

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Elenga et al.
U.S. Patent No.: 9,941,830 Attorney Docket No. 50095-0179IP2
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Title: LINEAR VIBRATION MODULES AND LINEAR-RESONANT
VIBRATION MODULES

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT
NO. 9,941,830 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 9,941,830
APPLE-1002	U.S. Patent No. 9,941,830 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/connect

[ions/assets/SBR/data/Chem/sub/corrosion/corrosion.htm#:~:tex
t=When%20it%20starts%20to%20corrode,keep%20attacking%
20the%20underlying%20iron](https://www.monroeengineering.com/blog/how-to-protect-aluminum-from-corrosion/) (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 Magnetic Materials, Phys 251; archived at Wayback Machine; citing a capture dated March 23, 2002 (https://web.archive.org/web/20020323183824/http://webphysics.iupui.edu/webscience/physics_archive/magneticmaterials.html)
- 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	Resonant Systems Preliminary Infringement Contentions, 7-23-cv-00077 (WDTX) (October 5, 2023)
APPLE-1045	Resonant Systems Opening Claim Construction Brief, <i>Resonant Systems, Inc. v. Samsung Electronics Co., Ltd. et al.</i> , 2-22-cv-00423 (EDTX) (December 21, 2023)
APPLE-1046	Apple, Inc. Opening Claim Construction Brief, 7-23-cv-00077 (WDTX) (March 21, 2024)
APPLE-1047	Resonant Systems, Inc.’s Responsive Claim Construction Brief, 7-23-cv-00077 (WDTX) (April 11, 2024)

LISTING OF CLAIMS

Claim 1	
[1pre]	A vibration module comprising:
[1a]	a housing;
[1b]	a moveable component;
[1c]	a power supply;
[1d]	user-input features;
[1e]	a driving component that drives the moveable component to oscillate within the housing; and
[1f]	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.
Claim 2	
[2]	The vibration module of claim 1 wherein the control component is one of: an variable oscillator circuit with additional control circuitry; and a control component that includes a microprocessor, a control program, stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by the one or more stored values.
Claim 3	
[3]	The vibration module of claim 1 wherein the 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.

Claim 4	
[4]	The vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.
Claim 5	
[5a]	The vibration module of claim 4 wherein the one or more operational control parameters is a strength of vibration produced by the oscillation of the moveable component; and
[5b]	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.
Claim 6	
[6a]	The vibration module of claim 4 wherein the 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
[6b]	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.
Claim 7	
[7]	The vibration module of claim 1 wherein the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component.

Claim 8	
[8a]	The vibration module of claim 1 wherein the housing is a tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets;
[8b]	wherein the movable component is a magnet shaped to slide within the tube; and
[8c]	wherein the driving component is an electromagnetic coil.
Claim 14	
[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.
Claim 15	
[15]	The vibration module of claim 1 wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.
Claim 16	
[16]	The vibration module of claim 15 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.
Claim 17	
[17]	The vibration module of claim 1 wherein the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features.
Claim 19	

[19pre]	A vibration module comprising:
[19a]	a housing;
[19b]	a moveable component;
[19c]	a power supply;
[19d]	user-input features;
[19e]	a driving component that drives the moveable component to oscillate within the housing;
[19f]	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; and
[19g]	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.
Claim 20	
[20pre]	A vibration module comprising:
[20a]	a housing;
[20b]	a moveable component;
[20c]	a power supply;
[20d]	user-input features;
[20e]	a driving component that drives the moveable component to oscillate within the housing; and
[20f]	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,

[20g]	wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.
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I. INTRODUCTION

Apple Inc. (“Apple” or “Petitioner”) petitions for IPR of claims 1-8, 14-17, 19, and 20 (“Challenged Claims”) of U.S. Patent No. 9,941,830 (“the ’830 patent”).

II. REQUIREMENTS FOR IPR

A. Standing

Apple certifies that the ’830 patent is available for IPR and Petitioner is not barred or estopped from requesting this review challenging the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

The Challenged Claims are invalid based on the grounds below. Dr. Hannaford provides supporting testimony (APPLE-1003).

Ground	Claims	§103
1A	1-4, 7, 8, 14, 15-17, 19, 20	Wakuda, Ramsay
1B	2-6	Wakuda, Ramsay, Amaya
1C	15, 16, 20	Wakuda, Ramsay, Tierling
2A	1-8, 14, 15-17, 19, 20	Wakuda, Ramsay, Rossi, Aldrich
2B	15, 16, 20	Wakuda, Ramsay, Rossi, Aldrich, Tierling

Each applied reference pre-dates U.S. provisional application 61/179,109, filed on May 18, 2009 (“Critical Date”), which is the earliest filed application from which the ’830 patent claims priority. Petitioner does not concede that the Critical

Date is May 18, 2009, but has applied references that pre-date the Critical Date and qualify as prior art as shown below.

