

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

RESONANT SYSTEMS, INC.,
Patent Owner.

IPR2024-00806
Patent 9,941,830 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
BRIAN D. RANGE, *Administrative Patent Judges*.

BEAMER, *Administrative Patent Judge*.

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

I. INTRODUCTION

Apple Inc., Petitioner, filed a Petition (Paper 3, “Pet.”) requesting an *inter partes* review of claims 1–8, 14–17, 19, and 20 of U.S. Patent No. 9,941,830 B2 (Ex. 1001, the “’830 patent”). Pet. 1. Resonant Systems, Inc., Patent Owner, filed a Preliminary Response (Paper 7, “Prelim. Resp.”). With the Board’s authorization, Petitioner filed a Preliminary Reply and Patent Owner a Preliminary Sur-Reply directed to claim construction. Papers 9 (“Reply”); 10 (“Sur-Reply”).

The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless the information presented in the Petition and any preliminary response shows that “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons explained below, we determine that Petitioner has established a reasonable likelihood that it would prevail with respect to at least one challenged claim. Accordingly, we institute an *inter partes* review as to challenged claims 1–8, 14–17, 19, and 20 and the grounds raised in the Petition.

II. BACKGROUND

A. *Real Parties in Interest*

Each party identifies itself as the real parties in interest. Pet. 82; Paper 5, 1.

B. *Related Matters*

The parties identify the following district three court proceedings as related matters: *Resonant Systems, Inc. d/b/a Revel HMI v. Apple, Inc.*, No.

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7:23-cv-00077 (W.D. Tex.) (the “Apple Litigation”); *Resonant Systems, Inc. v. Samsung Electronics Co., Ltd.*, No. 2:22-cv-00423 (E.D. Tex.); *Resonant Systems, Inc. v. Sony Group Corp.*, No. 2:22-cv-00424 (E.D. Tex.). Pet. 82; Paper 5, 2.

The parties identify the following PTAB proceedings also involving the ’830 patent: IPR2023-00993, IPR2023-01025, IPR2024-00570, and IPR2024-00808. Pet. 82–83; Paper 5. *See Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. v. Resonant Systems, Inc.*, Paper 17, IPR2023-00993 (PTAB Jan. 10, 2024) (granting institution, declining at institution to determine if the claims recite means plus function limitations, pending final written decision); *Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. v. Resonant Systems, Inc.*, Paper 16, IPR2023-01025 (PTAB Jan. 10, 2024) (denying institution); *Sony Interactive Entertainment Inc. et al. v. Resonant Systems, Inc.*, Paper 9, IPR2024-00570 (PTAB Aug. 26, 2024) (denying institution).

Other PTAB proceedings challenging related patents that may involve similar claim construction issues include the following: IPR2023-00992, IPR2024-00568, IPR2024-00569, IPR2024-00697, IPR2024-00698, IPR2024-00807, and IPR2024-00983.

C. The ’830 Patent

The ’830 patent 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, 1:16–21; *see also id.* at 3:11–25, code (57). The vibration generating devices include linear vibration

modules (LVMs) and linear-resonant vibration modules (LRVMs). *Id.* at 4:17–21, 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.” *Id.* at 4:21–25.

Figure 4A follows:

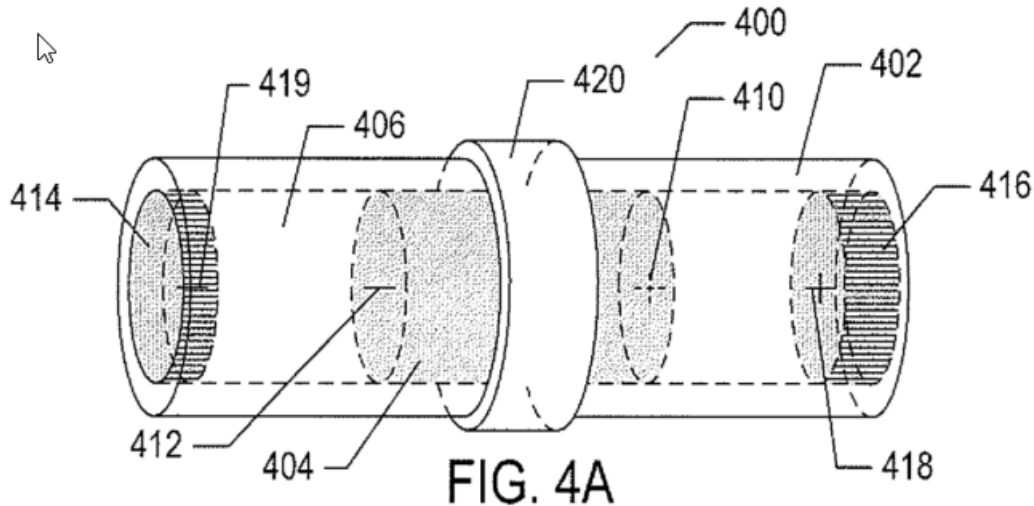


Figure 4A depicts LVRM 400, which includes cylindrical housing or tube 402 forming cylindrical chamber 406, disk-like magnets 414 (left) and 416 (right) with negative and positive polarity, respectively, and conductive coil 420 encircling tube 402. Ex. 1001, 4:49–5:10, Fig. 4A.

Disk-like magnets 414 and 416 repel magnet 404 when it moves to the extreme right or left according to a current supplied to coil 420 from a power source. Ex. 1001, 4:62–5:7. This current oscillates with an amplitude and frequency to create a changing magnetic field via coil 420, which in turn causes magnet 404 to change its direction and length of travel according to a user-specified amplitude and frequency of movement. *See id.* at 4:49–5:41, 6:33–44, Figs. 4B–4G.

Figure 6, a block diagram of the LRVM, follows:

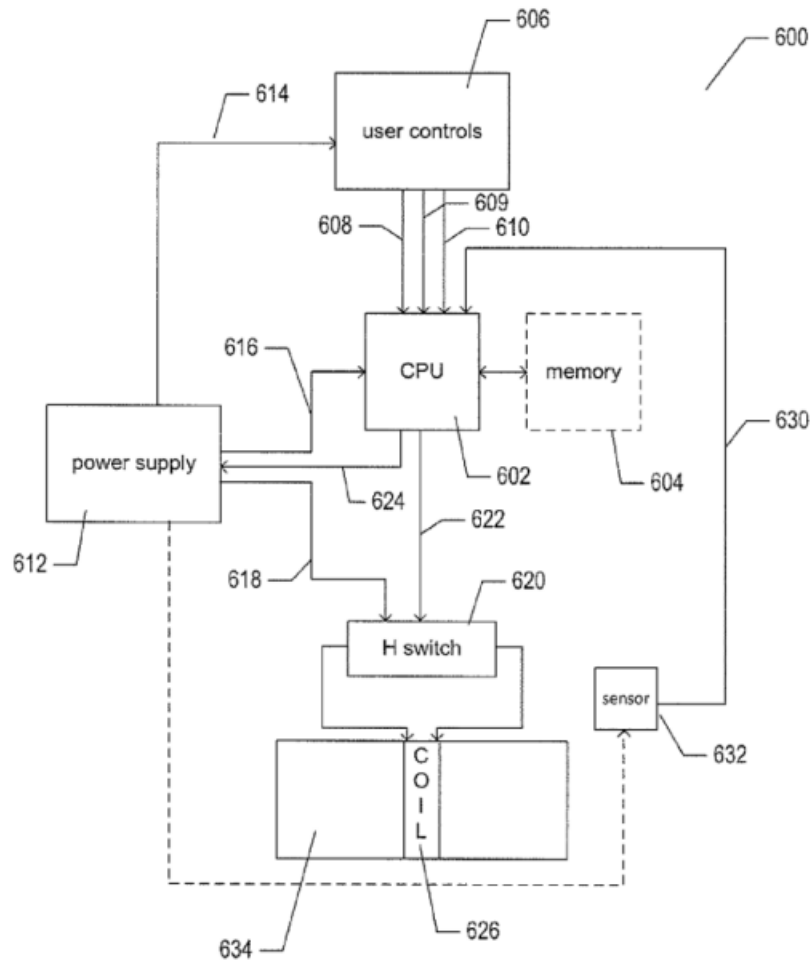


FIG. 6

Figure 6 illustrates LRVM 600, which includes the following: microprocessor (CPU) 602 executing a control program; memory chip 604 storing 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; magnet 634; H-bridge switch 620 that “receives a control-signal input” from

microprocessor (CPU) 602, which together control the direction and frequency of current supplied to coil 626. *See* Ex. 1001, 6:19–51, 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, 5:52–56; *see also id.* at 3:40–44, 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 6:2–5.

