Trials@uspto.gov
571-272-7822

Paper 35
Date: October 9, 2025

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*.

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

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. On October 15, 2024, we instituted *Inter Partes* review as to the challenged claims. Paper 11. Subsequently, Resonant Systems, Inc., Patent Owner, filed a Response ("PO Resp."), Petitioner filed a Reply ("Reply"), and Patent Owner filed a Sur-Reply ("Sur-Reply"). Papers 16, 22, 28. An oral hearing was held on July 17, 2025, and a copy of the transcript was entered into the record. Paper 32 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This Decision is a Final Written Decision under 35 U.S.C. § 318(a). Based on the complete record, we find that Petitioner has shown, by a preponderance of the evidence, that claims 1–8, 15–17, and 20 of the '830 patent are unpatentable and claims 14 and 19 of the '830 patent are not unpatentable.

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. 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, 1.

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, 1; PO Resp. 3. *See Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. v. Resonant Systems, Inc.,* Paper 48, IPR2023-00993 (PTAB Mar. 11, 2025) (Final Decision, Determining Some Challenged Claims Unpatentable) (on Appeal); *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);.*Apple, Inc.* v. *Resonant Systems, Inc.*, Paper 11, IPR2024-00808 (PTAB Oct. 15, 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. *See* PO Resp. 2.

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:

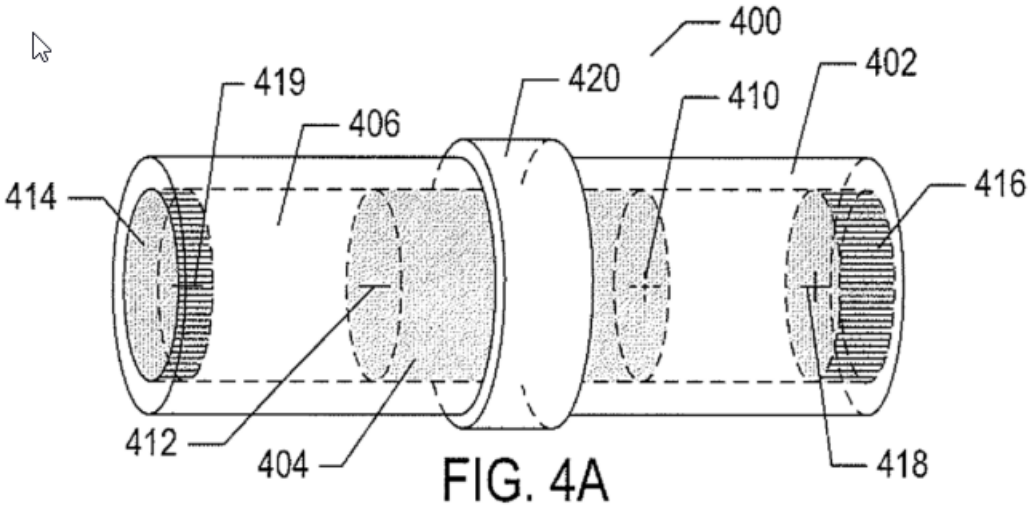


FIG. 4A

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. The '830 patent states that:

> The components of the LRVM, including the housing, moving mass, fixed magnets, and electromagnets, can be fashioned from many different types of materials, from polymers and plastics to metals and alloys in various composite materials.

Ex. 1001, 15:22–26.

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

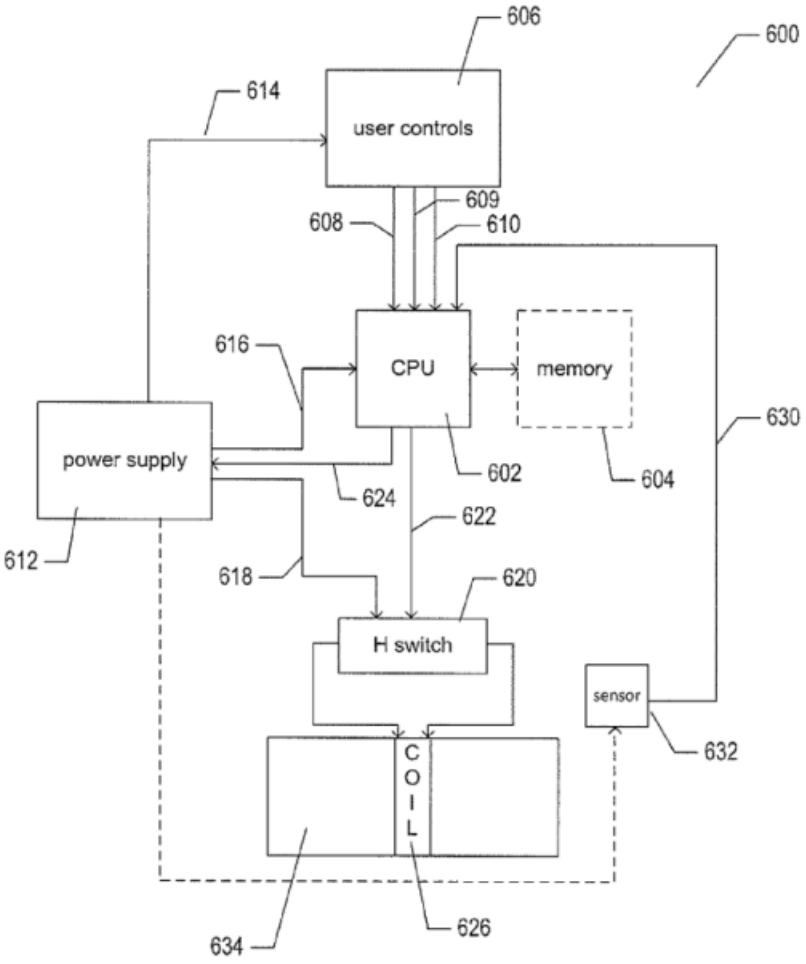


FIG. 6

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 discussed in more detail below at page 16. 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.

Figures 7A–7C, discussed below at pages 16 and 20, illustrate the control program, executed by the CPU, that controls operation of an embodiment of an LRVM. Ex. 1001, 6:53–8:32.

One embodiment disclosed in the '830 patent provides for incorporation of paramagnetic flux paths into an LVM, as illustrated in Figures 24A and 24B below.

