

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner

v.

RESONANT SYSTEMS, INC.,
Patent Owner

Case IPR2024-00807
Patent 8,860,337

**PETITIONER'S REPLY
TO PATENT OWNER'S RESPONSE**

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LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 8,860,337
APPLE-1002	U.S. Patent No. 8,860,337 File History
APPLE-1003	Declaration of Blake Hannaford
APPLE-1004	U.S. Patent No. 7,843,277 to Pedro Gregorio, et al. ("Gregorio")
APPLE-1005	U.S. Patent No. 7,005,811 to Hiroshi Wakuda, et al. ("Wakuda")
APPLE-1006	U.S. Patent Application Publication. No. 2008/0294984 to Erin B. Ramsay, et al. ("Ramsay")
APPLE-1007	U.S. Patent Application Publication No. 2006/0109256 to Danny A. Grant, et al. ("Grant")
APPLE-1008	U.S. Patent Application Publication No. 2005/0134561 to Kollin M. Tierling, et al. ("Tierling")
APPLE-1009	U.S. Patent Publication No. 2008/0246532 ("Cosper")
APPLE-1010	U.S. Patent Application Publication No. 2008/0198139 to Robert Andre Lacroix, et al. ("Lacroix")
APPLE-1011	U.S. Patent Application Publication No. 2005/0134562 to Danny Grant, et al.
APPLE-1012	C. McLyman, <i>Transformer and Inductor Design Handbook</i> , Marcel Dekker, Third Edition, Revised and Expanded, 2004
APPLE-1013	U.S. Patent No. 6,088,017 to Mark R. Tremblay, et al.

APPLE-1014	U.S. Patent No. 8,686,952 to Bobby Burrough, et al.
APPLE-1015	U.S. Patent No. 8,207,832 to Jue Byung Yun, et al.
APPLE-1016	U.S. Patent No. 8,203,640 to Jong Hwan Kim, et al.
APPLE-1017	U.S. Patent Application Publication No. 2007/0285216 to Kollin M. Tierling, et al.
APPLE-1018	Thorsten A. Kern, <i>Engineering Haptic Devices: A Beginner's Guide for Engineers</i> , Springer, 2009
APPLE-1019	U.S. Patent No. 6,982,696 to Erik J. Shahoian
APPLE-1020	U.S. Patent No. 4,879,641 to Domenico Rossi, et al. (“Rossi”)
APPLE-1021	Jack Aldrich, et al, <i>Controller for Driving a Piezoelectric Actuator at Resonance</i> , NASA Tech Briefs, April 2008 (“Aldrich”)
APPLE-1022	Declaration of June Munford re Aldrich
APPLE-1023	U.S. Patent No. 7,027,032 to Louis B. Rosenberg, et al. (“Rosenberg”)
APPLE-1024	U.S. Patent No. 5,736,797 to Ryo Motohashi, et al. (“Motohashi”)
APPLE-1025	U.S. Patent No. 5,955,799 to Hidetoshi Amaya, et al. (“Amaya”)
APPLE-1026	J. Peckol, <i>Embedded Systems, A contemporary Design Tool</i> , 2008 (“Peckol”)
APPLE-1027	Corrosion - two case studies: aluminium and iron, Primary Connections: Linking science with literacy, available at

<https://www.primaryconnections.org.au/themes/custom/connections/assets/SBR/data/Chem/sub/corrosion/corrosion.htm#:~:text=When%20it%20starts%20to%20corrode,keep%20attacking%20the%20underlying%20iron> (retrieved 2/12/2024)

- APPLE-1028 How to Protect Aluminum From Corrosion, OneMonroe, available at <https://monroeengineering.com/blog/how-to-protect-aluminum-from-corrosion/> (retrieved 2/12/2024)
- APPLE-1029 Electrical Conductivity of Materials, Blue Sea Systems, https://www.blueseasystems.com/resources/108/Electrical_Conductivity_of_Materials (retrieved 2/12/2024)
- APPLE-1030 Thermal Conductivity, available at hyperphysics.phy-astr.gsu.edu/hbase/Tables/thrcn.html (retrieved 2/12/2024)
- APPLE-1031 U.S. Patent No. 8,134,437 to Elliot Brooks
- APPLE-1032 David R. Lide, CRC Handbook of Chemistry and Physics, CRC Press, 80th Ed., 1999-2000
- APPLE-1033 Resonant Systems Proposed Claim Constructions, 7-23-cv-00077 (WDTX) (Feb. 15, 2024)
- APPLE-1034 Apple, Inc. Proposed Claim Constructions, 7-23-cv-00077 (WDTX) (Feb. 15, 2024)
- APPLE-1035 Types of Magnetism, DoITPoMS, Department of Materials Science and Metallurgy, University of Cambridge; archived at Wayback Machine; citing a capture dated October 9, 2006 (https://web.archive.org/web/20061015000000*/https://www.doitpoms.ac.uk/tlplib/ferromagnetic/types.php)
- APPLE-1036 Motion to Transfer Venue, 7-23-cv-00077 (WDTX)
- APPLE-1037 Moskowitz, B.M. (1991). Hitchhiker's Guide to Magnetism. In Environmental Magnetism Workshop, pp. 1–38. Minneapolis:

The Institute for Rock Magnetism and the Global Paleorecords
Research Training Group

APPLE-1038	Resistance and Ohm's Law; archived at Wayback Machine; citing a capture dated February 18, 1999 (https://web.archive.org/web/19990218085938/https://physics.bu.edu/~duffy/PY106/Resistance.html)
APPLE-1039	[RESERVED]
APPLE-1040	U.S. Patent Publication No. 2011/0133682 ("Egger")
APPLE-1041	U.S. Patent Publication No. 2008/0001484 ("Fuller")
APPLE-1042	U.S. Patent Publication No. 2006/0145547 ("Kraus")
APPLE-1043	U.S. Patent Publication No. 2005/0275294 ("Izumi")
APPLE-1044	[RESERVED]
APPLE-1045	[RESERVED]
APPLE-1046	Apple, Inc. Opening Claim Construction Brief, 7-23-cv-00077 (WDTX) (March 21, 2024)
APPLE-1047	Resonant Systems Responsive Claim Construction Brief, , 7- 23-cv-00077 (WDTX) (April 11, 2024)
APPLE-1048	Stipulation Letter
APPLE-1049	Second Declaration of Blake Hannaford
APPLE-1050	Wikipedia, Power supply, available at https://en.wikipedia.org/wiki/Power_supply , retrieved May 6, 2025

- APPLE-1051 Dictionary Definition of “Power Supply” (Comprehensive Dictionary of Electrical Engineering, 2nd Ed., 2005)
- APPLE-1052 Dictionary Definition of “Power Supply” (Lotus Illustrated Dictionary of Electrical Engineering, 2008)
- APPLE-1053 Dictionary Definition of “Power Supply” (Dictionary of Science And Technology, 2nd Ed., 2007)
- APPLE-1054 Wikipedia, Permeability (electromagnetism), available at [https://en.wikipedia.org/wiki/Permeability_\(electromagnetism\)](https://en.wikipedia.org/wiki/Permeability_(electromagnetism)), as cited in footnote 122 of Declaration of Patent Owner’s Expert, Dr. Goossen (EX-2009), retrieved May 5, 2025
- APPLE-1055 Certified Copy of Deposition Transcript of Patent Owner’s Expert, Dr. Keith W. Goossen, May 8, 2025

I. INTRODUCTION

The record is abundantly clear that Wakuda and Gregorio respectively teaches outputting a value to a power supply (the only limitation of claim 2 challenged by Patent Owner). Patent Owner's response (POR, or Response) fails to show otherwise. Indeed, Patent Owner ignores the express disclosures of Wakuda and Gregorio in teaching a power supply.

For these reasons, as further explained below, Patent Owner's arguments should be rejected and the Challenged Claims should be cancelled as obvious.

II. WAKUDA-BASED GROUNDS 1-2 RENDER CLAIMS 2-3 OBVIOUS UNDER MEANS-PLUS-FUNCTION CONSTRUCTIONS

As detailed in the Petition, Wakuda expressly describes its "drive means" as the claimed power supply, and teaches that its processor outputs the value ("drive signal") to the drive means, thereby satisfying step 762 of FIG. 7C. Pet., 17-18; APPLE-1049, [1].

The POR argues that the Petition fails to demonstrate that the processor "computes an output value p" and "outputs the value p to the power supply." POR, 15-20; APPLE-1049, [2]. This assertion ignores Wakuda's explicit disclosure of the claimed power supply (e.g., Wakuda's "drive means") and the processor computing and outputting a value (e.g., Wakuda's "drive signal") to the power supply. Pet., 7-8 (overview of Wakuda), 17-18 (element [1f] in Ground 1), 25 (element [2f] in

Ground 1), 47-49 (elements [1f] and [2f] in Ground 2).