D. Illustrative Claim

Independent claim 1 is illustrative of the challenged claims, and follows:

1. [pre] A 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 to oscillate 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 one or more stored values.

Pet. vii (bracketed information by Petitioner).

E. Asserted Grounds of Unpatentability

Petitioner contends that claims 1–8, 11, 15–17, and 20 are unpatentable as follows:¹

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–7	103(a)	Gregorio ²
8, 14, 19	103(a)	Gregorio, Wakuda ³
15, 16, 20	103(a)	Gregorio, Tierling ⁴
1–7, 15, 17, 20	103(a)	Gregorio, Ramsay ⁵
8, 14, 19	103(a)	Gregorio, Ramsay, Wakuda
15, 16, 20	103(a)	Gregorio, Ramsay, Tierling
1–7, 15, 17, 20	103(a)	Gregorio, Ramsay, Rossi, ⁶ Aldrich ⁷
8, 14, 19	103(a)	Gregorio, Ramsay, Rossi, Aldrich, Wakuda
15, 16, 20	103(a)	Gregorio, Ramsay, Rossi, Aldrich, Tierling

¹ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102, 103 effective March 16, 2013, which is after the ’830 patent’s effective filing date. *See* Ex. 1001, code (63). Therefore, the pre-AIA version of § 103 applies.

² Gregorio et al., US 7,843,277 B2, issued Nov. 30, 2010. Ex. 1004.

³ Wakuda et al., US 7,005,811 B2, issued Feb. 28, 2006. Ex. 1005.

⁴ Tierling et al., US 2005/0134561 A1, published June 23, 2005. Ex. 1008.

⁵ Ramsay et al., US 2008/0294984 A1, published Nov. 27, 2008. Ex. 1006.

⁶ Rossi et al., US 4,879,641, issued Nov. 7, 1989. Ex. 1020.

⁷ Aldrich et al, *Controller for Driving a Piezoelectric Actuator at Resonance*, NASA Tech Briefs, April 2008. Ex. 1021.

Pet. 1. Petitioner supports its Petition with a Declaration of Dr. Blake Hannaford. Ex. 1003.

III. DISCRETIONARY DENIAL UNDER 35 U.S.C. § 314(a)

Patent Owner contends that we should exercise our discretion to deny institution under 35 U.S.C. § 314(a) in light of the Apple Litigation. Prelim. Resp. 20–29. Patent Owner contends that the factors identified in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”), weigh in favor of exercising discretion to deny institution. *Id.*

On June 21, 2022, the Director of the U.S. Patent and Trademark Office (“USPTO”) issued a Memorandum titled “Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings With Parallel District Court Litigation” (“Memorandum”),⁸ which states, among other things, that “the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” Memorandum 3 (citing *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential as to § II.A)).

In a September 18, 2024 letter, Petitioner has stated that “Apple hereby stipulates that if the PTAB authorizes petitioner to enter this stipulation into evidence in IPR2024-00806 and institutes the proceeding, Apple will not pursue in the above-captioned litigation the same invalidity

⁸ The Memorandum is *available at* https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

grounds raised (or any grounds that could have been raised) in IPR2024-00806 for any claim of the patent.” Ex. 1048 (citing *Sotera*, IPR2020-01019, Paper 12).

Applying the guidance provided in the Memorandum, we decline to exercise our discretion to deny institution in this proceeding under *Fintiv* because Petitioner submitted a *Sotera* stipulation.

IV. ANALYSIS OF PETITIONER’S CHALLENGES

A. *The Obviousness Standard*

Section 103(a) forbids issuance of a patent when “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.”

KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007) (quoting 35 U.S.C. § 103(a)). The obviousness question involves resolving underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and when presented (not so here), (4) objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. *Level of Ordinary Skill in the Art*

Determining whether an invention would have been obvious under 35 U.S.C. § 103 requires resolving the level of ordinary skill in the pertinent art at the time of the effective filing date of the claimed invention. *Graham*, 383 U.S. at 17. The person of ordinary skill in the art is a hypothetical person who knows the relevant art. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors in determining the level of ordinary skill in the art

include the types of problems encountered in the art, the sophistication of the technology, and educational level of active workers in the field. *Id.* One or more factors may predominate. *Id.*

Petitioner’s expert declarant contends that person of ordinary skill in the art (POSITA)

would have had a degree in mechanical engineering, electrical engineering, physics, or a related technical field, and at least 2–3 years of experience related to the design or development of systems incorporating linear actuators; additional years of experience could substitute for the advanced-level degree.

Ex. 1003 ¶ 33. Patent Owner offers “a similar level of ordinary skill in the art.” Prelim. Resp. 4.

Based on a review of the record, we adopt Petitioner’s proposed level of ordinary skill in the art because it is consistent with the evidence of record, including the asserted prior art and ’830 patent specification.

C. Claim Construction

In *inter partes* reviews, the Board interprets claim language using the district-court-type standard, as described in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2023). Under this standard, claim terms have their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history. *See Phillips*, 415 F.3d at 1313–14.

For purposes of this proceeding, the parties agree that independent claims 1, 19, and 20 include means plus function limitations under 35 U.S.C. § 112 ¶ 6.⁹ Pet. 3–7; Prelim. Resp. 7–14.

An element in a claim for a combination may be expressed as a means . . . 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. In particular, the parties agree that the “driving component” and “control component” requirements of independent claims 1, 19, and 20 are means plus function limitations. Pet. 3–7; Prelim. Resp. 7–14. Construing a means plus function limitation under 35 U.S.C. § 112 ¶ 6 involves two steps: 1) identifying the claimed function and 2) identifying in the specification the corresponding structure that performs the claimed function. *Med.Instrumentation & Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1210 (Fed. Cir. 2003); *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 296 F.3d 1106, 1119 (Fed. Cir. 2002).

“[S]tructure disclosed in the specification” is “‘corresponding’ structure,” “only if the specification or prosecution history *clearly links or associates* that structure to the function recited in the claim.” *B. Braun Med. Inc., v. Abbott Lab’s*, 124 F.3d 1419, 1424 (Fed. Cir. 1997) (emphasis added) (“Because Braun’s specification does not adequately disclose the valve seat as structure that holds the disc firmly in place, Braun has failed to particularly point out and distinctly claim that particular means.”). “This duty to link or associate structure to function is the *quid pro quo* for the

⁹ As indicated above, statutory citations are to the pre-AIA version of 35 U.S.C. § 112. See *supra* note 1.

convenience of employing § 112, ¶ 6.” *Id.* (citing *O.I. Corp. v. Tekmar Co.*, 115 F.3d 1576, 1583 (Fed. Cir. 1997)). Our reviewing court explains:

If the specification is not clear as to the structure that the patentee intends to correspond to the claimed function, then the patentee has not paid that price but is *rather attempting to claim in functional terms unbounded by any reference to structure* in the specification. Such is impermissible under the statute.

Med. Instrumentation & Diagnostics Corp. v. Elekta AB, 344 F.3d 1205, 1211 (Fed. Cir. 2003) (emphasis added); *see also Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc.*, 248 F.3d 1303, 1313 (Fed. Cir. 2001) (finding particular structures not to be corresponding structures because “one skilled in the art would not perceive any clear link or association between these structures and the [recited] function of connecting adjacent elements together”).

I. Construction of “Driving Component”

The parties agree on the construction of “driving component.” The claimed function is, “drives the moveable component to oscillate within the housing.” Pet. 6; Ex. 2002, 2. The corresponding structure is:

[A] coil of conductive wire 420” (Figures 4A-4G); “coil 514” (Figures 5A-5B); “coil 626” (Figure 6); “electromagnet” (Figures 10-11); “additional coils 1202 and 1204” (Figure 12); “coils 1302 and 1304” (Figure 13); “driving coils 1412 and 1414” (Figure 14); “coil 1510” (Figures 15-17); “stator coils” (Figures 24A-25).