Reference	Date	Pre-AIA Section
Wakuda	2/28/2006	§102(b)
Tierling	6/23/2005	§102(b)
Ramsay	11/27/2008	§102(a)
Rossi	11/7/1989	§102(b)
Aldrich	4/2008	§102(b)
Amaya	9/21/1999	§102(b)

C. Claim Construction

All claim terms should be construed according to the *Phillips* standard. The Board has repeatedly explained that “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). As the prior art discloses the claims under each of the constructions offered in the Petition, the Board need not construe the claims to resolve unpatentability. *Id.*

1. Means-Plus-Function Terms

Certain claims recite “driving component” and “control component” as discussed below. These terms do not recite “means for” and thus a presumption exists that these terms are not subject to 35 U.S.C. §112(¶6). Although Patent Owner currently agrees in co-pending litigation that the terms “control component” and “driving component” should be interpreted according to the means-plus-

function construction, Patent Owner initially asserted that these terms are under the plain-and-ordinary meaning interpretation and, even now, Patent Owner's indication of corresponding structures under the means-plus-function construction does not align with its position in parallel litigation against Samsung Electronics (2:22-cv-00423). APPLE-1033, 1-4; APPLE-1045, 14-22. In view of Patent Owner's inconsistent positions, this Petition demonstrates unpatentability by applying both the plain-and-ordinary meaning and the means-plus-function meaning of these terms. Indeed, the Petition's plain-and-ordinary meaning interpretation (Grounds 1A-1C) and means-plus-function interpretation (Grounds 2A-2B) cover all of Patent Owner's various means-plus-function treatments of the terms.

The corresponding analysis and construction under 35 U.S.C. §112(¶6) for each term is provided below. Regardless of the interpretation adopted, the instant record demonstrates that the implicated terms are plainly satisfied in view of the overlap between the prior art cited herein and the '830 patent specification.

General Electric Co., IPR2018-00928, Paper 9, 12-16 (“the rule does not prohibit a petitioner from submitting more than one construction”); *Intel Corp.*, IPR2018-01340, Paper 8, 11-13; APPLE-1003, [21]-[32].

(a) “control component”

Claims 1 and 19 recite that the “control component” performs a specified

function (“controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values”). This Petition treats “control component” in these claims as including 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. APPLE-1046, 13; APPLE-1034, 6; APPLE-1003, [24]. The Petition treats this structure and its equivalents as the corresponding structure for the “control component” in claims 1 and 19.

Claim 20 recites that the “control component” performs a specified function (“controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values” and “drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes”). This Petition treats “control component” in claim 20 as including 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 and 13:20-59. APPLE-1046, 12-13; APPLE-1034, 6; APPLE-1003, [25]. The Petition treats this structure and its equivalents as the corresponding structure for the

“control component.”

While agreeing on the means-plus-function treatment in co-pending litigation, Patent Owner identifies an alternative means-plus-function construction that only includes some unspecified part of the disclosed algorithm of the ’830 patent. APPLE-1046, 12-13; APPLE-1047, 19-23. In related litigation against Samsung Electronics, Patent Owner similarly identified alternative means-plus-function constructions that only employ an oversimplified version of the ’830 patent’s algorithm. APPLE-1045, 14-22.

Regardless, the claims are unpatentable. Specifically, the claims are demonstrated unpatentable in Grounds 2A-2B that apply the means-plus-function interpretation of the recited control component. As Grounds 2A-2B demonstrate how the prior art addresses the claims according to the narrower means-plus-function interpretation, Grounds 2A-2B likewise address Patent Owner’s broader means-plus-function position as to the “control component.”¹ The claims are also

¹ Patent Owner also argued in the Samsung litigation that the term “control component” in claims 3-5 are means-plus-function limitations. APPLE-1045, 22-28. Notably, Patent Owner’s positions are the same as its position with respect to claim 1 in that litigation, or fall squarely within Petitioner’s means-plus-function

demonstrated unpatentable in Grounds 1A-1C under the plain-and-ordinary meaning and Patent Owner's alternative means-plus-function construction. APPLE-1003, [26]-[30].