A. Wakuda's "Drive Means" Teaches The Claimed Power Supply

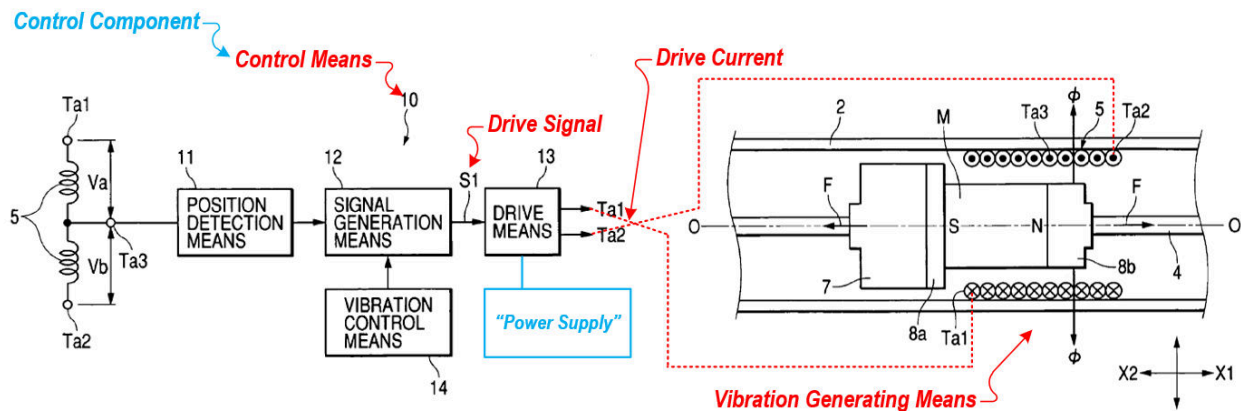
In Ground 1, the Petition clearly identified Wakuda's "drive means" as corresponding to the claimed power supply, citing Wakuda's FIG. 3. Pet., 17-18; APPLE-1049, [3]. This analysis is based on Wakuda's explicit disclosure:

The drive means 13 is provided with two output parts, one of which is connected to one of the terminals Ta1 of the coil 5 and the other of which is connected to the other of the terminals Ta2 of the coil 5.

The signal generation means 12 generates a drive signal S1 on the basis of a command from the vibration control means 14 to output the same to the drive means 13, and *a drive current having a predetermined waveform is given to the terminal Ta1 and the terminal Ta2 of the coil 5 from the drive means 13.* The signal generation means 12 stores the drive signals S1 having a plurality of patterns, and a drive signal S1 having a certain pattern is selected on the basis of a command from the vibration control means 14 to be given to the drive means 13.

APPLE-1005, 6:26-39.¹ This was also shown in annotated FIGS. 3 and 4 of Wakuda in the Petition. Pet., 18 (reproduced below).

¹ Unless otherwise noted, all emphasis added.



APPLE-1005, FIGS. 3 and 4 (annotated)

Indeed, Wakuda describes that the drive means 13 is connected to two terminals Ta1 and Ta2 of the coil 5 in the vibration generating means 1, and supplies “a drive current having a predetermined waveform” to the terminals of the coil. APPLE-1005, 6:18-39; Pet., 17-18. The drive means qualifies as a power supply because a POSITA would have understood and found it obvious that electric current is supplied with voltage, and electric power is defined by current and voltage. Pet., 17-18; APPLE-1003, [110], [134] (“electric power is defined by current and voltage”); APPLE-1049, [4]; *see also* APPLE-1055, 76:11-14 (“Q. Would you agree that if you supply current and voltage, that you are supplying power? A. Yes. But, he doesn't explain how.”), 138:17-20 (“Q. But, current power -- current/power necessarily comes from [a] power supply, correct? A. Yes. What I am saying there is that a single signal controls everything.”). Patent Owner’s expert, Dr. Goossen, agreed. EX-2009, [151] (“This is consistent with, and supports, my opinion that

Wakuda teaches a single drive signal S1 to drive means 13 to control both direction and *current/power*[.]”).²

A POSITA would have understood and found obvious that Wakuda’s drive means corresponds to the power supply, given the plain and ordinary meaning of the term “power supply.” APPLE-1049, [5]. For example, a POSITA would have

² While acknowledging his original opinion (APPLE-1055, 138:3-9), Dr. Goossen attempted to withdraw this opinion by characterizing this as “clumsy language” and redefine it as “to control both direction and the [] amplitude of the vibration” because the drive signal S1 “doesn’t change the amount of [current].” APPLE-1055, 134:13-135:4 (“Q. So, you would agree that drive signal again controls both direction and current/power, correct? A. Yeah. The -- that is a little bit clumsy language there. The drive signal S1 is constant current. And it uses that to control both direction and the, I would say, you know, amplitude of the vibration.”), 135:22-136:9, 138:12-16 (“Drive signal S1 is controlling the amplitude of the vibration waveform by its duty cycle. It doesn’t change the amount of – it itself doesn’t change current level.”). However, as discussed in this reply, this testimony is directly contrary to Wakuda’s express disclosure that the drive signal S1 can also change the amount of current. *See* §II.A.