Pet. 6-7 (citing Ex. 1001, 5:7-41, 5:61-66, 6:40-44, 9:22-64, 10:9-34, 14:24-28); Ex. 2002, 2.¹⁰ This construction is in accord with our reading of

¹⁰ Patent Owner states in its Preliminary Response that it “does not believe that the phrase involving a ‘driving component’ needs to be construed in order to decide whether to institute this IPR.” Prelim. Resp. 8. However,

the '830 patent and we adopt it for purposes of this Decision.

2. *Construction of “Control Component”*

The parties agree that the claimed function of the control component is, “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 one or more stored values.” Pet. 4; Ex. 2002, 6.

Petitioner proposes that the corresponding structure is “one of the switches shown in Figures 5A-6 and described at 5:52–6:5, 6:9–16, and the processor (also referred to as microprocessor, microcontroller, or CPU) that performs the algorithm shown in Figures 7A–7C and described at 6:52–8:40.” Pet. 4; Reply 2. Patent Owner proposes the same construction that the District Court has adopted in the Apple Litigation:

Function: controlling 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 specified by one or more stored values.

Structure: a microcontroller, a processor, a microprocessor, or a CPU that performs the algorithm shown in 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, *See, e.g.*, 7:20–7:34, 7:42–7:52, 7:60–8:40, and equivalents thereof.

Prelim. Resp. 8–9 (citing Ex. 2002, 6–7); *see also* Ex. 3001, 33–37 (August 23, 2024 “Claim Construction Memorandum And Order” recently entered in the Apple Litigation). Patent Owner acknowledges that Petitioner’s proposed construction is “similar,” while Petitioner characterizes its

Patent Owner agreed to the above construction in the Apple Litigation, which construction was adopted by the court. Ex. 2002, 2.

construction as “more thorough.” Prelim. Resp. 8; Reply 2. As elaborated below, our reading of the ’830 patent is in accord with the District Court’s construction, and we adopt it for purposes of this Decision.¹¹

a) *Frequency Function*

In particular, first considering the user-specified *frequency* function of the control component limitation: “controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a *frequency* . . . specified by one or more stored values,” the specification clearly links this recited function at least to algorithmic structure corresponding to steps 706 and 708 of Figure 7A. As the block diagram of Figure 6 shows and as explained in Section II.C above, “power supply 612 receives a control input 624 from the CPU to control the current supplied to the H-bridge switch 618 for transfer to the coil 626,” which controls the frequency. *See* Ex. 1001, 6:41–44. The relevant portion of Figure 7A follows:

¹¹ The District Court’s construction is in accord with Federal Circuit authority consistently requiring that the corresponding structure, in circumstances such as presented here, be more than simply a general purpose computer or microprocessor and that the specification must disclose an algorithm for performing the claimed function. *See, e.g., Noah Systems Inc. v. Intuit Inc.*, 675 F.3d 1302, 1312 (Fed. Cir. 2012); *Aristocrat Techs. Australia PTY Ltd. v. Int’l Game Tech.*, 521 F.3d 1328, 1333 (Fed. Cir. 2008).

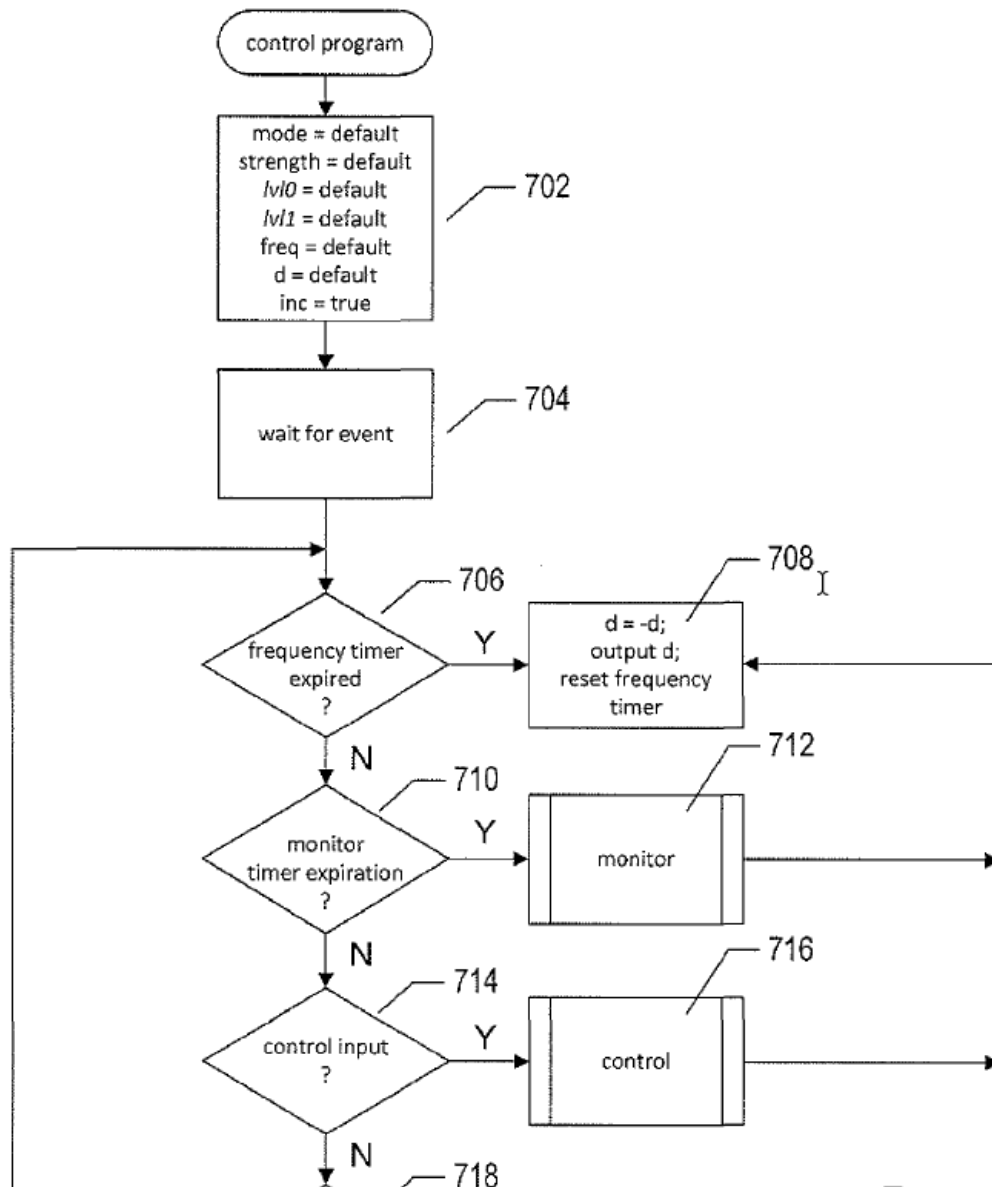


Figure 7A, which corresponds to a “high-level control program” executed by CPU 602 and memory 604 of Figure 6 (*supra* Section II.C), shows the algorithm using value d, “the control output to the H-bridge switch,” to control the frequency. *See* Ex. 1001, 6:33–7:27. In steps 706 and 708, the algorithm operates a timer to periodically flip the polarity of the d value applied to the H-bridge switch, which Figure 5A illustrates. *See id.*

Figure 5A, which depicts an H-bridge switch and control output d from step 708 of Figure 7A (also referred to as “directional signal d 502,” Ex. 1001, 5:58–59), follows:

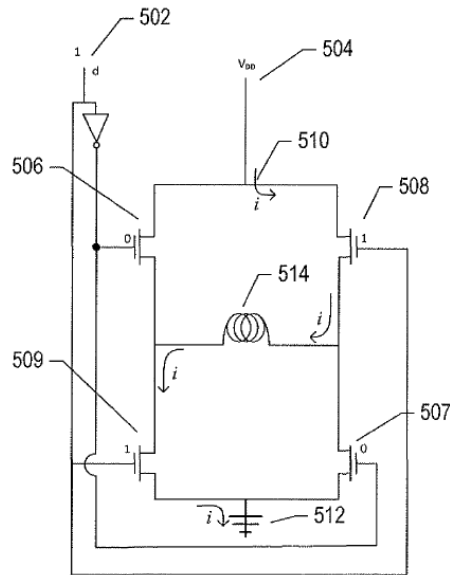


FIG. 5A

Figure 5A “illustrate[s] an H-bridge switch that can be used, in various embodiments of the current application, *to change the direction of current applied to the coil that drives linear oscillation.*” Ex. 1001, 3:40–44 (emphasis added). In other words, by controlling the polarity of directional signal d 502, the CPU changes the direction of current i through coil 514 from power supply 504 as Figure 5A above indicates, thereby changing the frequency depending on the timer. Specifically, the current i oscillates alternately through switches 508 and 509 (right to left through coil 514 as depicted) and switches 506 and 507 (left to right through coil 514) depending on whether the value of input d is “high” or “low” (which the timer controls). *See id.* at 5:50–6:5.

