

Petitioner contends that Ogusu teaches claim 7's limitations because Ogusu's vibration actuator includes first coil 2b and second coil 3b that drive the "movable component" (the holder, the bearing, the yokes, and the magnets) due to "magnetic fields [that are] parallel to the directions in which the moveable component is driven by the driving component." Pet. 87 (citing Ex. 1003 ¶¶ 330–331; Ex. 1015 ¶¶ 31–32).

Patent Owner makes no arguments specific to claim 7. *See, e.g.*, Resp. 52–59; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches claim 7's limitations. *See* Pet. 87; Ex. 1003 ¶¶ 330–331. For the reasons discussed above, we agree with Petitioner that an ordinarily skilled artisan would have been motivated to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes and would have obtained predictable results. *See supra* § III.K.1(h). Hence, Petitioner has shown by a preponderance of the evidence that claim 7 is unpatentable under § 103(a) because the claim would have been obvious over Ogusu and Fukumoto.

4. Dependent Claim 11

Claim 11 depends directly from claim 1 and specifies that "the linear vibration module further includes two or more driving components, each, when activated, driving the moveable component to linearly oscillate with an amplitude particular to the activated driving component." Ex. 1001, 16:50–54.

Petitioner contends that Ogusu teaches claim 11's limitations because Ogusu's vibration actuator includes first coil 2b and second coil 3b that drive the "movable component" (the holder, the bearing, the yokes, and the magnets) and cause it to linearly oscillate. Pet. 87–88 (citing Ex. 1015 ¶¶ 31–32, Fig. 1). Further, Petitioner asserts that an ordinarily skilled artisan "would have understood and found it obvious that Ogusu's vibration actuator applies electric current in a particular waveform with respective amplitude to each of the first and second coil, causing the movable element to vibrate according to that amplitude." *Id.* at 88 (citing Ex. 1003 ¶ 332; Ex. 1015 ¶¶ 36–37).

Patent Owner makes no arguments specific to claim 11. *See, e.g.*, Resp. 52–59; Sur-reply 7–14.

For the reasons stated by Petitioner and supported by Dr. Wolfe's testimony, we agree with Petitioner that Ogusu teaches claim 11's limitations. *See* Pet. 87–88; Ex. 1003 ¶ 332. For the reasons discussed above, we agree with Petitioner that an ordinarily skilled artisan would have been motivated to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes and would have obtained predictable results. *See supra* § III.K.1(h). Hence, Petitioner has shown by a preponderance of

the evidence that claim 11 is unpatentable under § 103(a) because the claim would have been obvious over Ogusu and Fukumoto.

5. DEPENDENT CLAIM 17

Claim 17 depends directly from claim 1 and specifies that "the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features." Ex. 1001, 17:19–24.

Petitioner contends that "Ogusu alone or in combination with Fukumoto" teaches claim 17's limitations. *See* Pet. 90–91. Specifically, Petitioner asserts that a user of Ogusu's vibration actuator "selects a vibration in the pager control section, and that vibration corresponds to a waveform with a specific amplitude and frequency which is then applied to the coils." *Id.* at 90 (citing Ex. 1015 ¶¶ 32, 55). To support its assertion, Petitioner presents an annotated version of Ogusu's Figure 4 as reproduced below:

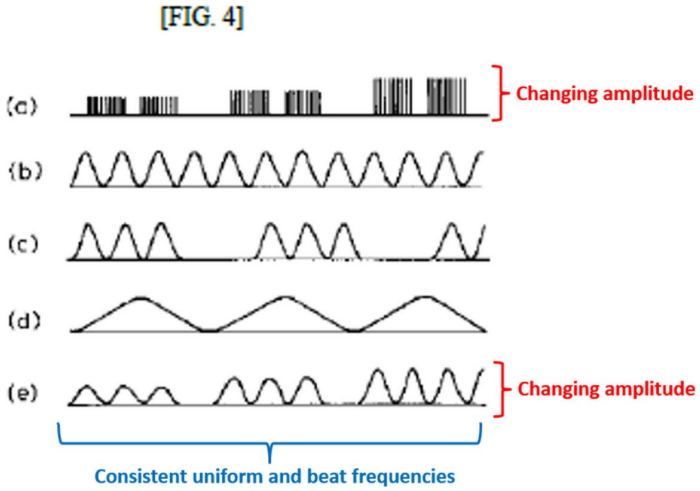

Figure 4 illustrates example current waveforms identified as waveforms (a) through (e) that a signal generator may supply to a vibration actuator's coils.

Ex. 1015 ¶¶ 32, 37–41, 61, Fig. 4. The above annotated version of Figure 4 includes the following annotations:

- the red annotation "Changing amplitude" next to waveform (a);
- the red annotation "Changing amplitude" next to waveform (e); and
- the blue annotation "Consistent uniform and beat frequencies" beneath waveform (e).