understood that the power supply is “an electrical device that supplies electric power to an electrical load” (APPLE-1050, 1), and this aligns exactly with what Wakuda (and other relevant prior art) describes with respect to the drive means 13, which is configured to supply a drive current to the coil of the vibration generating means. APPLE-1049, [5]; APPLE-1005, 6:18-39; *see also* APPLE-1051 (“an electronic module that converts power from some power source to a form which is needed by the equipment to which power is being supplied”); APPLE-1052 (“a separate unit or part of a circuit that supplies power to the rest of the circuit or to a system”); APPLE-1053 (“an electrical circuit that provides certain direct current voltage and current levels from an alternating current source for use in other electrical circuits”); *see also* ID (Paper 10), 30 (“Moreover, the ’337 patent does not disclose any detail or structure for the controllable power supply, indicating that such a controllable power supply was well-known.”).

Ignoring this express disclosure of Wakuda, Patent Owner argues that Wakuda teaches only a “single” drive signal S1, which allegedly only corresponds to the directional output “d” in the ’337 patent, and further argues that Wakuda is missing “a separate output p to the power supply.” POR, 16-19. Patent Owner’s argument is centered on the assumption that Wakuda’s drive signal S1 is designed only to change *the direction* of current, and does not change *the amount* of current. POR, 16-17 (“A POSITA reading Wakuda would readily understand Wakuda’s

teaching to use a single drive signal to control both the frequency and amplitude of the vibration of the vibration generating means, by controlling whether the drive signal is in-phase (“accumulation signal”) or out-of-phase (“damping signal”) with the vibrational waveform.”), 19-20 (“Wakuda teaches a drive signal to the drive means to switch the direction of the current supplied by the power supply to the coil, which is sufficient, in the context of the purported obviousness combination, to control the haptic effects.”). Dr. Goossen attempts to support this argument by repeatedly qualifying Wakuda’s drive means as “a conduit for power” APPLE-1055, 124:1-2, 125:11-16 (“the conduit for current”), 126:1-4, 128:7-129:5 (describing the ’337 patent’s H-bridge switch 620 as a conduit for power, which is separate from power supply 612 in the ’337 patent’s FIG. 6); *see also id.*, 76:20-77:2, 79:11-16, 127:16-19. His assertion is conclusory, contradicts Wakuda’s disclosure, and incorrectly assumes that Wakuda uses the same type of switching circuit disclosed in the ’337 patent. APPLE-1049, [6].

The assumption by Patent Owner and Dr. Goossen—Wakuda’s drive signal S1 is only to change the direction of constant current—is wrong. APPLE-1049, [7]. Nowhere does Wakuda limit its drive means 13 to only a switch that changes the direction of current. *Id.* In fact, Wakuda offers numerous teachings otherwise, namely a drive signal S1 having variable current. While Wakuda illustrates the drive signal S1 having a rectangular waveform as an example with reference to FIGS. 4-

6, Wakuda also clearly states that the drive signal S1 is not limited to this example and offers other example drive signals having a time-varying current level, such as a drive signal S1 having “a triangular wave or the like.” APPLE-1005, 6:63-66 (“In the embodiment, while the drive signal S1 is given to the coil 5 as a rectangular wave, the drive signal S1 may have a waveform such as a triangular wave or the like.”). Several paragraphs in Wakuda describe the driving signal to have a variable amount of current. For example, Wakuda describes that vibration amplitude “can be abruptly increased by increasing the excitation signal A or the reverse excitation signal B [of the drive signal S1] *in current quantity*.” APPLE-1005, 7:61-63. Further, in Wakuda, “the envelope E [of the vibration] can be changed in amplitude by changing the number of and *a current quantity* of the excitation signal A and the reverse excitation signal B [of the drive signal S1] and changing the number of and *a current quantity* of the inhibition signals C and the reverse inhibition signals D [of the drive signal S1].” *Id.*, 9:40-48; *see also id.*, 8:7-14 (describing, as an alternative method for increasing/decreasing vibration amplitude, “varying an input energy” by “control[ling] through amplitude variation, in which a drive current (or a drive voltage) given to the coil 5 is varied in quantity, and PWM (Pulse Width Modulation) control, in which a drive current (or a drive voltage) is varied in energization time”).

As shown, Wakuda clearly discloses that the drive signal S1 is configured to

adjust *both the direction and amount* of current being supplied to the drive means 13, which corresponds to the claimed power supply. APPLE-1049, [8]. The time-varying magnitude of the drive signal S1 confirms that the drive means 13 functions as the claimed power supply. *Id.*

B. Wakuda Teaches Outputting A Value (“Drive Signal”) To The Power Supply (Step 762 of FIG. 7C)

Wakuda expressly describes outputting the “drive signal” (output “p”) to the drive means (power supply), and the drive signal is designed to control both direction and amount of current being supplied to the coil of the vibration generating means. APPLE-1005, 6:18-39; *see also* Pet., 17-18; APPLE-1003, [110], [134]; APPLE-1049, [9]. Because the other references (Ramsay, Rossi, and Aldrich) do not modify these aspects of Wakuda, the combination of Wakuda-Ramsay-Rossi-Aldrich does not change the above analysis based on Wakuda. APPLE-1049, [9].