(b) “driving component”

As agreed by Patent Owner in co-pending litigation, the term “driving component that drives the moveable component to oscillate within the housing” is a means-plus-function limitation because it uses a non-structural generic placeholder (“component”) defined only by functional limitations (“driving ... the moveable component to oscillate within the housing”). The '830 patent describes the following structures that perform the recited function when they receive alternating current: “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). APPLE-1001, 5:7-41, 5:61-66, 6:40-44, 9:22-64, 10:9-34, 14:24-28. 37 CFR §42.104(b)(3); APPLE-1003, [31]-[32]. For the purpose of

interpretations. *Id.* Therefore, the Grounds in this Petition also show that claims 3-5 are unpatentable under Patent Owner's means-plus-function positions offered in the Samsung case.

analyzing the prior art grounds, the Petition treats these structures and their equivalents as the corresponding structure.

Regardless of means-plus-function or plain-and-ordinary meaning construction, all Grounds demonstrate unpatentability of the claims.

III. '830 PATENT

A. Brief Description

The '830 patent provides “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.” APPLE-1001, 1:16-21; APPLE-1003, [39]-[48]. Such vibration modules “can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces.” *Id.*, Abstract. For example, “the vibrational forces are produced by a linear oscillation of a weight or component within the LVM [linear vibration module].” *Id.*, 4:21-36.

B. Prosecution History

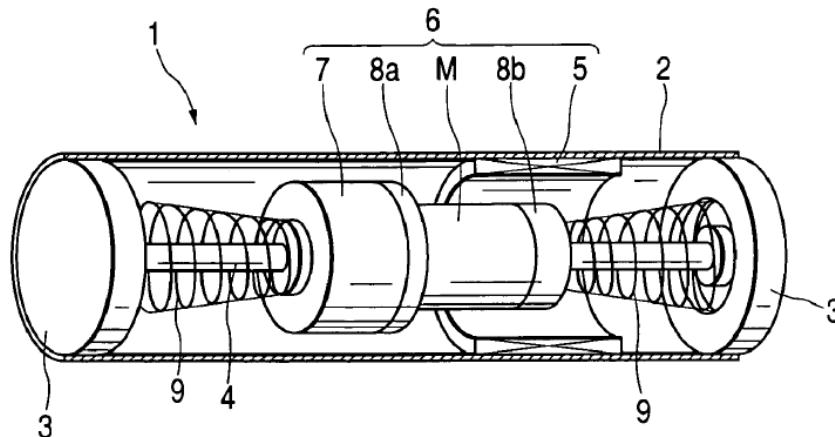
The examiner issued one office action with prior art rejections. APPLE-1002, 32-37. Applicant traversed this rejection without amendment. *Id.*, 22-25. A notice of allowance was issued without reasons for allowance. *Id.*, 10-16; APPLE-1003, [49]-[59].

IV. APPLICATION OF PRIOR ART

A. GROUND 1A: Wakuda-Ramsay Renders Obvious Claims 1-4, 7, 8, 14, 15-17, 19, 20 (Plain-and-Ordinary Meaning and Patent Owner's Means-Plus-Function Construction)

1. Wakuda

Wakuda provides “a vibration generator system, which can generate vibrations at a frequency that can be bodily sensed by humans, while being small in size, and which makes setting of a configuration of vibrations easy.” APPLE-1005, 2:13-17; APPLE-1003, [60]-[61]. Wakuda’s “vibration generator means 1” includes “cylindrical-shaped casing 2,” “covers 3,” “coil 5,” “movable body 6” including weight 7 and magnet M, and “energizing members 9” (e.g., “cone coil springs”) “provided between both ends of the movable body 6 and inner surfaces of the covers 3.” *Id.*, 4:30-5:24.