See Pet. 91; Ex. 1003 ¶ 335.

Additionally, Petitioner contends that "Fukumoto correlates a user input to a desired waveform, converts that waveform to a drive signal, and applies that drive signal to its oscillatory actuator." Pet. 91.

Further, Petitioner asserts that applying Fukumoto's implementation details to Ogusu would have amounted to:

> no more than applying a known technique (Fukumoto's process for converting a user input to a drive signal) to a known device ready for improvement (Ogusu's pager including its vibration actuator) to yield predictable results (a vibration actuator providing the desired vibration output with a specific amplitude and frequency corresponding to a user input).

Pet. 91 (citing Ex. 1003 ¶ 336).

Patent Owner makes no arguments specific to claim 17. *See, e.g.*, Resp. 52–59; Sur-reply 7–14.

For (1) the reasons stated by Petitioner and supported by Dr. Wolfe's testimony and (2) the reasons discussed above for the challenge based on Fukumoto alone, we agree with Petitioner that the combined disclosures in Ogusu and Fukumoto teach claim 17's limitations. *See* Pet. 90–91; Ex. 1003 ¶¶ 335–337; *supra* § III.D.8. For the reasons discussed above, we agree with Petitioner that an ordinarily skilled artisan would have been motivated

to combine Fukumoto's teachings with Ogusu's teachings in the way Petitioner proposes and would have obtained predictable results. *See supra* § III.K.1(h). Hence, Petitioner has shown by a preponderance of the evidence that claim 17 is unpatentable under § 103(a) because the claim would have been obvious over Ogusu and Fukumoto.

L. Alleged Obviousness over Ogusu, Fukumoto, Either Grant or Barton, and Ueda: Claims 3–6

Petitioner contends that claims 3–6 are unpatentable under § 103(a) because the claims would have been obvious over (1) Ogusu, Fukumoto, and Ueda, (2) Ogusu, Fukumoto, Grant, and Ueda, and (3) Ogusu, Fukumoto, Barton, and Ueda. *See* Pet. 91–92. Patent Owner disputes Petitioner's contentions. *See* Resp. 60–62.

Petitioner does not rely on Ogusu, Grant, or Barton for teaching claim 3's limitations. *See* Pet. 35–45, 75–92. Petitioner fails to show how Ogusu, Grant, and Barton individually or collectively cure the infirmities in Fukumoto and Ueda with respect to claim 3 for the challenge based on Fukumoto and Ueda. *See id.*; *supra* § III.F.2(c).

Hence, Petitioner has not shown by a preponderance of the evidence that claim 3 is unpatentable under § 103(a) based on (1) Ogusu, Fukumoto, and Ueda, (2) Ogusu, Fukumoto, Grant, and Ueda, or (3) Ogusu, Fukumoto, Barton, and Ueda. For the same reason, Petitioner has not shown by a preponderance of the evidence that claims 4–6 are unpatentable under § 103(a) based on those combinations of references.

M. Petitioner's Other Patentability Challenges: Claims 1–9, 11, 14, and 17

As noted above, Petitioner presents several challenges to the patentability of claims 1–9, 11, 14, and 17 under § 103(a) based on various

combinations of multiple references. *See supra* § II.G. The patentability challenges discussed above, however, resolve the patentability of claims 1–9, 11, 14, and 17 based on the asserted references. *See supra* §§ III.D–III.L. Hence, we need not reach the other patentability challenges. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *Bos. Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) (agreeing that the Board "need not address issues that are not necessary to the resolution of the proceeding").

IV. CONCLUSION

Based on the evidence presented with the Petition, the evidence introduced during the trial, and the parties' respective arguments, Petitioner has shown by a preponderance of the evidence that:

(1) claims 1, 2, 7, and 17 are unpatentable under § 103(a) based on Fukumoto;

(2) claims 1, 2, 7, 11, and 17 are unpatentable under § 103(a) based on Ogusu and Fukumoto; and

(3) claim 8 is unpatentable under § 103(a) based on Fukumoto and Fuller.[11]

[11] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding after the issuance of this Final Written Decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner 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).

Petitioner has not shown by a preponderance of the evidence that:

(1) claim 3 is unpatentable under § 103(a) based on either (i) Fukumoto, (ii) Fukumoto and Grant, or (iii) Fukumoto and Barton;

(2) claims 3–6 are unpatentable under § 103(a) based on either (i) Fukumoto and Ueda, (ii) Fukumoto, Grant, and Ueda, (iii) Fukumoto, Barton, and Ueda, (iv) Ogusu, Fukumoto, and Ueda, (v) Ogusu, Fukumoto, Grant, and Ueda, or (vi) Ogusu, Fukumoto, Barton, and Ueda;

(3) claim 9 is unpatentable under § 103(a) based on either (i) Fukumoto, (ii) Fukumoto and Grant, or (iii) Fukumoto and Barton; and

(4) claim 14 is unpatentable under § 103(a) based on either (i) Fukumoto, Dong, and Ogusu, (ii) Fukumoto, Grant, Dong, and Ogusu, or (iii) Fukumoto, Barton, Dong, and Ogusu.