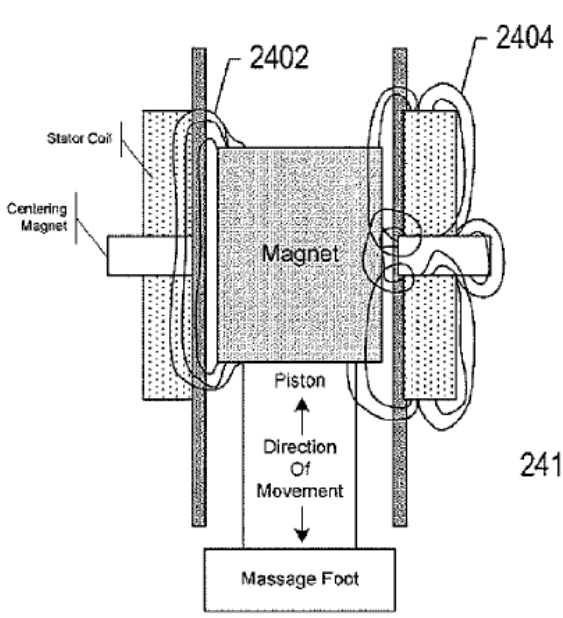


FIG. 24A

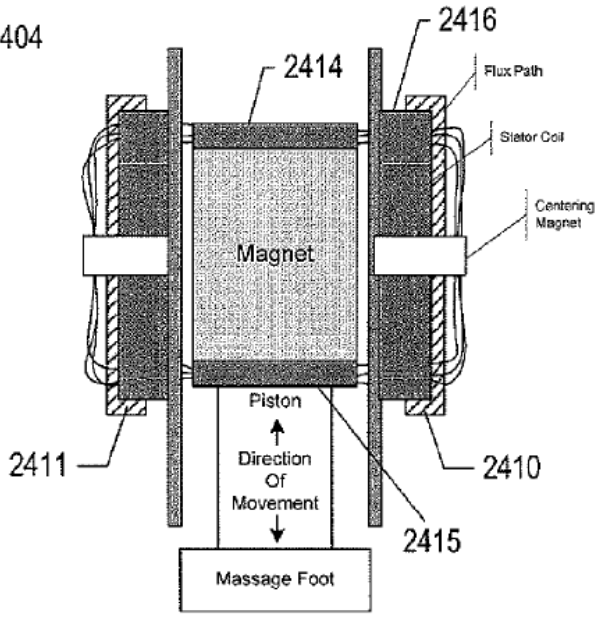


FIG. 24B

Figure 24A shows an LVM without paramagnetic flux paths, with magnetic field lines 2402 shown passing through air. Ex. 1001, 14:20–24. FIG. 24B shows an LVM with added paramagnetic flux paths 2410–2411 around the stator coils and flux-path disks 2414–2415 at the ends of cylindrical magnet 2416 causing fewer flux lines to pass through free air. *Id.* at 14:24–30. According to the '830 patent, adding paramagnetic materials of adequate permeability and size (to avoid saturation) provide a lower-resistance (referred to as "lower reluctance") path for magnetic flux, allowing the magnetic field to more efficiently perform more work. *Id.* at 14:13–19. The '830 patent specifies that the added material is "made from a material with a relatively large magnetic permeability . . . to concentrate and increase the linear magnetic forces produced by the various coils." *Id.* at 15:34–38.

D. Illustrative Claims

Independent claim 1 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); Ex. 1001, 15:57–67.

Dependent claim 14 follows:

> 14. The vibration module of claim 1 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.

Pet. ix; Ex. 1001, 17:26–29.

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] 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.

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
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

Pet. 1. Petitioner supports its challenges with a Declaration of Dr. Blake Hannaford and a Supplemental Declaration of Dr. Blake Hannaford. Exs. 1003, 1049.

III. ANALYSIS OF PETITIONER'S CHALLENGES

A. Legal Standards

To prevail in its grounds for unpatentability during trial, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). "In an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

[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.

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter 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). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective indicia of nonobviousness (also called secondary considerations), such as commercial success, long-felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze the grounds based on obviousness in accordance with the above-stated principles.

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." PO Resp. 3.

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. Claim terms need only be construed to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

The parties agree that independent claims 1, 19, and 20 include means plus function limitations under 35 U.S.C. § 112 ¶ 6.[8] Pet. 3–7; PO Resp. 6–14.

> 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; PO Resp. 6–14. 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

[8] 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").

1. Construction of "Driving Component"

Petitioner submits that the claimed function of "driving component" is, "drives the moveable component to oscillate within the housing," and that 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).

Patent Owner states that it "does not believe that the phrase involving a 'driving component' needs to be construed in order to resolve any issue in this proceeding." PO Resp. 7. However, Patent Owner agreed to the above

construction in the Apple Litigation, which construction was adopted by the court. Ex. 2002, 2.

This construction is in accord with our reading of the '830 patent and we adopt it.

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. Patent Owner refers to the construction that the District Court has adopted in the Apple Litigation. PO Resp. 7–8. That construction holds:

> **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.

Ex. 2002, 6–7; *see also* Ex. 3001, 33–37 (August 23, 2024 "Claim Construction Memorandum And Order" entered in the Apple Litigation). Patent Owner acknowledges that Petitioner's proposed construction is

"similar," while Petitioner characterizes the alternative constructions as "oversimplified." PO Resp. 7; Pet. 5.

Patent Owner emphasizes that, in accord with all constructions considered, the control component must provide a value "p" corresponding to the currently selected amplitude of the LVM to the power supply so that the power supply outputs an appropriate current to the coil. PO Resp. 8–14. Patent Owner also argues that the control component must provide a separate value "d" corresponding to the direction of current to the coil per the selected frequency of the LVM. PO Resp. 20; Sur-Reply 2–5, 7.[9]

As elaborated below, our reading of the '830 patent is a modification of the District Court's construction of "control component."[10]

a) Frequency Function

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

[9] For the first time in its Sur-Reply, Patent owner also argues that the step that sets the "d" value must occur before the step that sets the "p" value. Sur-Reply 3–4.