Nevertheless, Patent Owner argues that Wakuda fails to teach outputting value “p” to the power supply because Wakuda’s drive signal S1 only corresponds to the directional output “d” in the ’337 patent. POR, 16-20. In particular, Patent Owner alleges that, under the means-plus-function construction, the control component provides two values: (1) directional output “d” corresponding to the desired direction, and (2) separate output “p” to the power supply, and that the Petition fails to show the latter. POR, 19. As explained above in Section II.A, this is wrong.

APPLE-1049, [10]. As shown above, Wakuda's control component outputs both the desired direction "d" and the desired power "p." *Id.*

In the Wakuda-Ramsay-Rossi combination, Rossi's H-bridge is implemented as *part* of Wakuda's drive means 13 to switch the direction/polarity of drive signals to the coil of the vibration generating means, thereby adjusting the frequency of haptic effect. Pet., 32; APPLE-1003, [135]-[144]; APPLE-1049, [11]. Contrary to Patent Owner's conclusory arguments, Rossi's H-bridge does not replace the entirety of Wakuda's drive means 13. Instead, it provides an example of how to implement the frequency control part (e.g., directional signal control part) of Wakuda's drive means 13. *Id.* Accordingly, Wakuda's drive means 13 preserves the capability to adjust the amplitude of current being applied to the coil in order to adjust the strength/magnitude of the haptic vibration. *Id.*; *see generally* Pet., 32-34, 39-40; APPLE-1003, [135]-[144], [160].

Therefore, the Petition's analysis ("the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user") is supported by the Wakuda-Ramsay-Rossi-Aldrich combination, which implements the processor in the resulting system as outputting the drive signal (including outputs "p" and "d") to the drive means 13 (power supply), according to a user input (as shown in Ramsay). Pet., 17-18 (citing APPLE-1005, 6:23-47), 47; APPLE-1003, [110]-[113], [186]-[188] (citing APPLE-1006,

[0022]-[0026], [0030]-[0033], [0035], [0039], [0046], [0051], [0053]-[0055]); APPLE-1049, [12].

III. GREGORIO-BASED GROUNDS 3A-B AND 4A-B RENDER CLAIMS 2-3 OBVIOUS UNDER MEANS-PLUS-FUNCTION CONSTRUCTIONS

As discussed in the Petition, Gregorio expressly describes its “actuator drive circuit” as the claimed power supply and teaches that its processor outputs the value (“control signals”) to the actuator drive circuit, thereby satisfying step 762 of FIG. 7C. Pet., 50-52, 59-60, 62-65, 79-80; APPLE-1049, [13].

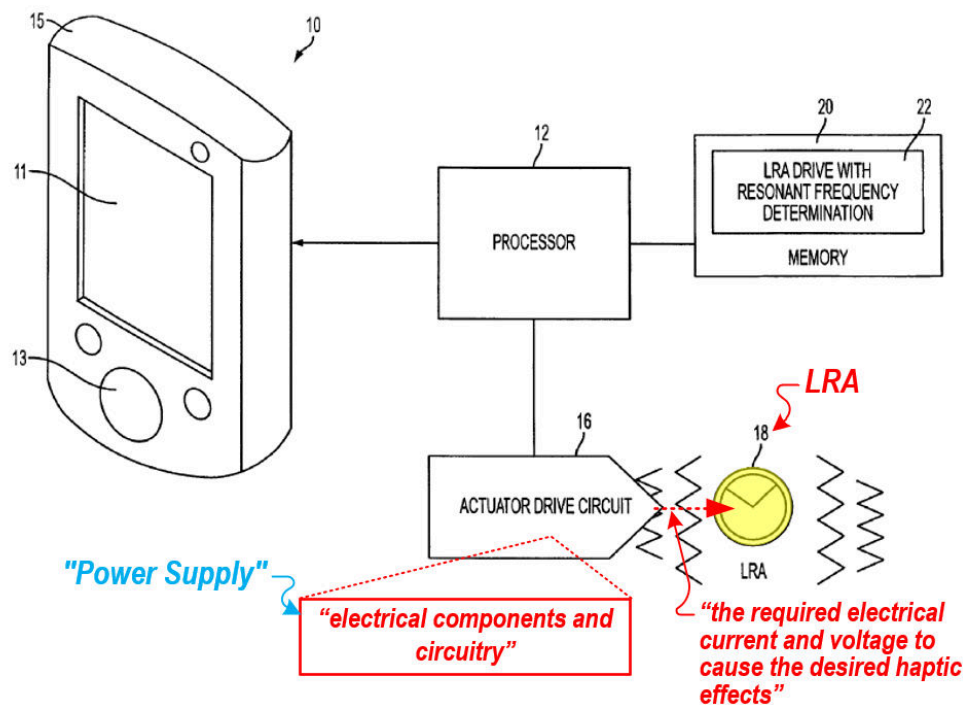
The POR argues that the Petition fails to demonstrate that the processor “computes an output value p” and “outputs the value p to the power supply.” POR, 24, 27. Patent Owner’s assertion again ignores Gregorio’s explicit disclosure of the claimed power supply (e.g., Gregorio’s “actuator drive circuit”) and the processor computing and outputting a value (e.g., Gregorio’s “control signals”) to the power supply. Pet., 50-52 (overview of Gregorio), 59-60 (element [1c] in Ground 3A), 62-64 (element [1f] in Ground 3A), 65 (elements [2c] and [2f] referring to elements [1c] and [1f] in Ground 3A), 70 (elements [2c] and [2f] in Ground 3B referring to corresponding elements in Ground 3A), 79 (elements [2c] and [2f] in Ground 4A), 80 (Ground 4B); APPLE-1049, [14].