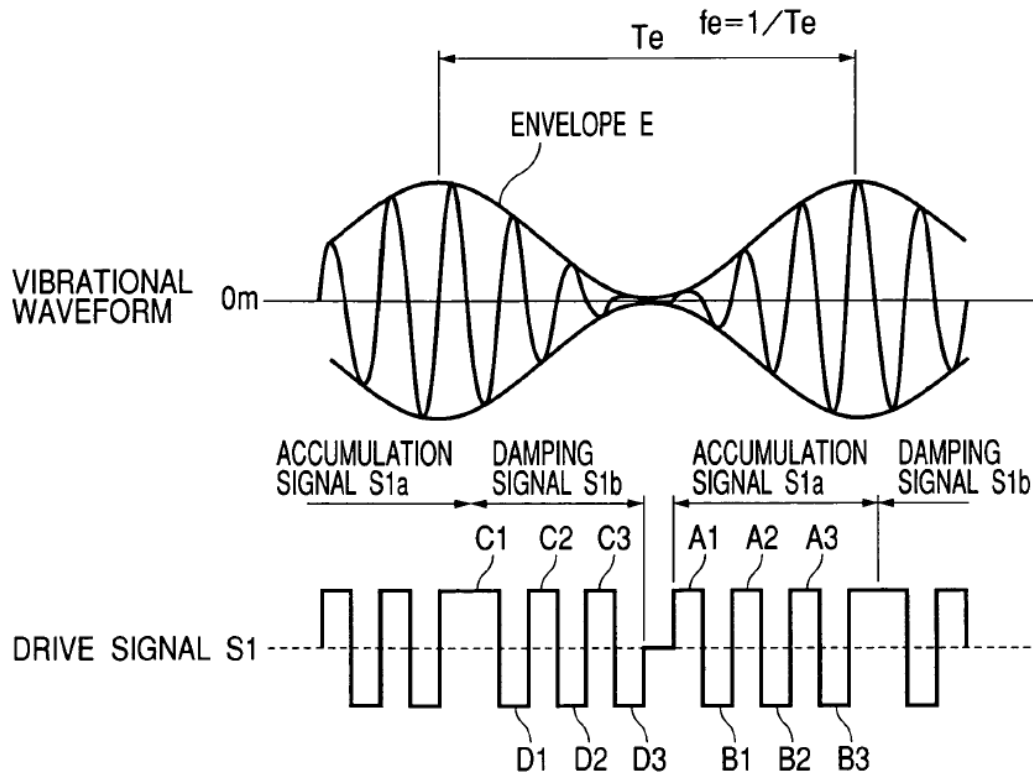


APPLE-1005, Figure 1A

Wakuda generates “drive signal S1” for driving the movable body, including “an accumulation signal S1a” that “excites resonant vibrations at the natural

frequency in the movable body 6,” and “a damping signal S1b” thereafter.

APPLE-1005, 7:9-17, 8:40-48, Figure 4; APPLE-1003, [62]. Referring to Figure 5, “where the accumulation signal S1a and the damping signal S1b are made consecutive and signals composed of a set of the accumulation signal S1a and the damping signal S1b are given at a cycle T_e ,” “the movable body 6 vibrates at the natural frequency (resonance frequency), its amplitude increasing with time for the accumulation signal S1 a, and damping with time for the damping signal S1b.” *Id.*, 9:12-15. “[A] line connecting peaks of amplitude of the movable body 6 together is shown as an envelope E, the envelope E increasing or decreasing according to the cycle T_e of the accumulation signal S1a and the damping signal S1b, and a frequency f_e of the envelope E corresponding to $1/T_e$.” *Id.*, 9:15-20. As such, “[a] frequency of the envelope is in a lower band than a natural frequency. The envelope is varied whereby changes in intensity of vibrations are given to humans. Since changes in intensity of vibrations are easy to be bodily sensed as changes in feeling of pressure and the frequency of the envelope is in a frequency band, which can be bodily sensed effectively, humans can surely detect vibrations.” *Id.*, 2:29-40.



APPLE-1005, Figure 5

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.” APPLE-1006, Abstract; APPLE-1003, [63]-[65]. “[T]he user may access programmable haptic design software 30 via GUI 24” to modify “parameters or characteristics of a haptic output or haptic track” that are modifiable “include a frequency of vibration and amplitude of vibration. *Id.*, [0030]-[0035], [0046], [0053], Figure 4. Ramsay also can “enable[] the user to enter one or more frequencies for the haptic track or even

continually changing frequencies to be played along the length of the haptic track.” *Id.*, [0046], [0037]. Users can also “combine or mix different haptic tracks together if desired to provide a fuller haptic experience.” *Id.*, [0015], [0030], [0047].

Further, Ramsay’s “ROM 28 may be configured to store a library of preset haptic tracks,” and “also store haptic track files created or modified by the user.” APPLE-1006, [0028], [0034], [0042], [0049], [0058], [0065]; APPLE-1003, [66].