[10] 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 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:

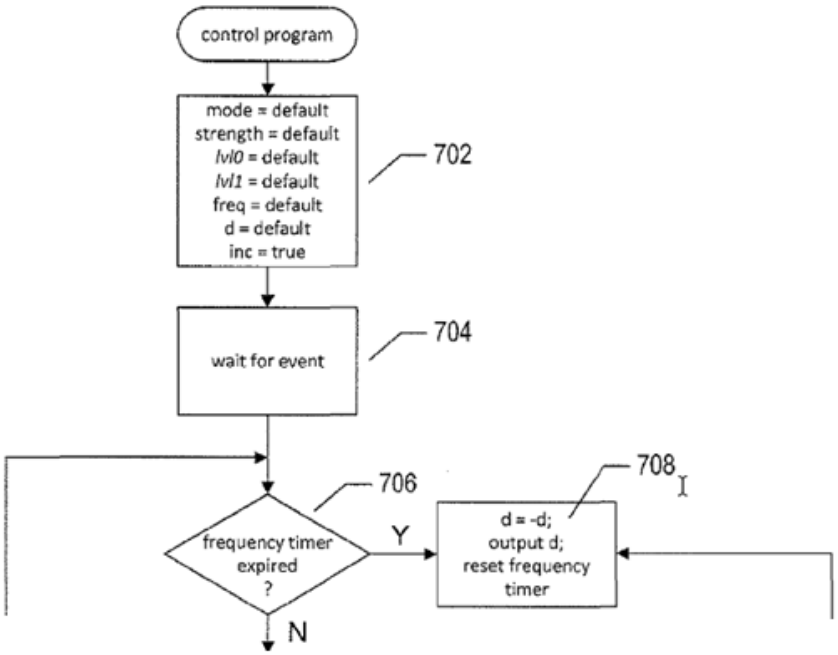


Figure 7A, which corresponds to a "high-level control program" executed by CPU 602 and memory 604 of Figure 6 (*supra* Section II.C), shows the algorithm using value d, "the control output to the H-bridge switch," to control the frequency. *See* Ex. 1001, 6:33–7:27. In steps 706 and 708, the algorithm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

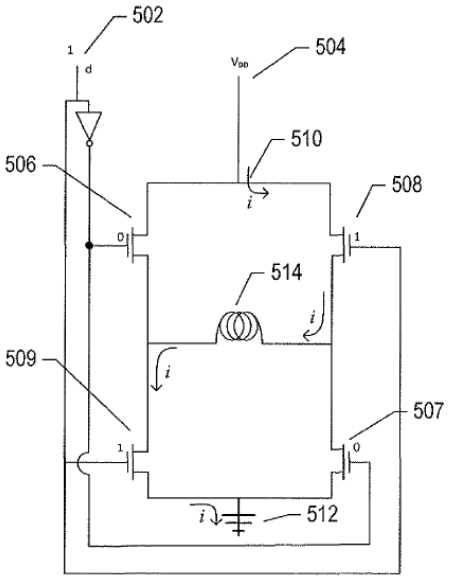


FIG. 5A

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.

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, Fig. 5, coil 626, Fig. 6), where the coil is structure that corresponds to the recited "driving component," as noted above.[11]

We adopt the District Court's conclusion in the Apple litigation that the "control component" structure itself does not require an H-bridge switch, but only requires that the processor generates the "d" inputs to the switch; and further that the structure does not require does not require 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. This is in accord with settled law

[11] "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.

that limits the structure to that necessary to perform the claimed function. [12] By the same token, we modify the District Court's construction to the extent it would require, based on such steps as 706, 710, and 716, a specific order of the steps of generating the "p" and "d" values. The claims only require the control component to control the power supply to cause oscillation at a specified frequency and amplitude, but do not require the frequency value to be generated before the amplitude value, or vice versa.

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

[12] *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*.); Univ. of Pitt. of Commonwealth Sys. of Higher Educ. v. Varian Med. Sys., Inc.*, 561 F. App'x 934, 941 (Fed. Cir. 2014) ("The district court properly located the disclosure of an algorithm that covered what was necessary to perform the claimed function . . . and nothing more . . . . The algorithm need only include what is necessary to perform the claimed function."); *Northrop Grumman Corp. v. Intel Corp.*, 325 F.3d 1346, 1352 (Fed. Cir. 2003) ("A court may not import into the claim features that are unnecessary to perform the claimed function. Features that do not perform the recited function do not constitute corresponding structure and thus do not serve as claim limitations."); *Micro Chem., Inc. v. Great Plains Chem. Co.*, 194 F.3d 1250, 1258 (Fed. Cir. 1999) (Section 112, ¶ 6 does not "permit incorporation of structure from the written description beyond that necessary to perform the claimed function").

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:

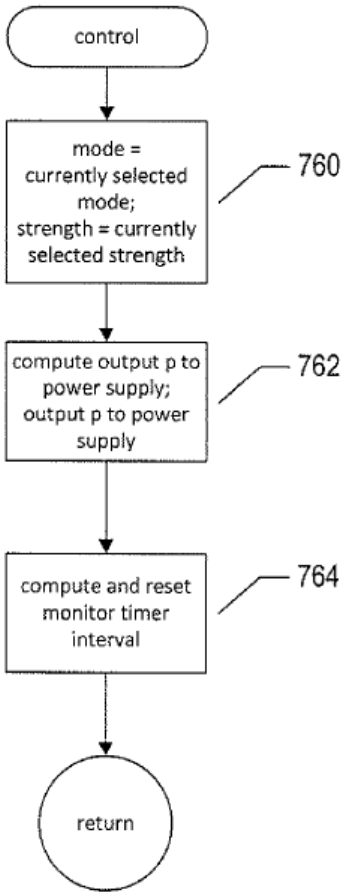


FIG. 7C

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 a 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.[13]

[13] This summary is materially the same as the summary in the Institution Decision, but the construction summary here eliminates "an H-bridge switch circuit" and replaces it with "a circuit." *See* Inst. Dec. 20 § IV.C.2.c. This comports with the District Court's construction indicating that limitation 2.f

3. Construction of "Paramagnetic Material"

Dependent claim 14 and independent claim 19 require "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, 17:26–33, 18:20–22. Aspects of this requirement are discussed in Section III.E below.

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.

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does not require an H-bridge, as outlined above. *See* Ex. 3001, 30–33, 35; Inst. Dec. 17 n.12 (noting same).

[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 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 analysis of its grounds based on the applicable means-plus-function interpretations.