A. Gregorio’s “Actuator Drive Circuit” Teaches The Claimed Power Supply

In Ground 3A (element [1c]), the Petition identifies Gregorio's "actuator drive circuit" as the claimed power supply. Pet., 59-60 (citing Gregorio's FIG. 1); APPLE-1049, [15]. This analysis is based on Gregorio's explicit disclosure:

Processor 12 outputs the 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.

APPLE-1004, 2:36-39. This was also shown in annotated FIG. 1 of Gregorio in the Petition. Pet., 60 (reproduced below).



APPLE-1004, FIG. 1 (annotated)

Indeed, Gregorio describes that the actuator drive circuit 16 includes "electronic components and circuitry used to supply LRA 18 with the required

electrical current and voltage,” and therefore is qualified as a power supply because “electric power is defined by current and voltage.” Pet., 59-60; APPLE-1004, 2:36-39; APPLE-1055, 76:11-14 (“Q. Would you agree that if you supply current and voltage, that you are supplying power? A. Yes. But, he doesn't explain how.”); APPLE-1049, [16].

A POSITA would have understood and found obvious that Gregorio’s actuator drive circuit corresponds to the power supply, given the plain and ordinary meaning of the term “power supply.” APPLE-1049, [17]. For example, a POSITA would have understood that the power supply is “an electrical device that supplies electric power to an electrical load” (APPLE-1050, 1), and this aligns exactly with Gregorio’s description of actuator drive circuit 16, “which includes electronic components and circuitry used to supply LRA 18 with the required electrical current and voltage” (APPLE-1004, 2:36-39). APPLE-1049, [17]; *see also* APPLE-1051 (“an electronic module that converts power from some power source to a form which is needed by the equipment to which power is being supplied”); APPLE-1052 (“a separate unit or part of a circuit that supplies power to the rest of the circuit or to a system”); APPLE-1053 (“an electrical circuit that provides certain direct current voltage and current levels from an alternating current source for use in other electrical circuits”); *see also* ID (Paper 10), 44 (“Moreover, the ’337 patent does not disclose any detail or structure for the controllable power supply, indicating that such

a controllable power supply was well-known.”).

Confronted with Gregorio’s express discussion of the power supply, Patent Owner’s expert, Dr. Goossen, introduced a new argument during his deposition that Gregorio’s actuator drive circuit is only “a conduit for power” because “it does not vary the level of power.” APPLE-1055, 76:20-77:2, 79:11-16, 127:16-19; APPLE-1049, [18]. In the context of the ’337 patent’s FIG. 6, he characterized H-bridge switch 620 as a conduit for power, which is separate from power supply 612. APPLE-1055, 128:7-129:5. Therefore, similar to the argument with respect to Wakuda, Dr. Goossen appears to argue that Gregorio’s actuator drive circuit would only operate to change the polarity of current flowing through the drive circuit, based only on a “directional signal d.” APPLE-1049, [18]; *see* APPLE-1001, 5:68-65. This assertion is conclusory, contradicts Gregorio’s disclosure, and incorrectly assumes that Gregorio uses the same type of switching circuit disclosed in the ’337 patent. APPLE-1049, [18].