3. Wakuda-Ramsay

In the predictable combination, Wakuda’s system is implemented to enable users to customize parameters for haptic effects, according to Ramsay. APPLE-1003, [86]-[87]. The resulting system provides Wakuda’s “small-sized terminal devices, such as portable telephones, PDA, portable game equipment[],” that are implemented to store the customized haptic effects to be selected/used in generating desired haptic feedback. *Id.*; APPLE-1005, 1:11-14. Further, Wakuda-Ramsay’s terminal device includes “input/output devices” as equipped in Ramsay’s “end user device” similar to Wakuda’s terminal device. APPLE-1003, [87]; APPLE-1006, [0019], [0022]-[0024]. Ramsay modifies Wakuda’s system to embed “[s]oftware and systems” “according to the teachings [of Ramsay], to lead a user through the process of entering and/or modify[ing] parameters and characteristics of haptic tracks.” APPLE-1006, [0015]; APPLE-1003, [87]. Particularly, the memory device in Wakuda-Ramsay (Ramsay’s memory) would

store “software program for enabling an end user to create and/or modify haptic effects, the software program of which can be executed by processor,’ and would “store haptic track files created or modified by the user and [] also store mixed track files, which include multiple haptic tracks combined together.” APPLE-1006, [0025]-[0028]; APPLE-1003, [87]. Further, the resulting system allows users to “access[] programmable haptic design software 30 via GUI 24 and open[] a file to be edited,” and “interact with programmable haptic design software 30 by input and output mechanisms of GUI,” according to Ramsay. APPLE-1006, [0037]; APPLE-1003, [87].

A person of ordinary skill in the art (POSITA)² would have been motivated and found it obvious to modify Wakuda’s system to be user-configurable according to Ramsay for several reasons. APPLE-1003, [88]. Particularly, as discussed in Ramsay, a POSITA would have recognized that capability of modifying characteristics of haptic feedback was normally limited to professional haptics designers, and end users “typically [did] not have the option on the device itself to modify characteristics of haptic feedback.” APPLE-1006, [0014]; APPLE-1003, [88]. Therefore, a POSITA would have looked for references like Ramsay to expand the functionalities of haptic devices and allow end users to have

² APPLE-1003, [33]-[34] (defining a POSITA).

capabilities to freely create and customize haptic effects. APPLE-1003, [88]; APPLE-1006, [0014]-[0015]. With Ramsay's teachings, a POSITA would have been motivated to provide Wakuda's system with Ramsay's user tools to offer flexibility in customizing haptic effects by allowing users to conveniently "create or modify the haptic effect files directly on the device." *Id.* The resulting system would also benefit from Ramsay's GUI that displays haptic tracks and offers various, easy-to-use mechanisms for adjusting haptic parameters. *Id.*; APPLE-1006, [0053]-[0057].

Further, the Wakuda-Ramsay combination would enable the resulting system to "provide a fuller haptic experience" by allowing users to "combine or mix different haptic tracks together if desired" according to Ramsay. APPLE-1006, [0030], [0047]. A POSITA would have recognized that vibrant and interesting haptic effects would result from the combination that enables independent controlling of the frequency and amplitude for oscillation. APPLE-1003, [89] (citing APPLE-1018, 224).

Additional reasons would have prompted a POSITA to implement Wakuda's vibration generator system to store haptic effects, in accordance with Ramsay's teachings, so that the parameters of a haptic effect, such as frequency and amplitude, are specified in the stored values. APPLE-1003, [90]. Storing haptic effects in the resulting system would further achieve Wakuda's purposes of

“realizing a variety of vibrations” and “freely set[ting] a configuration of vibrations.” *Id.*; APPLE-1005, 1:11-64, 2:13-17, 3:22-30.

A POSITA would have had a reasonable expectation of success in making the proposed modifications given that Wakuda and Ramsay describe the same techniques for controlling a linear actuator to produce desired output. APPLE-1003, [91]; APPLE-1005, 3:42-44; APPLE-1006, [0026]. Indeed, a POSITA would have recognized that the Wakuda-Ramsay combination requires only routine knowledge of software implementation techniques, which were well within the POSITA’s skill. APPLE-1003, [91]. The modification to Wakuda based on Ramsay’s teachings merely involves implementing Ramsay’s software solutions in Wakuda’s hardware setup without substantially changing Wakuda’s other structures. *Id.* The combination would modify Wakuda’s system only to the extent that it is necessary to implement Ramsay’s software tools, and Wakuda’s system would otherwise remain unchanged and perform its intended operations. *Id.*, [92]. Indeed, Wakuda and Ramsay share similar structures and operations that are compatible. *Id.* For example, while Wakuda already discloses or renders obvious the frequency and amplitude being specified by the stored values (Ground 1A, [1f]), Ramsay similarly discloses that “the customized haptic effects created by a user can be stored on the device for use by the user.” APPLE-1006, [0017], [0027]-[0028]. Further, a POSITA would have recognized that Wakuda’s and