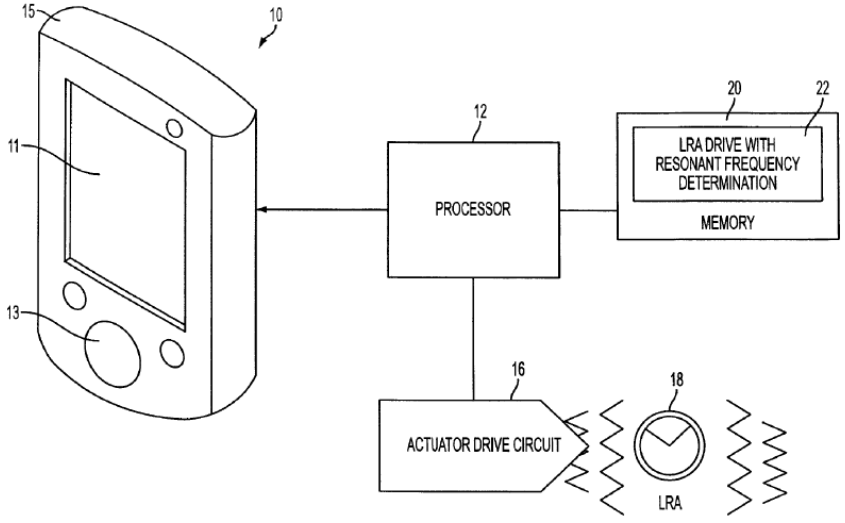


FIG. 1

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 "decide[s] what haptic effects are to be played and the order in which the effects are played based on high level parameters," such as "magnitude, frequency and duration," which can dynamically vary "based on a user's interaction." *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. Actuator drive circuit 16 provides the drive signals to LRA 18. *Id.* at 4:15–17.

Figure 2 is reproduced below.

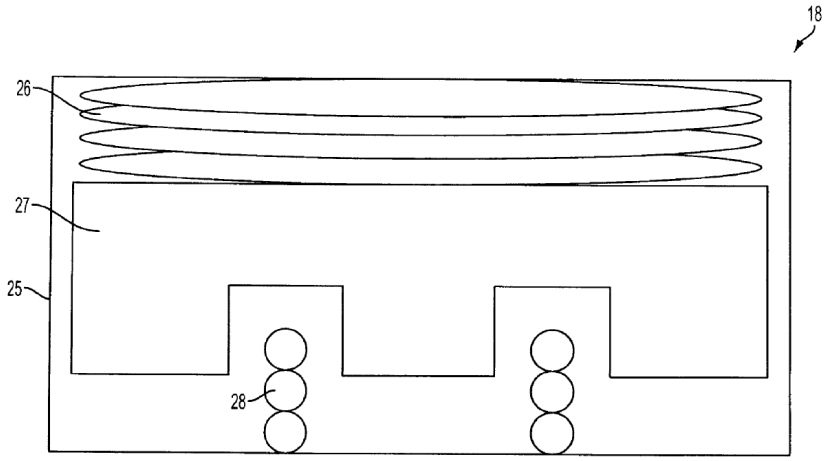


FIG. 2

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.

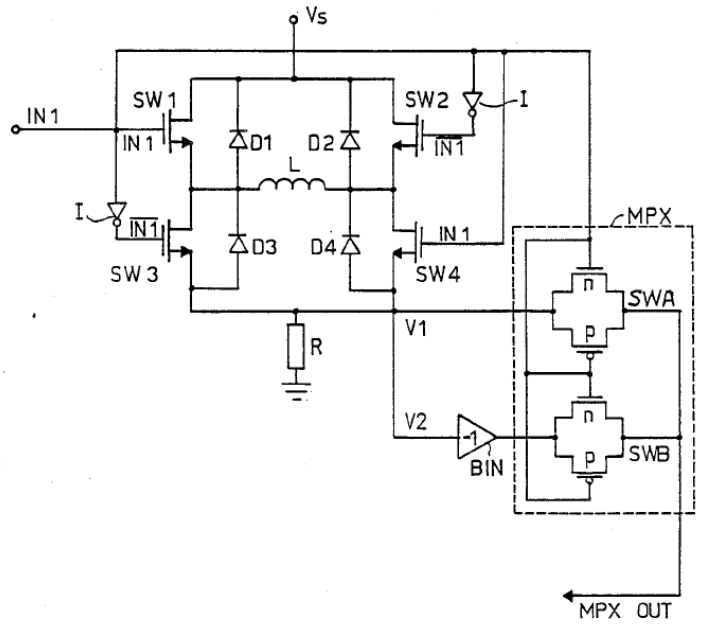


FIG. 6

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. "[C]locked driving signal" IN1 is split and a portion passed through inverters I to generate an inverted signal $\overline{\text{IN1}}$. *Id.* at 2:64–65. The IN1 and $\overline{\text{IN1}}$ 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

[15] We refer to the page numbers in the original.

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 to 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).

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).

Patent Owner does not address Petitioner's arguments regarding the motivation to combine Gregorio, Ramsay, Rossi, and Aldrich. *See generally* PO Resp. 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, 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]

[16] We make no determination as to whether or not the preamble of independent claim 1 (or of independent claims 19 and 20) is limiting.

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 relies on the fact that Gregorio's actuator drive circuit 16 "includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage to cause the desired haptic effects." Pet. 13 (citing Ex. 1004, 2:36–39); Reply 2. 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." *Id.* at 13–14 (citing Ex. 1004, Fig. 1, 2:18–39, 3:17–20; Ex. 1003 ¶ 97); Reply 3–4 (citing Exs. 1050–1053 (power supply definitions); Ex. 1049 ¶¶ 4–5).

In regard to claim limitation 1[c], Patent Owner asserts that Petitioner concedes that the "drive circuit 16 may not be a power supply," based on Petitioner's argument that "a person of ordinary skill in the art (POSITA) would have understood that actuator drive circuit 16 corresponds to, or is coupled to, a power supply." PO Resp. 16 (citing Pet. 14). However, Petitioner's reliance on the disclosure in Gregorio that "actuator drive circuit 16 includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage to cause the desired haptic effects" (Pet. 13; Reply 2–4) is convincing evidence that it would have been obvious to include the required power supply in the actuator drive circuit 16 itself,

otherwise it could not "supply . . . the required electrical current and voltage." Ex. 1004, 2:38–39.

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 requiring, for example, a coil structure or equivalent. Section III.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 III.C.2, *supra*. For this requirement, Petitioner relies on the disclosure in Gregorio of processor 12 programmed with LRA Drive with Resonant Frequency Determination module 22 in memory 20, which processor provides control signals that control the supply of power from the power supply (actuator drive circuit 16) to the driving component (coil 18), including the required electrical current and voltage, based on stored parameters including magnitude and frequency. Pet. 16–18, 71–72 (citing Ex. 1004, Fig. 1, 2:18–50, 3:12–28, 4:20–65; Ex. 1003 ¶¶ 103–106, 259–261); Reply 7–8 (citing Ex. 1004, Fig. 5, 2:25–30, 2:36–39, 2:45–50, 4:1–2, 4:5–7, 5:60–61, cl. 2; Ex. 1049 ¶ 11).