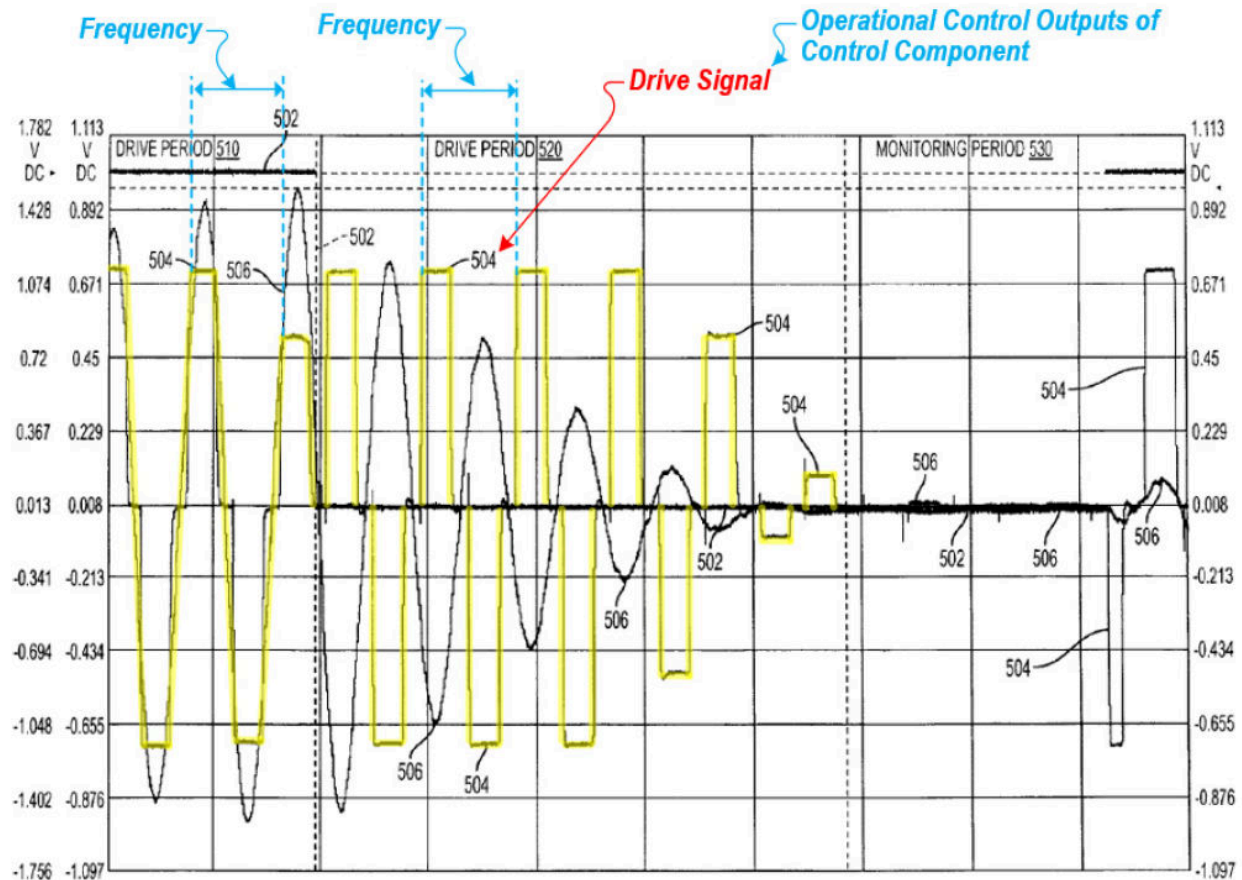
Indeed, Gregorio offers no reason to limit its actuator drive circuit 16 in such a way, namely only as a switch that controls the polarity of the drive signals for LRA 18. APPLE-1049, [19]. Referring to FIG. 1, Gregorio describes that the actuator drive circuit 16 is coupled to the processor 12 and the LRA 18. APPLE-1004, 2:18-20. Gregorio describes no other element that is connected to the actuator drive circuit 16. APPLE-1049, [19]. With this configuration, Gregorio describes that

“[p]rocessor 12 outputs the control signals to drive circuit 16” and the drive circuit 16 “suppl[ies] LRA 18 with the required electrical current and voltage to cause the desired haptic effects.” *Id.*, 2:36-39. Further, Gregorio’s 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.*, 2:25-30.

Therefore, a POSITA, reading Gregorio’s disclosure, would have naturally understood and found it obvious that the “control signals” from the processor 12 to the actuator drive circuit 16 include information that controls the drive circuit 16 to “supply LRA 18 with the required electrical current and voltage” that correspond to the “high level parameters” (i.e., “magnitude, frequency and duration”) for the selected haptic effect. APPLE-1049, [20]. That is, the “control signals” from the processor 12 to the drive circuit 16 determine the attributes (e.g., amplitude, direction, etc.) of the current supplied by the actuator drive circuit 16 (the claimed power supply) to the LRA 18. *Id.*; APPLE-1004, 2:36-39, 2:45-50.