Ramsay's purposes (e.g., providing haptic feedback) are compatible, and the Wakuda-Ramsay combination would have accomplished those purposes in a similar way that each of Wakuda and Ramsay achieves. APPLE-1003, [92]. The intended operations in each of Wakuda and Ramsay would be achievable in parallel to receive the benefits described by each reference. *Id.* Therefore, combining Wakuda and Ramsay was merely the application of known techniques (Ramsay's software solution for user's customization of haptic effects) to a known device (Wakuda's vibration generator system) ready for improvement to yield predictable results (benefits articulated above). *KSR Int'l Co. v. Teleflex Inc.* 550 U.S. 398, 417 (2007).

4. Analysis

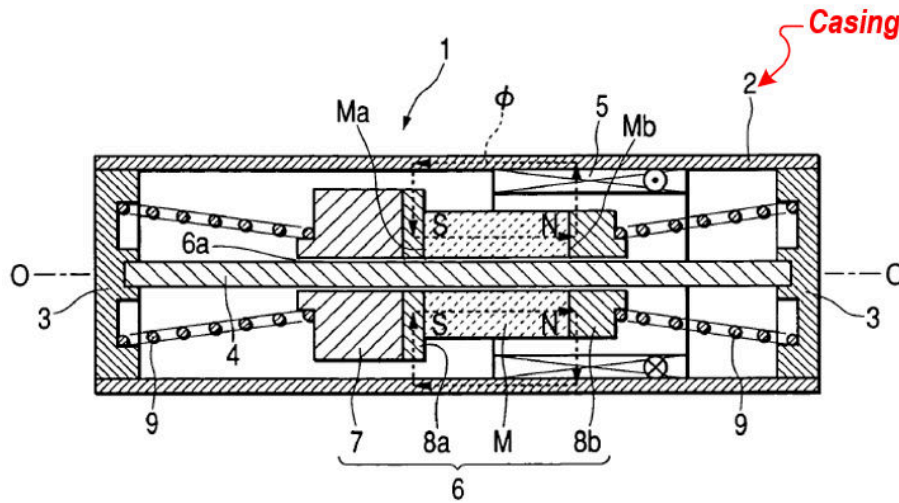
[1pre]

Wakuda-Ramsay provides a vibration module, such as Wakuda's "bodily sensed vibration generator system mountable on small-sized information terminal devices, such as portable telephones, PDA, portable game equipment[], and so on." APPLE-1005, 1:11-16; APPLE-1003, [93]-[95]. According to Wakuda, the system includes "vibration generator means 1" that includes "casing 2," "covers 3," "coil 5," "movable body 6," and "control means 10." APPLE-1005, 4:30-5:24, 6:11-62. The vibration module in the resulting system further includes "input/output devices" as taught by Ramsay. APPLE-1003, [94]; APPLE-1006, [0022], [0024];

§IV.A.3.

[1a]

Wakuda-Ramsay provides a housing (“casing 2”) within the resulting system. APPLE-1003, [96]-[97]; APPLE-1005, 4:34-38.

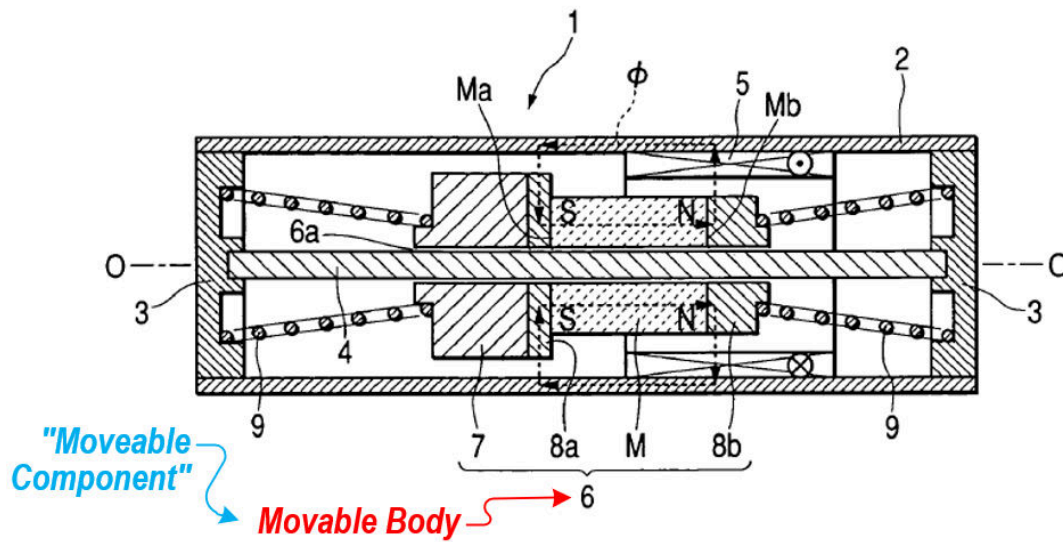


APPLE-1005, Figure 1B³

[1b]