To implement this user-defined oscillation frequency, Figure 7A describes a “timer[]” to “control[] the change in direction of the current applied to the coil, at a currently established frequency.” Ex. 1001, 7:12–20. After the frequency timer expires, “as determined in step 706, *the value of the output signal d is flipped* [i.e., from low to high, or vice versa], in step 708, and output to the H-bridge switch, with the frequency timer being reset to trigger a next frequency-related event.” *Id.* at 7:23–27 (emphasis added). “The frequency-timer interval is determined by the current value of the variable freq.” *Id.* at 7:27–29.¹²

Therefore, the specification clearly links the function of “control[ing] supply of power from the power supply to . . . cause the moveable component to oscillate at a *frequency* . . . specified by one or more stored values” at least to portions of steps 706 and 708 of the flow diagram algorithm of Figure 7A, as described above. Thus, the control component requires a microprocessor and memory with algorithmic structure including a timing algorithm or similar coding for creating a control output signal that flips to control the direction of current flow through a coil (e.g., coil 514,

¹² For purposes of this Decision, we adopt the District Court’s conclusion that the “control component” structure does not require an H-bridge switch or computing initial default values as specified in step 702 of Figure 7A (i.e., values not specified by a user). Ex. 3001, 30–33, 35. *See Golight, Inc. v. Wal-Mart Stores, Inc.*, 355 F.3d 1327, 1334 (Fed. Cir. 2004) (“[T]o the extent the [disclosed] assembly contains particular structures for permitting rotation through 360°, such as the follower pin 64 and slot 65, these structures are superfluous to our claim construction analysis because they are not required for performing the claimed function,” which does not require 360° rotation.).

Fig. 5, coil 626, Fig. 6), where the coil is structure that corresponds to the recited “driving component,” as noted above.¹³

b) Amplitude Function

Next considering the user-specified *amplitude* function of the control component limitation: “control supply of power from the power supply to the driving component to cause the moveable component to oscillate at . . . an *amplitude* specified by one or more stored values,” the specification clearly links this recited function to the flow-control diagram of Figure 7C and its description. Ex. 1001, 8:20–30, Fig. 7C. Figure 7C follows:

¹³ “Rather than using a formal timer mechanism, certain implementations may simply employ counted loops or other simple programming techniques for periodically carrying out tasks.” Ex. 1001, 7:17–20.

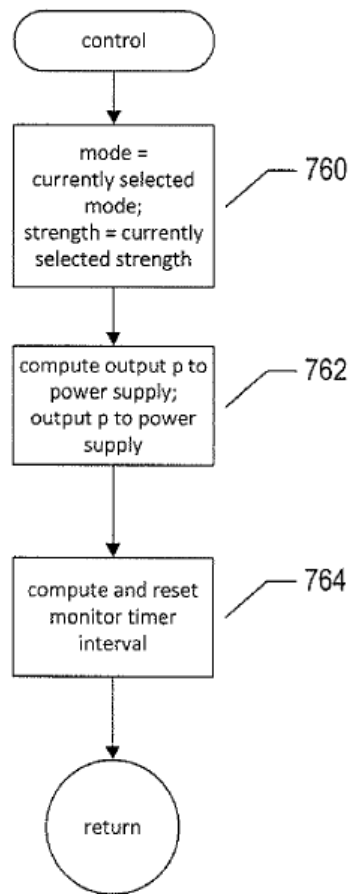


FIG. 7C

Figure 7C represents “a control-flow diagram for the routine ‘control,’ called in step 716 in FIG. 7A.” Ex. 1001, 8:20–21. The specification discloses that in step 762, “the routine ‘control’ 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.*” Ex. 1001, 8:20–30. Step 762 corresponds to, for example, control input 624 transmitted from CPU 602 to power supply 612 of Figure 6 to control the current from power supply 612 to coil 626. *See supra* Section II.C (describing Fig. 6); Ex. 1001, 6:41–44 (“The

power supply 612 receives a control input 624 from the CPU to control the current supplied to the H-bridge switch 618 for transfer to the coil 626.”).

The specification thus clearly links step 760, which selects current strength and mode, and step 762, which corresponds to control input 624 transmitted from CPU 602 to power supply 612 in the block diagram of Figure 6, to the recited function, “control supply of power from the power supply to the driving component to cause the moveable component to oscillate at . . . an amplitude specified by one or more stored values.” Ex. 1001, 8:20–30, Fig. 7C.

c) Control Component Summary

In summary, the corresponding structure of the “control component” under a means plus function interpretation that relies upon a microprocessor (and memory) as corresponding structure further requires algorithmic structure at least for 1) operating a timer or its equivalent to flip the polarity of a control value periodically corresponding to a user-selected frequency and input the control value to an H-bridge switch circuit to change the direction of the current through the coil as supplied by the power supply, and 2) computing an output value corresponding to a user-selected amplitude of oscillation and outputting the value to the claimed power supply so that the power supply outputs an appropriate current amplitude to a coil..

D. Alleged Obviousness of Claims 1–7, 15, 17, and 20 over Gregorio, Ramsay, Rossi, and Aldrich

Petitioner contends that claims 1–7, 15, 17, and 20 would have been obvious over the combined teachings of Gregorio, Ramsay, Rossi, and Aldrich. Pet. 54–75.¹⁴

1. Gregorio

Gregorio discloses a device with an “LRA [Linear Resonant Actuator] to generate vibrotactile haptic feedback on a user interface.” Ex. 1004, 2:3–5. Figure 1 is reproduced below.

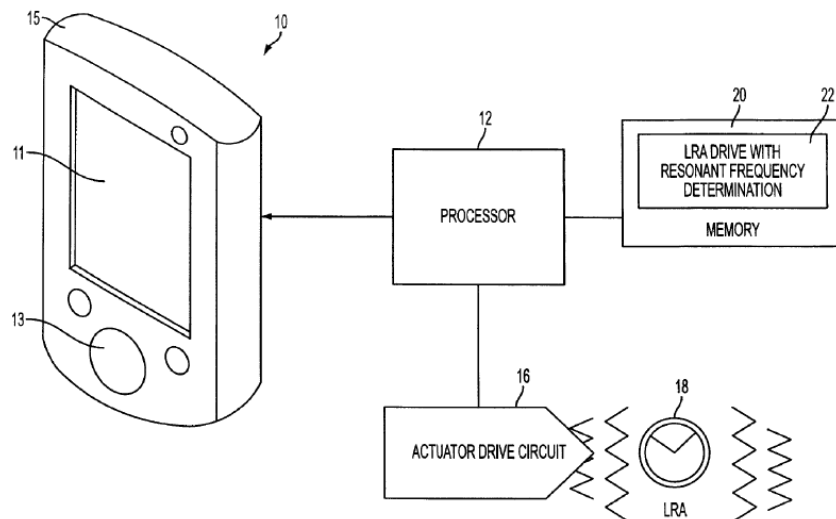


FIG. 1

¹⁴ Petitioner also challenges claims 1–7 over Gregorio alone, and claims 1–7, 15, 17, and 20 over the combination of Gregorio and Ramsay. Pet. 8–25, 45–53. However, those grounds are based on assumed “plain and ordinary meaning” interpretations of the claims that we do not adopt. *See* Pet. 3, 54; Reply 2. Therefore, we do not consider those grounds of Petitioner’s challenge, except to the extent that Petitioner incorporates portions by reference in its analysis of its grounds based on the applicable means-plus-function interpretations.

Figure 1 is a block diagram of a haptically-enabled system 10, such as a cellular telephone, PDA, or computer tablet, which includes a haptic feedback mechanism that generates vibrations on the system. Ex. 1004, 2:10–15, 3:1–2. The system includes processor 12, memory 20, actuator drive circuit 16, and LRA actuator 18. *Id.* at 2:18–20. Processor 12 controls the haptic effects based on high level parameters including magnitude, frequency and duration. *Id.* at 2:25–30. Processor 12 outputs control signals to drive circuit 16, which includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage to cause the desired haptic effects. *Id.* at 2:36–39. Memory 20 includes LRA Drive with Resonant Frequency Determination module 22 which are instructions executed by processor 12 to generate drive signals for LRA 18. *Id.* at 2:46–49.