In fact, Gregorio’s drive signal 504, which is applied to LRA to generate a desired haptic effect, has a varying magnitude, which is adjusted by varying the amplitude of current or the level of power. APPLE-1004, 4:1-2, 4:5-7, 5:60-61, FIG. 5 (reproduced below with the drive signal 504 annotated to show its varying amplitude), cl. 2 (“modifying an amplitude of one of the drive pulses in response to

the signal”). As repeatedly explained above, such varying current or power is delivered from the actuator drive circuit 16 to LRA 18. APPLE-1049, [21].



APPLE-1004, FIG. 5 (annotated)

As such, the time-varying magnitude of the drive signal 504 confirms that the drive circuit 16 functions as the claimed power supply, which is controlled to provide variable current/power through the control signals from the processor 12. APPLE-1049, [22]. Dr. Goossen’s new and unsupported “conduit for power” argument does not survive scrutiny. *Id.*

B. Gregorio Teaches That The Processor Computes And Outputs A

Value (“Control Signals”) To The Power Supply (Step 762 in FIG. 7C)

Gregorio expressly describes that the processor outputs the “control signals” (output “p”) to the actuator drive circuit (power supply), and the control signals are designed to control the actuator drive circuit to supply LRA with current or power that is variable according to the high-level parameters (“magnitude, frequency and duration”) for a desired haptic effect. APPLE-1004, 2:25-30, 2:36-39, 2:45-50, 4:1-2, 4:5-7, 5:60-61, FIG. 5, cl. 2; Pet., 47 (citing APPLE-1003, [186]-[188]), 79 (citing APPLE-1003, [288], [318]-[320]); APPLE-1049, [23]. Because the other references (Ramsay, Rossi, and Aldrich) do not modify these aspects of Gregorio, the combination of Gregorio-Ramsay-Rossi-Aldrich does not change the above analysis based on Gregorio. APPLE-1049, [23].

Nevertheless, Patent Owner argues that the Petition fails to show the “output value p” to the power supply, as shown in step 762 of FIG. 7C. POR, 27. In particular, Patent Owner alleges that, under the means-plus-function construction, the control component provides two values: (1) output “d” corresponding to the desired direction, as produced by the frequency timer, and (2) output “p” to the

power supply, and that the Petition fails to show the latter. POR, 27.³ As explained above in Section III.A, this is wrong. APPLE-1049, [24]. Gregorio's control component outputs both the desired direction "d" and the desired power "p." *Id.*

In the Gregorio-Ramsay-Rossi combination, Rossi's H-bridge is implemented as *part* of Gregorio's actuator driver circuit 16 to switch the direction/polarity of drive signals to LRA, thereby adjusting the frequency of the haptic effect. APPLE-1049, [25]; Pet., 75-76; APPLE-1003, [263]-[272].

Contrary to Patent Owner's conclusory arguments, Rossi's H-bridge does not replace the entirety of Gregorio's drive circuit 16. APPLE-1049, [26]. Instead, it provides an example of how to implement the frequency control part (e.g., directional signal control part) of Gregorio's actuator drive circuit 16. *Id.* Accordingly, Gregorio's drive circuit 16 preserves the capability to adjust the amplitude of current applied to LRA to adjust the strength/magnitude of the haptic effect. *Id.*; *see generally* Pet., 75-76, 79-80; APPLE-1003, [265]-[272], [289]-[292], [323].

³ In POR, Patent Owner does not dispute that the Petition showed the features associated with output "d."

Therefore, the Petition's analysis ("the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user") is supported by the Gregorio-Ramsay-Rossi-Aldrich combination, which implements Gregorio's processor and memory (control component) as outputting the control signals (including outputs "p" and "d") to the actuator drive circuit 16 (power supply), according to a user input (as shown in Ramsay). Pet., 62-64 (citing APPLE-1004, 2:36-39, 3:12-28, 4:20-22, 4:49-65, 2:25-28), 47, 79; APPLE-1003, [186]-[188], [288], [318]-[320] (citing APPLE-1006, [0022]-[0026], [0030]-[0033], [0035], [0039], [0046], [0051], [0053]-[0055]); APPLE-1049, [27].

IV. CONCLUSION

Petitioner has established that the Challenged Claims are unpatentable and respectfully requests that the Board find the same.

Respectfully submitted,

Date: May 29, 2025

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CERTIFICATION UNDER 37 C.F.R. § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner Reply to Patent Owner Response totals 3,620 words, which is less than the 5,600 allowed under 37 CFR § 42.24(c)(1).

Respectfully submitted,

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on May 29, 2025, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response was provided by email to Patent Owner by serving the email correspondence addresses of record as follows:

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