Wakuda-Ramsay provides a moveable component (“movable body 6” including “weight 7” and “magnet M”) within the resulting system. APPLE-1003, [98]; APPLE-1005, 4:48-57.

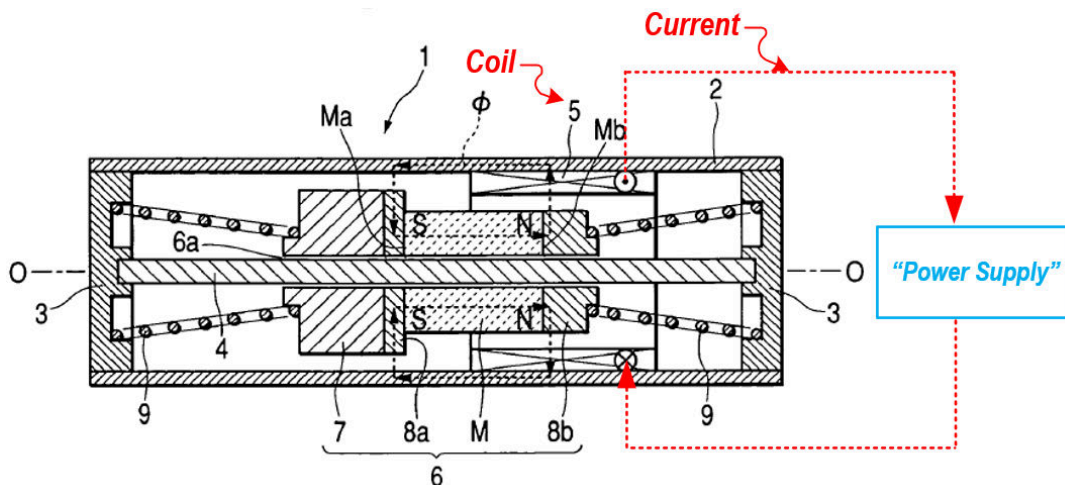
³ All annotations in the figures herein are added unless otherwise indicated.



APPLE-1005, Figure 2

[1c]

Wakuda-Ramsay provides a power supply that supplies current to the “coil 5.” APPLE-1005, 4:42-47. Referring to Figure 1 below, Wakuda describes that current is supplied to the coil to generate a magnetic force. *Id.*, 6:4-10. To do so, a POSITA would have understood and found obvious that Wakuda’s system includes a power supply. APPLE-1003, [99].



APPLE-1005, Figure 2

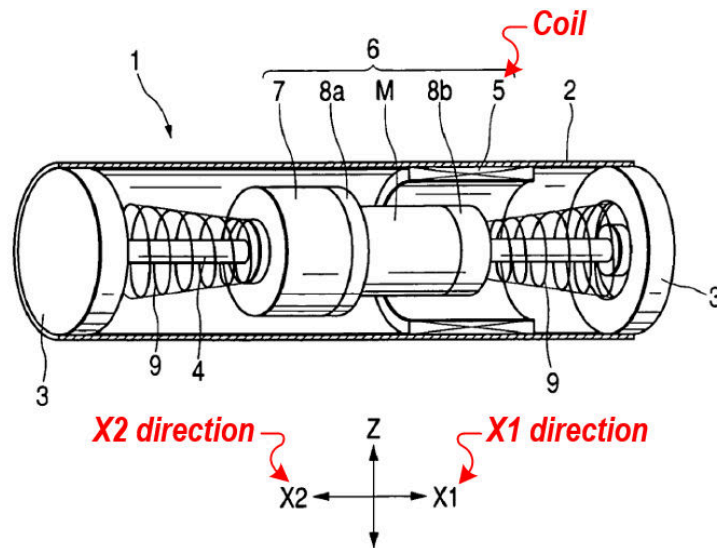
Indeed, “terminal devices, such as portable telephones, PDA, portable game equipment[]” were well-known to include a battery or connect to a power source to supply power to components internal to the devices. APPLE-1005, 1:11-14; APPLE-1003, [100] (citing APPLE-1019 and APPLE-1007).