In summary:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–3, 7–9, 15, 17	103(a)	Fukumoto[12]	1, 2, 7, 17	3, 8, 9
1–3, 7–9, 15, 17	103(a)	Fukumoto, Grant[13]		3, 8, 9

[12] We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

[13] In view of our determination that claims 1, 2, 7, and 17 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8, III.E, III.K.1–III.K.3, III.K.5. We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–3, 7–9, 15, 17	103(a)	Fukumoto, Barton[14]		3, 8, 9
3–6	103(a)	Fukumoto, Ueda		3–6
3–6	103(a)	Fukumoto, Grant, Ueda		3–6
3–6	103(a)	Fukumoto, Barton, Ueda		3–6
7, 8	103(a)	Fukumoto, Erixon[15]		
7, 8	103(a)	Fukumoto, Grant, Erixon[16]		
7, 8	103(a)	Fukumoto, Barton, Erixon[17]		
8	103(a)	Fukumoto, Fuller	8	

[14] In view of our determination that claims 1, 2, 7, and 17 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8, III.E, III.K.1–III.K.3, III.K.5. We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

[15] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

[16] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

[17] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
8	103(a)	Fukumoto, Grant, Fuller[18]		
8	103(a)	Fukumoto, Barton, Fuller[19]		
14	103(a)	Fukumoto, Dong, Ogusu		14
14	103(a)	Fukumoto, Grant, Dong, Ogusu		14
14	103(a)	Fukumoto, Barton, Dong, Ogusu		14
15	103(a)	Fukumoto, Saiki[20]		
15	103(a)	Fukumoto, Grant, Saiki[21]		

[18] In view of our determination that claim 8 is unpatentable based on another challenge, we do not reach this challenge to claim 8. *See supra* §§ III.H, III.M.
[19] In view of our determination that claim 8 is unpatentable based on another challenge, we do not reach this challenge to claim 8. *See supra* §§ III.H, III.M.
[20] We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.
[21] We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
15	103(a)	Fukumoto, Barton, Saiki[22]		
16	103(a)	Fukumoto, Saiki, Masahiko[23]		
16	103(a)	Fukumoto, Grant, Saiki, Masahiko[24]		
16	103(a)	Fukumoto, Barton, Saiki, Masahiko[25]		
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto[26]	1, 2, 7, 11, 17	

[22] We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.
[23] We do not address the patentability of claim 16 because Patent Owner statutorily disclaimed claim 16 during this proceeding. *See* Paper 27, 1; Ex. 2015.
[24] We do not address the patentability of claim 16 because Patent Owner statutorily disclaimed claim 16 during this proceeding. *See* Paper 27, 1; Ex. 2015.
[25] We do not address the patentability of claim 16 because Patent Owner statutorily disclaimed claim 16 during this proceeding. *See* Paper 27, 1; Ex. 2015.
[26] We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto, Grant[27]		
1, 2, 7, 11, 15, 17	103(a)	Ogusu, Fukumoto, Barton[28]		
3–6	103(a)	Ogusu, Fukumoto, Ueda		3–6
3–6	103(a)	Ogusu, Fukumoto, Grant, Ueda		3–6
3–6	103(a)	Ogusu, Fukumoto, Barton, Ueda		3–6
7, 8	103(a)	Ogusu, Fukumoto, Erixon[29]		

[27] In view of our determination that claims 1, 2, 7, 11, and 17 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8, III.K.1–III.K.5. We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

[28] In view of our determination that claims 1, 2, 7, 11, and 17 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.2–III.D.3, III.D.5, III.D.8, III.K.1–III.K.5. We do not address the patentability of claim 15 because Patent Owner statutorily disclaimed claim 15 during this proceeding. *See* Paper 27, 1; Ex. 2015.

[29] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
7, 8	103(a)	Ogusu, Fukumoto, Grant, Erixon[30]		
7, 8	103(a)	Ogusu, Fukumoto, Barton, Erixon[31]		
Overall Outcome			1, 2, 7, 8, 11, 17	3–6, 9, 14

V. ORDER

Accordingly, it is

ORDERED that claims 1, 2, 7, 8, 11, and 17 in the '081 patent are determined to be unpatentable;

ORDERED that claims 3–6, 9, and 14 in the '081 patent are not determined to be unpatentable; and

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

[30] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

[31] In view of our determination that claims 7 and 8 are unpatentable based on other challenges, we do not reach this challenge to those claims. *See supra* §§ III.D.5, III.H, III.K.3. III.M.

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