Figure 2 is reproduced below.

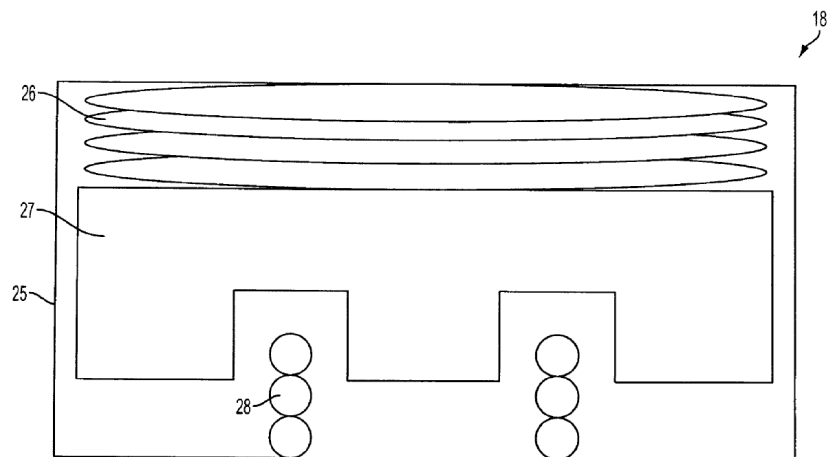


FIG. 2

Figure 2 is a cut-away side view of LRA 18 including casing 25, magnet/mass 27, linear spring 26, and electric coil 28. Ex. 1004, 3:12–14. When current flows thru coil 28 a magnetic field forms around the coil to interact with the magnetic field of magnet 27, and depending on the

direction of the current flow, pushes or pulls on the magnet to compress or decompress the spring. *Id.* at 3:17–24.

2. *Ramsay*

Ramsay provides techniques for “enabling a regular user of an end user device, such as a cellular telephone, to customize parameters associated with haptic effects applied to the user by the end user device.” Ex. 1006, Abstr. Users can access software to modify frequency and amplitude of the vibration. *Id.* Fig. 4, ¶¶ 30–35, 46, 53. Ramsay explains that “haptic feedback can be used to supplement auditory and visual feedback to enhance how information is provided to the user.” *Id.* ¶ 14. However, unlike the ability to change “ring tones,” “a user typically does not have the option on the device itself to modify characteristics of haptic feedback.” *Id.* Ramsay discloses “enabling a user of an end user device to access software adapted to design or modify haptic effects of the end user device,” or “enabling the user to open a haptic track file and enter or modify parameters associated with the haptic effects of the opened haptic track file.” *Id.* Ramsay discloses altering the speed of a motor with the use of an “eccentric rotating mass (ERM) actuator,” or modifying “amplitude values” with the use of a “linear resonant actuator (LRA).” *Id.* ¶ 26.

3. *Rossi*

Rossi is directed to “circuits for a switching mode driving of a load and in particular to circuit arrangements for controlling the current being delivered to the load.” Ex. 1020, 1:8-11. Rossi discloses an H-bridge switching circuit for controlling electric motors and other inductive loads using pulse width modulation. *Id.* at Fig. 1, 1:8–15. Rossi further discloses an improved circuit for sensing the magnitude and direction of a current

flowing through the load of the H-bridge switching circuit that includes “two pairs of analog switches arranged in a bridge configuration.” *Id.* at Abstr., Figs. 4, 6, 1:65-3:55. Figure 6 is reproduced below.

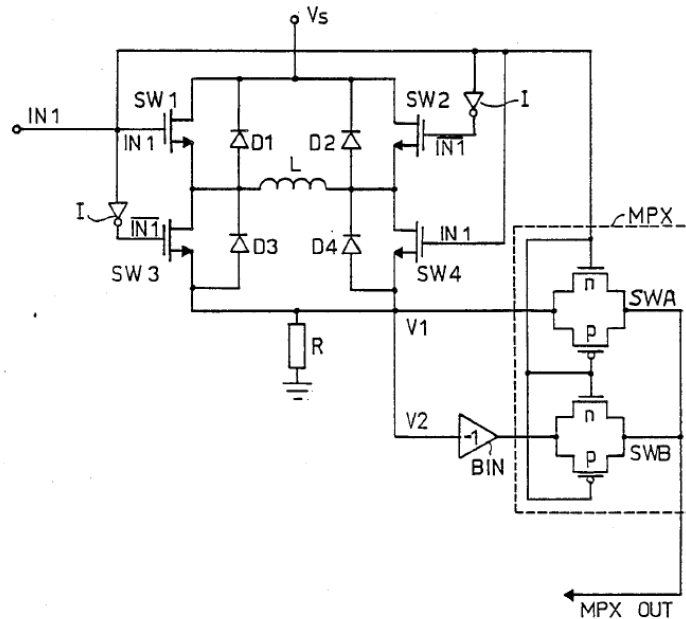


FIG. 6

Figure 6 is a circuit diagram of an H-bridge stage utilizing analog switches implemented by means of MOS transistors. Ex. 1020, 1:56–64. Driving signal IN1 is split and a portion passed through inverters I to generate an internal driving signal IN1 and inverted signal $\overline{\text{IN1}}$. *Id.* at 2:64–65. Those signals control the state of transistors SW1–SW4 and thus control the direction of current through inductive load L, and also drive inputs V1 and V2 to multiplexer MPX, the output of which is used to determine the magnitude and direction of the electric current flowing through load L. *Id.* at 2:65–3:10.

4. Aldrich

Aldrich describes a feedback control algorithm to drive an electromechanical device that is driven by a sinusoidal excitation signal to

“one of the resonance peaks and eventually to oscillate about the peak.”
Ex. 1021, 41, 42.¹⁵ The digital control system is implemented by means of an algorithm that includes a “hill-climbing control algorithm” for coarse tracking to find resonance, an “estimation-based extremum seeking control (ESC) algorithm” for fine resonance tracking, and a supervisory algorithm that switches between the other two algorithms. *Id.* at 42. The drive frequency is incremented or decremented to maintain oscillation about a resonance frequency. *Id.*

5. *The Combination of Gregorio, Ramsay, Rossi, and Aldrich*

Petitioner argues that it would have been obvious to modify Gregorio to include the ability disclosed in Ramsay to allow a user to customize and store parameters associated with haptic effects, such as creating “haptic track files” that specify variations in the amplitude and frequency of the effect over time to achieve a desired effect. Pet. 46–47 (citing Ex. 1006 ¶¶ 15, 25–28, 37; Ex. 1003 ¶¶ 192–193). Petitioner argues that this combination would have been motivated by the desire to expand the functionalities of haptic devices to allow end users create and customize haptic effects, to provide a fuller haptic experience, and to be able to store haptic effects to save processing power compared to real-time generated effects. *Id.* at 47–49 (citing Ex. 1006 ¶¶ 14–15, 30, 47, 53–57; Ex. 1003 ¶¶ 194–196). Petitioner argues that this making combination would have had a reasonable expectation of success given that both references deal with linear actuators, both disclose storing frequency and amplitude values, and the combination involves routine knowledge of software techniques. *Id.* at 49–50 (citing Ex. 1004, 2:3–9; Ex. 1006 ¶¶ 17, 26–28; Ex. 1003 ¶¶ 197–198).

¹⁵ We refer to the page numbers in the original.

Petitioner further argues that it would have been obvious to use the H-bridge switch of Rossi as part of the Gregorio actuator drive circuit 16 in the asserted Gregorio-Ramsay combination to periodically switch the polarity of drive signals to electric coil 28 of Gregorio, and thus oscillate magnet 27, under the control of a signal from processor 12 of Gregorio. Pet. 56 (citing Ex. 1003 ¶ 211). Petitioner argues that this combination would have been motivated because Gregorio does not disclose implementation details and therefore one of ordinary skill would have looked toward teachings like Rossi to fill in those details, and that an H-bridge switch was a well-known example circuit for implementing a change in “current flow direction/polarity” for “push” and “pull” actions in a system, and was a simple, cost-effective, and reliable circuit design. *Id.* at 56–58 (citing Ex. 1020, Abstr., Figs. 4, 6, 1:65–3:54; Ex. 1003 ¶¶ 212–217). Petitioner argues that making this combination would have had a reasonable expectation of success given that it involved known techniques through routine circuit design considerations and software instructions for generating the control signal. *Id.* at 58 (citing Ex. 1003 ¶ 218).