For claim requirement 1[f], 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, 58, 65; 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, 68–69 (citing Ex. 1020, Fig. 6, 1:65–2:15, 3:44–55, 4:20–22; Ex. 1003 ¶¶ 235, 249); Reply 9–10 (citing Ex. 1049 ¶¶ 13–15). In particular, Petitioner argues that "[a] POSITA would have found obvious that, based on the Gregorio-Ramsay-Rossi-Aldrich combination, the microprocessor is programmed to provide a control output to the H-bridge switch for controlling the direction of the drive signal through the coil." Pet. 64 (citing 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).

In regard to claim limitation 1[f], Patent Owner argues that "Petitioner's assumption that the power supply receives a signal from the processor is a sweeping conclusion that does not follow from any obviousness argument," and asserts that "[t]he petition does not contend that Gregorio discloses any processor or algorithm that provides an 'output value p corresponding to the currently selected strength' or an 'output p to the power supply.'" PO Resp. 16, 19 (citing Ex. 2009 ¶ 116).[17] Patent Owner argues that Petitioner's reliance on the Gregorio/Ramsay/Rossi/Aldrich combination also fails to disclose or render obvious any control signal to the power supply. *Id.* at 31 (citing Ex. 2009 ¶ 124). Patent Owner further argues that Petitioner, and the Board, improperly rely on portions of Petitioner's expert's declaration not disclosed in the Petition itself. *Id.* at 32 (citing Paper 11 at 31). In addition, Patent Owner argues that the means-plus-function construction requires two separate outputs from the control component — output "d" controlling the direction of the current, and output "p" controlling the power — and argues that the Petition does not show both of these outputs. PO Resp. 20 (citing Ex. 2009 ¶ 123); Sur-Reply 3–5, 7. For the first time in its Sur-Reply, Patent Owner asserts that the means-plus-function construction requires a specific order for the "output d" step 708 and the "output p" step 762, and argues that Petitioner does not show that the relied-on combination teaches this order. Sur-Reply 3–5.

[17] Exhibit 2009 is the Declaration of Keith W. Goossen, submitted by Patent Owner in support of its arguments. PO Resp. 1.

The preponderance of the evidence establishes that both the "output d" step 708 and the separate "output p" step 762 would have been taught or suggested by the proffered combination. Despite Patent Owner's arguments to the contrary, Petitioner specifically addresses "output d" step 708, showing that that step is satisfied by the Gregorio-Ramsay-Rossi-Aldrich combination, in which the microprocessor is programmed to provide a control output to the H-bridge switch of Rossi for controlling the direction of the drive signal through the coil. Pet. 64 (citing Ex. 1003 ¶ 235).

Regarding "output p" step 762, 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. As Petitioner states and supports in the Petition itself (not relying on expert testimony beyond the scope of the Petition), processor 12 of Gregorio "outputs the control signals to drive circuit 16 [the power supply] which includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage to cause the desired haptic effects." Ex. 1004, 2:36–39 (cited at Pet. 9, 13, 17; Ex. 1003 ¶¶ 63, 97, 104, 109). 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]." Pet. 72 (citing, *e.g.*, Ex. 1003 ¶ 259).[18] Moreover,

[18] Patent Owner focuses on Petitioner's expert's testimony that "[w]hen the user input is received, the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user." PO Resp. 33 (referring to Ex. 1003 ¶ 259). Patent Owner asserts that this testimony is beyond the scope of the Petition, is conclusory and "has no foundation in the Petition," and also asserts that the expert "does not provide

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).

These two steps are separate and independent in the proffered combination. Moreover, as discussed in Section III.C.2.a) above, notwithstanding Patent Owner’s arguments, the claims to do not require that these steps are performed in a particular order.

Accordingly, we determine, having considered and weighed the entirety of the evidence, that Petitioner has proved by a preponderance of the evidence that independent 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

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any . . . discussion of an output p to the power supply.” *Id.* at 32–33. However, as discussed above, Gregorio discloses that processor 12 of Gregorio “outputs the control signals to drive circuit 16 [the power supply] which includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage to cause the desired haptic effects.” Ex. 1004, 2:36–39. This passage was cited multiple times in the Petition and the expert declaration (at Pet. 9, 13, 17; and at Ex. 1003 ¶¶ 63, 97, 104, 109), and provides ample explicit support for the expert’s testimony.

> 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. Pet. 19, 73.

> 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*—3[19]] 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

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

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 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).

Patent Owner does not provide any separate arguments regarding dependent claims 2–7, 15, and 17. *See generally* PO Resp. Patent Owner makes the same argument for claim 20 as for claim 1, which we consider above. PO Resp. 35. Accordingly, we determine, having considered and weighed the entirety of the evidence, that Petitioner has proved by a preponderance of the evidence that claims 2–7, 15, 17, and 20 are unpatentable under 35 U.S.C. § 103(a) 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 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

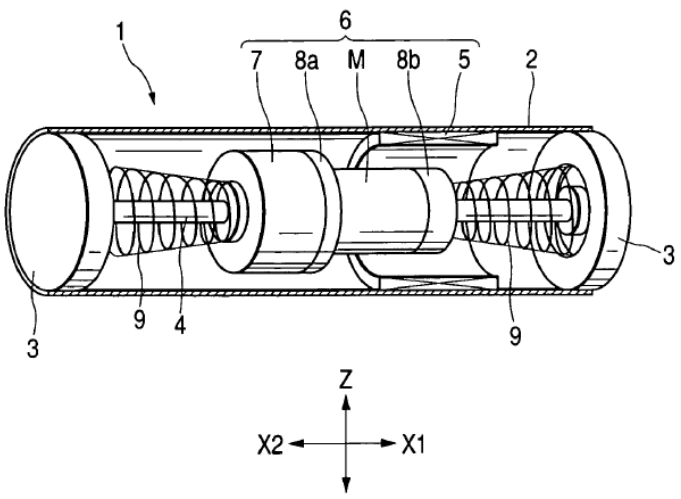


Figure 1A depicts vibration generator means 1 including cylindrical-shaped casing 2, covers 3, coil 5, movable body 6 including weight 7 and magnet M, and cone coil springs 9. Ex. 1005, 4:30–5:24.