Petitioner further argues that it would have been obvious to modify the Gregorio-Ramsay-Rossi combination, using the control algorithm disclosed in Aldrich, to replace the monitoring technique of Gregorio with that of Aldrich to maintain a resonance frequency by incrementing or decrementing the drive frequency. Pet. 58–59 (citing Ex. 1004, 4:22–28, 4:42–48; Ex. 1021, 2; Ex. 1003 ¶ 219). Petitioner’s expert provides implementation details of Aldrich, including that the Aldrich hill-climb technique would use a Boolean value to indicate whether the frequency was being increased, with local variables set to default values, and use integer

values when processing sensor signals. *Id.* at 59–60 (citing Ex. 1021, 2; Ex. 1003 ¶¶ 220–222). Petitioner argues that these modifications would have been motivated to improve the Gregorio system using the Aldrich feedback algorithm for targeting a resonant frequency, given that the Gregorio approach had shortcomings that required a monitoring period with reduced haptic feedback, receiving weak EMF signals. *Id.* at 61–62 (citing Ex. 2004, 3:65–5:55, 5:63–65; Ex. 1021, 1–3; Ex. 1003 ¶¶ 223–227). Petitioner argues that making this combination would have had a reasonable expectation of success given that it involved known techniques for improvement to yield predictable results, readily implemented via software executed by the microprocessor. *Id.* at 62–63 (citing Ex. 2004, 2:44–50; Ex. 1021, 2; Ex. 1003 ¶ 229).

At this stage, we are persuaded by Petitioner’s declarant’s testimony that one of ordinary skill would have been motivated to combine Gregorio, Ramsay, Rossi, and Aldrich in the manner proposed. Ex. 1003 ¶¶ 193–198, 211–229. Accordingly, for purposes of this Decision, we determine that Petitioner has provided sufficiently articulated reasoning with rational underpinnings for the proffered combined teachings of Gregorio, Ramsay, Rossi, and Aldrich.

6. *Independent Claim 1*

For the “vibration module” preamble of independent claim 1, Petitioner generally relies on the disclosure in Gregorio of a “haptic

feedback system.” Pet. 11–12 (citing Ex. 1004, Fig. 1, 2:10–20; Ex. 1003 ¶¶ 92–93).¹⁶

For claim requirement 1[a] of a “housing,” Petitioner relies on the disclosure in Gregorio of housing 25. Pet. 12 (citing Ex. 1004, Fig. 2, 3:13–15; Ex. 1003 ¶¶ 94–95).

For claim requirement 1[b] of a “moveable component,” Petitioner relies on the disclosure in Gregorio of magnet/mass 27. Pet. 13 (citing Ex. 1004, Fig. 2, 3:12–14, 3:17–21; Ex. 1003 ¶ 96).

For claim requirement 1[c] of a “power supply,” Petitioner argues that “[b]ecause electric power is defined by current and voltage, a person of ordinary skill in the art would have understood that actuator drive circuit 16 corresponds to, or is coupled to, a power supply.” Pet. 13–14 (citing Ex. 1004, Fig. 1, 2:18–39, 3:17–20; Ex. 1003 ¶ 97).

For claim requirement 1[d] of “user-input features,” Petitioner relies on the disclosure in Gregorio of “touch sensitive surface 11” that “generates and displays images for the user to interact with, such as keys, dials, etc.” and/or “mechanical keys/buttons 13.” Pet. 14–15 (citing Ex. 1004, Fig. 1, 2:10–14, 2:64–67; Ex. 1003 ¶ 100). Petitioner also relies on the disclosure in Ramsay of a graphical user interface (GUI) providing a menu options. Pet. 50 (citing Ex. 1006 ¶¶ 15, 24, 32, 53; Ex. 1003 ¶ 200).

As discussed above, claim requirement 1[e], a “driving component that drives the moveable component to oscillate within the housing,” is a means-plus-function requirement subject to 35 U.S.C. § 112 ¶ 6, further

¹⁶ Based on the present record, we make no determination at this stage of the proceeding that the preamble of independent claim 1 (or of independent claims 19 and 20) is limiting.

requiring, for example, a coil structure or equivalent. Section IV.C.1, *supra*. For this requirement, Petitioner relies on the disclosure in Gregorio of electric coil 28. Pet. 15–16 (citing Ex. 1004, Fig. 2, 2:10–20, 3:12–28; Ex. 1003 ¶¶ 101–102).

As also discussed above, claim requirement 1[f] of 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 one or more stored values,” is a means-plus-function requirement subject to 35 U.S.C. § 112 ¶ 6, further requiring:

[A] microcontroller, a processor, a microprocessor, or a CPU that performs the algorithm shown in 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.

Section IV.C.2, *supra*. For this requirement, Petitioner relies on the disclosure in Gregorio of processor 12 and memory 20 programmed with LRA Drive with Resonant Frequency Determination module 22 that controls the supply of power from the power supply to the driving component, including the required electrical current and voltage, based on stored parameters including magnitude and frequency. Pet. 16–18 (citing Ex. 1004, Fig. 1, 2:18–50, 3:12–28, 4:20–65; Ex. 1003 ¶¶ 103–106). Petitioner also relies on the disclosure in Ramsay of storage of frequency and amplitude parameters in “a library of preset haptic tracks” or “haptic track files.” Pet. 51 (citing Ex. 1006 ¶¶ 28, 34, 42, 49; Ex. 1003 ¶ 201). In addition, Petitioner relies on the inclusion of an H-Bridge switch, as disclosed in Rossi, to receive control signals from the microprocessor for controlling the

direction of the drive signal through the coil. Pet. 64 (citing Ex. 1020, Fig. 6, 1:65–2:15, 3:44–55; Ex. 1003 ¶ 235). Finally, relying on the frequency-determining algorithms of Aldrich, Petitioner provides record support and expert testimony for its arguments that the Gregorio/Ramsay/Rossi/Aldrich combination teaches or suggests the algorithm described in Figures 7A–7C of the ’830 patent. Pet. 65–72 (*see* Ex. 1003 ¶¶ 236–262, and citations therein).

Patent Owner argues that Petitioner “fails to show that Gregorio discloses or renders obvious the claimed ‘power supply’ and ‘control component’ to satisfy limitations 1[c] and 1[f], under a proper construction of the term ‘control component.’” Prelim. Resp. 15, 19–20; Sur-Reply 1–2. Specifically, Patent Owner argues that, under the means-plus-function analysis, step 762 of Figure 7C of the ’830 patent, “output p to power supply,” has not been established. Prelim. Resp. 15.¹⁷ Patent Owner argues that Petitioner’s reliance on the actuator drive circuit 16 of Figure 1 of

¹⁷ Patent Owner actually argues:

[T]his algorithm must include at least the step of “provide a corresponding output to the power supply.” In other words, the “power supply” of limitation 1[c] . . . must be capable of being provided an output, and the “control component” of limitation 1[f] . . . must be capable of providing such an output to the power supply.

Prelim. Resp. 15. This is potentially ambiguous, but we understand this to refer to step 762 of Figure 7C of the ’830 patent, and the “output” that Patent Owner refers to is what is termed “output p” in the algorithm. This is an *output* from the control component, which is an *input* to the power supply. We understand Patent Owner’s statement that the power supply must be capable of being provided an output refers to the *input to* the power supply *provided by* the control component in step 762.

Gregorio, which Petitioner argues includes a power supply (*see* Pet. 13–14), is insufficient because there is no disclosure of an input to the power supply that would accept “output p” from a control component. *Id.* at 15–18.

Patent Owner argues that Petitioner relies on “unspecified ‘electrical components and circuitry’ within the ‘actuator drive circuit 16’” in Gregorio and “does not teach or render obvious the required outputting from the processor to a power supply.” *Id.* at 16. In addition, argues Patent Owner, Petitioner’s alternative reliance on current generator 422 in Figure 4 of Gregorio as the power supply (*see* Pet. 14) is without merit because the only inputs to 422 are from a low-pass filter 421 and the signal U2A from an or-gate, but no input from the processor. *Id.* at 16–17 (citing Ex. 1004, Fig. 4).

Petitioner has sufficiently shown that step 762 of Figure 7C would have been taught or suggested by the proffered combination. That step computes an output “p” value, which corresponds to the current “strength” — *i.e.*, amplitude — of the current through coil 514, and applies it to the power supply so that it provides that current to the coil. Ex. 1001, Fig. 7C, 8:26–30. Petitioner relies on its expert’s testimony that it would have been obvious that actuator drive circuit 16 of Gregorio “corresponds to, or is coupled to, a power supply.” Pet. 14 (citing Ex. 1003 ¶ 97). Petitioner further argues that “the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user [input].” *Id.* at 72 (citing Ex. 1003 ¶¶ 259–261); Reply 3. Patent Owner argues that this statement is unpersuasive as conclusory, and objects to Petitioner’s reliance on three paragraphs of its expert’s testimony. Sur-Reply 2–3. However, at this stage we find Petitioner’s reasoning persuasive and its reliance on the testimony appropriate. Moreover, the ’830

patent does not disclose any detail or structure for the controllable power supply, indicating that such a controllable power supply was well-known. *See* Ex. 1001, 6:41–44; *Uber Techs., Inc. v. X One, Inc.*, 957 F.3d 1334, 1339 (Fed. Cir. 2020) (reasoning that when a patent specification “is entirely silent on how to” perform a claimed feature, it “suggest[s] that a person of ordinary skill in the art was more than capable of” performing that claimed feature).

Accordingly, based on our analysis set forth above, including our analysis of Patent Owner’s arguments, we determine, on the current record and for purposes of this Decision, that the information presented in the Petition demonstrates a reasonable likelihood that Petitioner will prevail in establishing that claim 1 is unpatentable under 35 U.S.C. § 103(a) over the combination of Gregorio, Ramsay, Rossi, and Aldrich.

7. *Claims 2–7, 15, 17, and 20*

Claim 2 depends from claim 1 and additionally requires:

[T]he control component is one of: an variable oscillator circuit with additional control circuitry; and a control component that includes a microprocessor, 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 the one or more stored values.

Ex. 1001, 16:1–14. For claim 2, Petitioner relies on its control component analysis for claim 1.¹⁸ Pet. 19, 73.

¹⁸ Although not the subject of this IPR, we note that claim 2 arguably recites sufficient structure that would cause it to no longer be classified as a means-plus-function claim per 35 U.S.C. § 112 ¶ 6. *Cf.* Ex. 3001, 17–22.

Claim 3 depends from claim 1 and additionally requires:

[T]he control component receives output signals from sensors within the vibration module during operation of the 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, 16:15–20. For claim 3, Petitioner relies on the disclosure in Gregorio of receiving back EMF or position measurements from sensors such as a sensing coil, Hall sensor, or optical sensor to adjust the frequency and amplitude of drive signals. Pet. 20–21 (citing Ex. 1004, 2:5–8, 2:45–50, 3:8–11, 4:5–5:67, 6:5–9; Ex. 1003 ¶¶ 116–121).

Claim 4 depends from claim 1 [*sic*—3¹⁹] and additionally requires:

[T]he 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 vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.

Ex. 1001, 16:21–27. For claim 4, Petitioner relies on the adjustments of amplitude and frequency in Gregorio, described above for claim 3, resulting in desired EMF or position measurements associated with a desired haptic effect. Pet. 22 (citing Ex. 1004, 2:5–50, 3:8–11, 4:5–6:9; Ex. 1003 ¶¶ 124–125).

Claim 5 depends from claim 4 and additionally requires:

[T]he one or more operational control parameters is a strength of vibration produced by the oscillation of the moveable

However, that would broaden the scope of dependent claim 2 beyond that of independent claim 1, potentially raising Section 112 indefiniteness issues.

¹⁹ We agree with the court in the Apple Litigation that claim 4 should be treated as depending from claim 3. Ex. 3001, 49–50.

component; and wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to oscillate, the control component dynamically adjusting the power supplied to the driving component to produce oscillation of the movable component at a resonant frequency for the vibration module.

Ex. 1001, 16:28–38. For claim 5, Petitioner relies on the adjustments of amplitude and frequency in Gregorio, described above for claims 3 and 4, resulting in dynamic adjustments to maintain a resonant frequency. Pet. 22–23 (citing Ex. 1004, 2:5–8, 2:45–50, 3:65–67, 4:15–6:9; Ex. 1003 ¶¶ 87–89, 126–133).

Claim 6 depends from claim 4 and additionally requires:

[T]he one or more operational control parameters include both a strength of vibration produced by the oscillation of the moveable component and a current operational mode; and wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to oscillate.

Ex. 1001, 16:39–48. For claim 6, Petitioner relies on the adjustments of amplitude and frequency in Gregorio, described above for claims 3 and 4, and the disclosure in Gregorio of “forward drive” and “braking” operational modes and haptic effects which cause adjustments to the amplitude and frequency of drive signals. Pet. 23–25 (citing Ex. 1004, Figs. 3, 4, 6, 2:5–2:50, 3:65–6:9; Ex. 1003 ¶¶ 134–141).

Claim 7 depends from claim 1 and additionally requires:

[T]he 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, 16:49–53. For claim 7, Petitioner relies on the disclosure in Gregorio of coil 28, which generates magnetic fields parallel to the directions in which magnet 27 is driven. Pet. 25 (citing Ex. 1004, Fig. 2, 3:12–21; Ex. 1003 ¶ 142).

Claim 15 depends from claim 1 and additionally requires, “the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.” Ex. 1001, 17:30–33. For claim 15, Petitioner relies on the disclosure in Ramsay that “one or more frequencies” can be entered for each haptic track, enabling users to “combine or mix different haptic tracks together,” and allowing “two or more haptic tracks [to] be programmed to be simultaneous or partially overlapping in time,” which Petitioner argues would have taught or suggested driving simultaneous oscillation of the movable component at two or more frequencies. Pet. 51–52 (citing Ex. 1006 ¶¶ 27, 30, 46–47; Ex. 1003 ¶ 202).

Claim 17 depends from claim 1 and additionally requires:

[T]he 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, 18:1–6. For claim 17, Petitioner relies on the disclosure in Ramsay of an on-device user interface that allows the user to separately input frequency and amplitude. Pet. 52–53 (citing Ex. 1006 ¶¶ 5, 15, 24, 30, 32–33, 46, 53–55; Ex. 1003 ¶¶ 203–204).

Independent claim 20 is commensurate with claim 1 combined with claim 15. Ex. 1001, 18:23–37. For claim 20, Petitioner relies on its analysis for those claims. Pet. 53 (citing Ex. 1003 ¶¶ 205–206).

At this stage of the proceeding, Patent Owner does not provide any separate argument against dependent claims 2–7, 15, and 17. *See generally* Prelim. Resp. Patent Owner makes the same argument for claim 20 as for claim 1, which we consider above. *Id.* at 15, 19. Based on the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood that claims 2–7, 15, 17, and 20 are unpatentable over the combination of Gregorio, Ramsay, Rossi, and Aldrich.

E. Alleged Obviousness of Claims 8, 14, and 19 over Gregorio, Ramsay, Rossi, Aldrich, and Wakuda

Petitioner contends that claims 8, 14, and 19 would have been obvious over the combined teachings of Gregorio, Ramsay, Rossi, Aldrich, and Wakuda. Pet. 75–76.²⁰ Wakuda discloses “a vibration generator system, which can generate vibrations at a frequency that can be bodily sensed by humans.” Ex. 1005, 2:13–17. Figure 1A of Wakuda is reproduced below.

²⁰ Petitioner also challenges claims 8, 14, and 19 over Gregorio and Wakuda, and alternatively over the combination of Gregorio, Ramsay, and Wakuda. Pet. 26–36, 53–54. However, those grounds are based on assumed “plain and ordinary meaning” interpretations of the claims that we do not adopt. *See* Pet. 3, 54. Therefore, we do not consider those grounds of Petitioner’s challenge, except to the extent that Petitioner incorporates portions by reference in its grounds based on the applicable means-plus-function interpretations.