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:

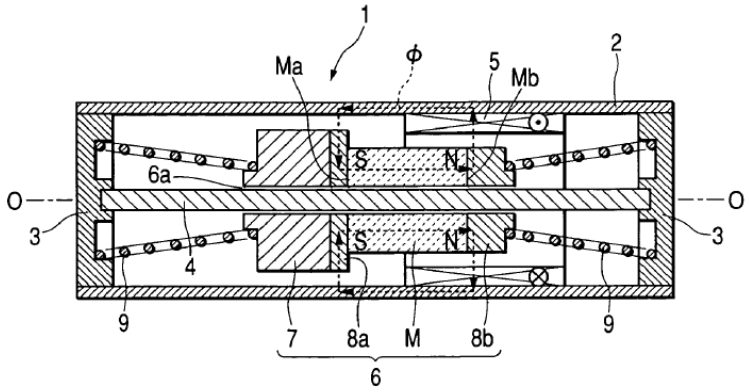
> [T]he housing is a tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets; wherein the movable component is a magnet shaped to slide within the tube; and wherein the driving component is an electromagnetic coil.

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). Patent Owner does not provide any separate argument directed to dependent

claim 8. *See generally* PO Resp. We determine, having considered and weighed the entirety of the evidence, that Petitioner has proved by a preponderance of the evidence that claim 8 is unpatentable under 35 U.S.C. § 103(a) over the combination of Gregorio, Ramsay, Rossi, Aldrich, and Wakuda.

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 Figure1A 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). In particular, Petitioner argues

that paramagnetic materials such as aluminum were known types of magnetic material capable of use in creating a magnetic flux path, and that aluminum was commonly used for housings of haptic feedback actuators, was advantageously lighter than magnetic materials like iron and steel, was more resistant to rust and corrosion than iron and steel, and was an excellent conductor of electricity and heat. *Id.* at 32–34 (citing Exs. 1013, 1027–1032, 1035, 1037; Ex. 1003 ¶¶ 155–160). Petitioner further argues that use of paramagnetic materials would have been a predictable application of known techniques with a reasonable expectation of success, and an obvious matter of design choice. *Id.* at 34–36 (citing Ex. 1003 ¶¶ 161–162).

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).

In regard to claims 14 and 19, Patent Owner argues that one of ordinary skill would not have been motivated to use a paramagnetic material such as aluminum as the "magnetic" material of Wakuda, because Wakuda makes no mention of paramagnetic materials, and that one of ordinary skill would have understood that the category of "magnetic" materials in Wakuda did not include paramagnetic materials such as aluminum. PO Resp. 21–22 (citing Ex. 2009 ¶ 130). Patent Owner argues that the references on which Petitioner relies do not support Petitioner's argument that paramagnetic materials are one of a limited number of "magnetic" materials that would have been regarded as an appropriate choice for use in Wakuda. *Id.* at 21–29. In particular, while Exhibit 1032 ("Magnetic Materials") broadly

states that "**All** materials are magnetic in the sense that they are affected by magnetic fields," it also states that "most applications of magnetic materials call for ferromagnetic materials." *Id.* at 22 (citing Ex.1032; Ex. 2009 ¶ 131). Patent Owner points out that Wakuda expressly calls for the use of both "a magnetic substance" and "a non-magnetic substance" for different parts of its apparatus, which, argues Patent Owner, would inform one of ordinary skill that the broad classification in Exhibit 1032 of all materials being a type of magnetic material would not have applied to the term "magnetic" as used in Wakuda. *Id.* (citing Ex. 1005, 4:34–38, 4:48–54); *see also* Tr. 33:1–6.

Patent Owner also relies on the statement in Exhibit 1037 ("Hitchhiker's Guide to Magnetism"):

> Ferromagnetic and ferrimagnetic materials are usually what we consider as being magnetic (*i.e.*, behaving like iron). The remaining three are so weakly magnetic that they are usually thought of as "nonmagnetic."

PO Resp. 23 (citing Ex. 1027, 1; Ex. 2009 ¶ 132). In addition, Patent Owner argues that Exhibit 1031 (US Patent 8,134,437), which Petitioner cites as an example of using aluminum for housings of haptic feedback actuators (at Pet. 32), refers to paramagnetic materials — and to aluminum specifically — as "non-magnetic." *Id.* at 23–24 (citing Ex. 1031, 21:61–22:3; Ex. 2009 ¶ 134).

Further, relying on a textbook by McLyman (Exhibit 1012) submitted by Petitioner and on the above reproduced Figure 1B of Wakuda, Patent Owner argues that the shape of the lines of flux shown in Figure 1B would only work with ferromagnetic material, not paramagnetic material — thus, argues Patent Owner, one of ordinary skill would not regard paramagnetic materials as a reasonable design choice for what is shown in Wakuda. PO

Resp. 24–27 (citing Ex. 1005, Fig. 1B, 5:54–64; Ex. 1012, 27; Ex. 2009 ¶¶ 135–140). Patent Owner explains that Wakuda requires materials that are good conductors of magnetic flux, which have a high permeability, such as iron, nickel, and cobalt, which have permeability values in the thousands. *Id.* at 27–28 (citing Ex. 1012, 27; Ex. 1037, 12–14; Ex. 2009 ¶¶ 141, 143). In contrast, submits Patent Owner, the permeability of aluminum is approximately 1.000022, making it a non-magnetic material with permeability of the same order as air, which has a permeability of 1.0, and thus one of ordinary skill would recognize aluminum had such a weak effect as to be unsuitable for Wakuda. *Id.* at 28–29 (citing Ex. 1012, 27; Ex. 1037, 14; Ex. 2009 ¶¶ 144–145); Sur-Reply 8.

In Reply, Petitioner argues that Wakuda does not explicitly exclude paramagnetic materials, and relies on statements in the ’830 patent which state that paramagnetic materials can reduce the reluctance of magnetic circuits, which necessarily means that they are sufficiently magnetic for use in Wakuda. Reply 10–12 (citing Ex. 1001, 14:4–19, 17:26–29, 18:20–22; Ex.1049 ¶¶ 17, 19–20). Petitioner also argues that the ’830 disclosure establishes that the level of knowledge and skill in the art reveals that paramagnetic materials do work in a comparable design. *Id.* at 13–14 (citing Ex.1049 ¶¶ 22, 25). Moreover, argues Petitioner, the fact that the ’830 patent only provides general characteristics of paramagnetic materials, but leaves implementation details up to the person of ordinary skill in the art, likewise applies to the Wakuda disclosure, thus supporting Petitioner’s argument that it would have been obvious to use paramagnetic materials in Wakuda. *Id.* at 14–16 (citing Ex. 1001, 14:3–58; Ex.1049 ¶¶ 26–27). Petitioner further argues that, even though paramagnetic materials have the

disadvantage of low permeability, they have other advantages such as light weight, rust/corrosion resistance, and electric and heat conductivity, which provide sufficient grounds to motivate their use in Wakuda. *Id.* at 12–13 (citing Ex.1049 ¶ 21).

In addition, Petitioner responds to Patent Owner's criticisms of the references that Petitioner relies on for the proposition that materials such as aluminum would have been acceptable for use in Wakuda. Reply 16–20. In particular, Petitioner's response to the statement in Exhibit 1032 ("Magnetic Materials"), that "most applications of magnetic materials call for ferromagnetic materials," is that "***most*** applications" are not "***all*** applications." *Id.* at 17 (citing Ex. 1032, 1; Ex.1055, 102:10–17; Ex. 1049 ¶ 30). Likewise, Petitioner argues that notwithstanding the statement in Exhibit 1037 ("Hitchhiker's Guide to Magnetism") that paramagnetic materials are usually thought of as "nonmagnetic," paramagnetic materials nevertheless have a degree of magnetic characteristics. *Id.* at 18 (citing Ex. 1037, 1; Ex.1055, 104:12–19, 103:3–5; Ex. 1049 ¶ 31). Further, Petitioner asserts that Patent Owner misconstrues Exhibit 1031 (US Patent 8,134,437), arguing that "nothing in [that reference] equates 'non-magnetic' with 'paramagnetic.'" *Id.* (citing Ex. 1031, 21:61–22:3, 38:2–4, 35:4–6, 36:17–19, 36:55–57; Ex. 1049 ¶ 32). Finally, Petitioner argues that the McLyman textbook (Exhibit 1012) does not identify aluminum or any other paramagnetic materials as nonmagnetic, and points out that the permeability of aluminum is greater than that of air (1.000022 versus 1.00000037). *Id.* at 19–20 (citing Ex. 1012, 27; Ex. 1054; Ex. 1055, 117:7–118:12; Ex. 1049 ¶¶ 34–35).

We agree with Patent Owner that a person of ordinary skill in the art would not have been motivated to use paramagnetic materials for the flux paths in Wakuda. Starting with claim 14 itself, it limits the use of paramagnetic materials to those that are "further include[ed]" and that are "shaped and positioned to reduce the reluctance . . . ." Ex. 1001, 17:27–28. The '830 patent specification further emphasizes that the added paramagnetic materials must be of "adequate permeability and size (to avoid saturation)" to provide a lower-resistance (referred to as "lower reluctance") path for magnetic flux, "allow[ing] the magnetic field to more efficiently perform more work." *Id.* at 14:13–19. Indeed, the patent further instructs that the material is "made from a material with a ***relatively large magnetic permeability*** . . . to concentrate and increase the linear magnetic forces produced by the various coils." *Id.* at 15:34–38 (emphasis added). Thus, merely relying, as Petitioner does, on the common use of aluminum as a ***structural*** component, such as in housings of haptic feedback actuators, is an unconvincing argument for obviousness of the claim over Wakuda. Petitioner would in effect broadly construe claim 14 so that it added nothing to claim 1, given that any device that embodied claim 1 would normally include a casing made of aluminum or the like.

In any event, the issue here is whether one of ordinary skill would have been motivated to implement the materials that Wakuda specifies to be "magnetic" with paramagnetic materials. We find in the negative. Wakuda carefully specifies that the materials that form the flux path in the disclosed embodiment that Petitioner relies on are "made of a ***magnetic substance***" or "***magnetic material***":

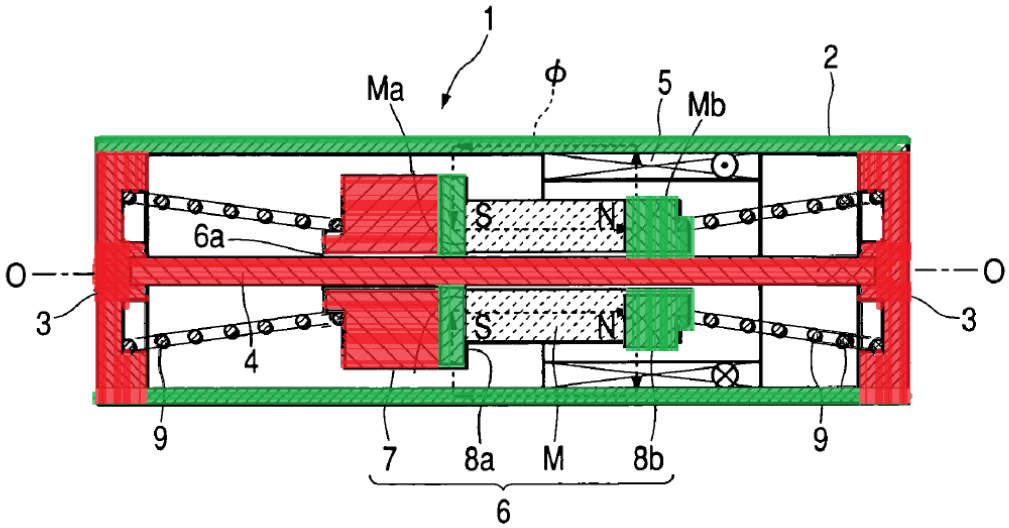
> The vibration generating means **1** shown in FIG. 1 comprises a cylindrical-shaped casing **2** made of a ***magnetic substance*** as a support . . . .
>
> . . . .
>
> [T]he magnet M is provided on both end surfaces thereof with yoke members **8a, 8b**, which are formed from a ***magnetic material*** . . . .

Ex. 1005, 4:34–36, 4:51–54 (emphasis added). Likewise, the non-flux-path portions of the Wakuda embodiment are carefully specified as "made of a ***non-magnetic substance***":

> [C]overs **3, 3** [are] made of a ***non-magnetic substance*** . . . . A shaft **4** [is] made of a ***non-magnetic substance*** . . . .
>
> . . . .
>
> The movable body **6** is provided at one end thereof (a X2 side) with a weight **7** made of a ***non-magnetic substance*** . . . .

Ex. 1005, 4:34–36, 4:51–54 (emphasis added). The above description is illustrated in the highlighted version of Wakuda Figure 1B reproduced below.

FIG. 1B



In Figure 1B above, the components specified as made of magnetic substance/material are highlighted in green and those of non-magnetic substance/material are highlighted in red.