FIG. 1A

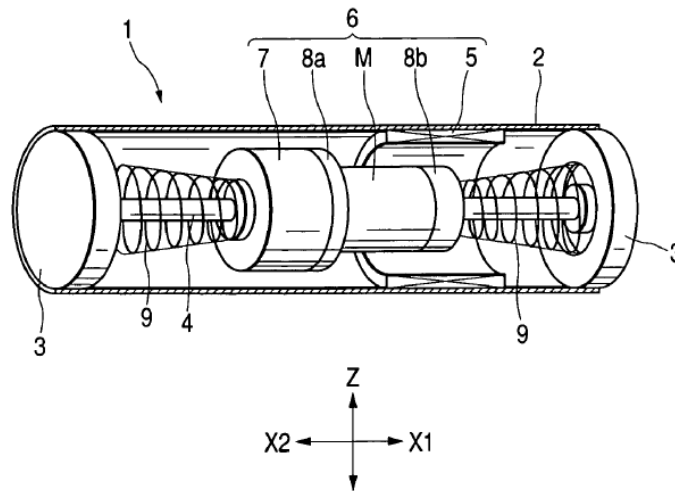


Figure 1A depicts vibration generator means 1 including cylindrical-shaped casing 2, covers 3, coil 5, movable body 6 including weight 7 and magnet M, and cone coil springs 9. Ex. 1005, 4:30-5:24. Petitioner argues that it would have been obvious to use Wakuda's vibration generator as the Linear Resonant Actuator of Gregorio, because Wakuda discloses a similar system used in similar devices and supplies implementation details not disclosed in Gregorio, combinable using known techniques. Pet. 26-29 (citing Ex. 1004, Fig. 2, 3:1-2, 3:12-28; Ex. 1005, Fig. 1B, 1:11-14, 4:33-6:10; Ex. 1003 ¶¶ 143-149).

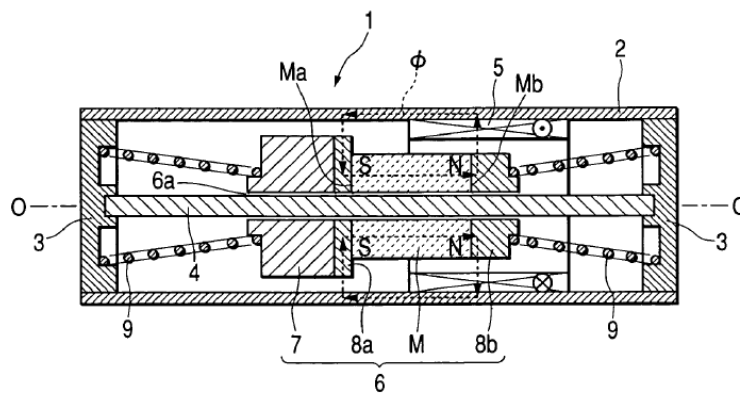
Claim 8 depends from claim 1 and additionally requires:

[T]he housing is a tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets; wherein the movable component is a magnet shaped to slide within the tube; and wherein the driving component is an electromagnetic coil.

Ex. 1001, 16:54-60. For claim 8, Petitioner relies on the disclosure in Wakuda described above. Pet. 29-30 (citing Ex. 1003 ¶¶ 150-152).

Claim 14 depends from claim 1 and additionally requires, “further including flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the vibration module.” Ex. 1001, 17:26–29. For claim 14, Petitioner relies on the disclosure in Wakuda represented by Figure 1B reproduced below. Pet. 31–32.

FIG. 1B



Petitioner submits that Figure 1B, a cross section of Figure 1A reproduced above, depicts flux path ϕ through yoke members 8a, 8b and casing 2, which are made of magnetic material and thus reduce the reluctance of the magnetic circuit. Pet. 30–31 (citing Ex. 1005, 4:34–54, 5:56–64; Ex. 1003 ¶¶ 153–154). Petitioner argues that it would have been obvious for the magnetic material to be made of a paramagnetic material, such as aluminum. Pet. 32–36 (citing Ex. 1003 ¶¶ 155–162).

Independent claim 19 is commensurate with claim 1 combined with claim 14. Ex. 1001, 18:23–37. For claim 19, Petitioner relies on its analysis for those claims, with the additional reliance on the disclosure in Wakuda of a vibration module, casing, weight and magnet, coil, and control means. Pet. 36 (citing Ex. 1003 ¶¶ 163–177).

At this stage of the proceeding, Patent Owner does not provide any separate argument against dependent claims 8 and 14. *See generally* Prelim. Resp. Patent Owner makes the same argument for claim 19 as for claim 1, which we consider above. *Id.* at 15, 20. Based on the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood that claims 8, 14, and 19 would have been obvious over the combined teachings of Gregorio, Ramsay, Rossi, Aldrich, and Wakuda.

F. Alleged Obviousness of Claims 15, 16, and 20 over Gregorio, Ramsay, Rossi, Aldrich, and Tierling

Petitioner contends that claims 15, 16, and 20 would have been obvious over the combined teachings of Gregorio, Ramsay, Rossi, Aldrich, and Tierling. Pet. 75–76.²¹ Tierling provides “mapping drive signals to haptic sensations” at user interface devices, such as wireless phone. Ex. 1008 ¶¶ 2–3. Tierling can create haptic effects by superimposing desired output frequency and a resonant frequency of a haptic device. *Id.*, Figs. 9–10, ¶¶ 31, 110–112. Petitioner argues that it would have been obvious to adapt Gregorio’s system to plays Tierling’s haptic effects using Tierling’s effect mapping functionalities, given that Gregorio refers to haptic effects based on the resonance frequency and high-level parameters such as

²¹ Petitioner also challenges claims 15, 16, and 20 over Gregorio and Tierling, and alternatively over the combination of Gregorio, Ramsay, and Tierling. Pet. 36–45, 53–54. However, those grounds are based on assumed “plain and ordinary meaning” interpretations of the claims that we do not adopt. *See* Pet. 3, 54. Therefore, we do not consider those grounds of Petitioner’s challenge, except to the extent that Petitioner incorporates portions by reference in its grounds based on the applicable means-plus-function interpretations.

magnitude and frequency, and Tierling provides specific examples of such which can be adapted via known techniques. Pet. 38–40 (citing Ex. 1003 ¶¶ 178–182).

For claim 15 (reproduced in Section IV.D.7 above), Petitioner relies on the disclosure in Tierling of generating a desired output sinusoidal response having a frequency of approximately 1 Hz superimposed on a higher frequency resonant mode of a harmonic haptic device. Pet. 40–42 (citing Ex. 1008, Figs. 9, 10, ¶¶ 31, 108, ; Ex. 1003 ¶¶ 183–185).

Claim 16 depends from claim 15 and additionally requires, “the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.” Ex. 1001, 17:34–39. For claim 16, Petitioner relies on the disclosure in Tierling described above, and explains that it includes the required primary oscillation frequency modulated by a modulating oscillation frequency, a beat frequency, and an aperiodic oscillation waveform. Pet. 42–45 (citing Ex. 1003 ¶¶ 186–189).

Independent claim 20 is commensurate with claim 1 combined with claim 15. Ex. 1001, 18:23–37. For claim 20, Petitioner relies on its analysis for those claims. Pet. 45 (citing Ex. 1003 ¶¶ 190–191).

At this stage of the proceeding, Patent Owner does not provide any separate argument against dependent claims 15 and 16. *See generally* Prelim. Resp. Patent Owner makes the same argument for claim 20 as for claim 1, which we consider above. *Id.* at 15, 20. Based on the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood that claims 15, 16, and 20 would have been obvious over the combined teachings of Gregorio, Ramsay, Rossi, Aldrich, and Tierling.

V. CONCLUSION

After considering the evidence and arguments presented in the Petition and the Preliminary Response, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing on its assertion that at least one claim of the ' 830 patent is unpatentable. Accordingly, we institute an *inter partes* review of claims 1–8, 14–17, 19, and 20 and all of the grounds presented in the Petition. *See* 37 C.F.R. § 42.108(a); *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018); *AC Techs. S.A. v. Amazon.com, Inc.*, 912 F.3d 1358, 1364 (Fed. Cir. 2019) (“[I]f the Board institutes an IPR, it must . . . address all grounds of unpatentability raised by the petitioner.”). At this stage of the proceeding, we have not made a final determination as to the patentability of these challenged claims.”

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that pursuant to 35 U.S.C. § 314, *inter partes* review is instituted as to challenged claims 17–21 of the '830 patent with respect to all grounds of unpatentability presented in the Petition; and

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

IPR2024-00806
Patent 9,941,830 B2

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