Wakuda explains the importance of the distinction that it draws between magnetic versus non-magnetic substances/materials: "[s]ince the shaft **4** is formed from a ***non-magnetic material***, the movable body **6** is not attracted to the shaft **4** by forces of the magnet and a moving load is small when the movable body **6** moves along the shaft **4**." Ex. 1005, 4:64–67 (emphasis added). In addition, the importance of using magnetic substances/materials to maintain a strong magnetic flux path is apparent from the fact that regulating the resonant frequency of the motion of the moveable body in the Wakuda system depends on detecting the changes in electromotive force resulting from the relative position of the yoke 8b to the coil 5. *Id.* at Fig. 2, 6:18–24, 9:63–10:32. Petitioner has not explained how a paramagnetic material with very low permeability would work in this context, and Patent Owner's expert testifies that it would not work. Ex. 2009 ¶ 140;[21] *see also* Sur-Reply 8–9 (citing Ex. 2009 ¶¶ 137–145).

That one of ordinary skill would not have considered using paramagnetic materials such as aluminum in Wakuda as the specified magnetic substance becomes apparent by asking the question, "if the components that Wakuda instructs to be made of magnetic materials are made of aluminum (or some alternative low-permeability paramagnetic substance), what then are the non-magnetic components made of?"

[21] At the hearing, Patent Owner's counsel appeared hesitant to confirm Patent Owner's expert's testimony on this score. Tr. 36:14–37:11. Nonetheless, we are persuaded by it.

Presumably the answer would not be "aluminum," because whatever Wakuda specifies, it certainly requires the magnetic substance to be something different from the non-magnetic substance. And nothing in the record reveals any other candidate substance (platinum, stainless steel, or even Teflon or wood) with sufficiently lower permeability than aluminum that would persuasively justify calling that material "non-magnetic" as the counterpart to the supposedly "magnetic" aluminum. *See* Ex. 1054, 5.

None of Petitioner's arguments directed to the advantages of using aluminum — light weight, rust/corrosion resistance, and electric and heat conductivity — are enough to compensate for the inadequate low permeability of aluminum that make it unsuitable for the Wakuda application. Sur-Reply 8–9 (citing Ex. 2009 ¶¶ 137–145). Also, to the extent a person of ordinary skill in the art would have known to use aluminum for reasons unrelated to magnetism (for example, for structure), Petitioner has not adequately established that the aluminum in this instance would be meaningfully "shaped and positioned to reduce the reluctance of one or more magnetic circuits," as claims 14 and 19 require. In addition, Petitioner's substantial reliance on the disclosures in the '830 patent (at Reply 11–16) is unpersuasive. Clearly, it is improper to determine that the '830 patent claims would have been obvious because of the teachings of the '830 patent itself. *See Graham*, 383 U.S. at 36 ("resist the temptation to read into the prior art the teachings of the invention in issue").

Accordingly, we determine, having considered and weighed the entirety of the evidence, that Petitioner has not proved by a preponderance of the evidence that claims 14 and 19 are unpatentable under 35 U.S.C.

§ 103(a) over the combination 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.[22] 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 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 III.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

[22] 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 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.

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).

Patent Owner does not provide any separate argument directed to dependent claims 15 and 16. *See generally* PO Resp. Patent Owner makes the same argument for claim 20 as for claim 1, which we consider above. PO Resp. 35. We determine, having considered and weighed the entirety of the evidence, that Petitioner has proved by a preponderance of the evidence that claims 15, 16, and 20 are unpatentable under 35 U.S.C. § 103(a) over the combination of Gregorio, Ramsay, Rossi, Aldrich, and Tierling.

IV. CONCLUSION[23]

For the foregoing reasons, we are persuaded that Petitioner establishes by a preponderance of the evidence that claims 1–8, 15–17, and 20 of the

[23] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this

'830 patent are unpatentable and claims 14 and 19 of the '830 patent are not unpatentable.

In summary:

Claims	35 U.S.C. §	References/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–7	103(a)	Gregorio[24]		
8, 14, 19	103(a)	Gregorio, Wakuda[25]		
15, 16, 20	103(a)	Gregorio, Tierling[26]		
1–7, 15, 17, 20	103(a)	Gregorio, Ramsay[27]		

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).

[24] We do not reach this ground because we have considered claims 1–7 in light of the combination of Gregorio, Ramsay, Rossi, and Aldrich.

[25] We do not reach this ground because we have considered claims 8, 14, and 19 in light of the combination of Gregorio, Ramsay, Rossi, Aldrich, and Wakuda.

[26] We do not reach this ground because we have considered claims 15, 16, and 20 in light of the combination of Gregorio, Ramsay, Rossi, Aldrich, and Tierling.

[27] We do not reach this ground because we have considered claims 1–7, 15, 17, and 20 in light of the combination of Gregorio, Ramsay, Rossi, and Aldrich.

Claims	35 U.S.C. §	References/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
8, 14, 19	103(a)	Gregorio, Ramsay, Wakuda[28]		
15, 16, 20	103(a)	Gregorio, Ramsay, Tierling[29]		
1–7, 15, 17, 20	103(a)	Gregorio, Ramsay, Rossi, Aldrich	1–7, 15, 17, 20	
8, 14, 19	103(a)	Gregorio, Ramsay, Rossi, Aldrich, Wakuda	8	14, 19
15, 16, 20	103(a)	Gregorio, Ramsay, Rossi, Aldrich, Tierling	15, 16, 20	
Overall Outcome			1–8, 15–17, 20	14, 19

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that claims 1–8, 15–17, and 20 of US Patent 9,941,830 B2 have been shown to be unpatentable under 35 U.S.C. § 103; and

[28] We do not reach this ground because we have considered claims 8, 14, and 19 in light of the combination of Gregorio, Ramsay, Rossi, Aldrich, and Wakuda.

[29] We do not reach this ground because we have considered claims 15, 16, and 20 in light of the combination of Gregorio, Ramsay, Rossi, Aldrich, and Tierling.

FURTHER ORDERED that claims 14 and 19 of US Patent 9,941,830 B2 have not been shown to be unpatentable under 35 U.S.C. § 103; and

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

PETITIONER:

W. Karl Renner
Thomas Rozylowicz
Sangki Park
Craig Deutsch
FISH & RICHARDSON P.C.
axf-ptab@fr.com
tar@fr.com
spark@fr.com
deutsch@fr.com

PATENT OWNER:

Reza Mirzaie
Qi Tong
Kristopher Davis
Neil Rubin
RUSS AUGUST & KABAT
rmirzaie@raklaw.com
ptong@raklaw.com
kdavis@raklaw.com
nrubin@raklaw.com