[1d]

Wakuda-Ramsay provides user-input features (Ramsay’s “input/output device”) as provided in Wakuda’s “terminal devices, such as portable telephones, PDA, portable game equipment[].” APPLE-1005, 1:11-16; APPLE-1003, [101]-[102] (citing APPLE-1010). Similar to Wakuda’s terminal devices, Ramsay describes “end user device 10,” such as “mobile handset, cell phone, personal digital assistant (PDA),” which includes “input/output devices 12.” APPLE-1006, [0019], [0022], [0024] (“keyboards, keypads,” “touch screen,” “touch pads, buttons, sliders”).

[1e]

Wakuda-Ramsay provides the driving component (“coil”), which generates a driving force in each of two opposite directions, such as X1 and X2 directions in Wakuda’s Figure 1A. APPLE-1003, [103]; APPLE-1005, 6:4-10, Figures 1A-1B.

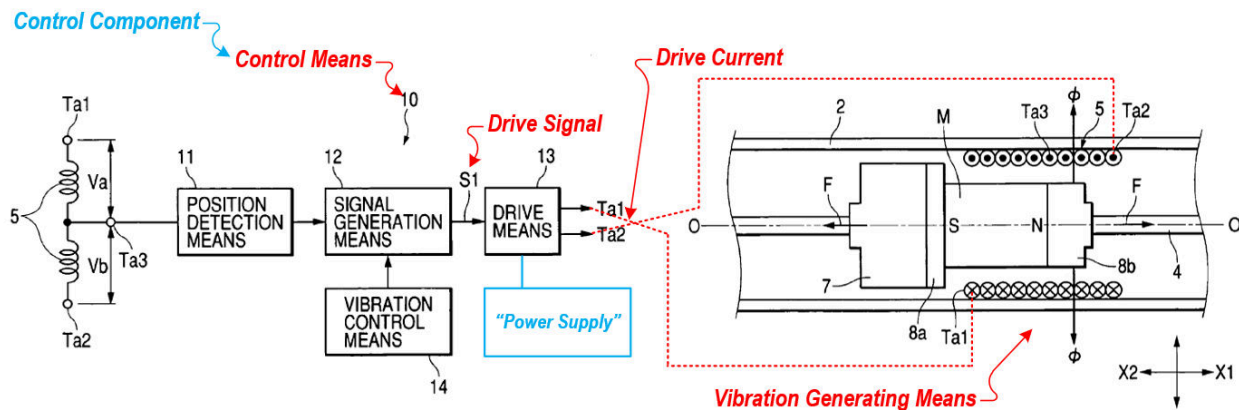


APPLE-1005, Figure 1A

[1f]

Wakuda-Ramsay provides a control component (“control means 10”).
APPLE-1003, [104]; APPLE-1005, 6:23-39. Wakuda’s control means includes “signal generation means 12” that “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.” APPLE-1005, 6:23-39. According to the drive signal S1, the drive means 13 provides “a drive current having a predetermined waveform ... to the terminal Ta1 and the terminal Ta2 of the coil 5. *Id.* Because the drive means 13 supplies the drive current to the coil of the vibration generating means, a POSITA would have readily understood and found obvious that the drive means 13 includes, or is coupled to, the power supply ([1c]), and that the control means (control component) controls, via the drive signal S1, the supply of current (supply

of power) from the power supply, which is included in or coupled to the drive means 13, to the coil (moveable component ([1b])). APPLE-1003, [104]; APPLE-1005, Figures 3-4 (below). Indeed, “the signal generation means 12 performs control, such as switching of current direction of the drive signal S1,” which is an apparent example of controlling supply of power from the power supply to the driving component. APPLE-1005, 6:45-47; APPLE-1003, [104].



APPLE-1005, Figures 3 and 4

As discussed in [1c], Wakuda describes applying current in opposite directions (X1 and X2 directions) to generate driving forces in opposite directions and cause the movable component to oscillate. APPLE-1003, [105]; APPLE-1005, 6:4-10. Further, Wakuda describes that the oscillation occurs at a frequency and an amplitude because the drive signal is configured such that “a vibrational waveform of the movable body makes an envelope” and “the envelope can be changed in frequency and amplitude, so that it becomes possible to generate a variety of

vibrations.” APPLE-1005, Abstract, 2:18-46, 9:12-10:42.

In the resulting system, the frequency and amplitude for oscillation are specified by stored values. Particularly, Wakuda’s drive signals, which cause the oscillation in the “envelope” waveform, are predefined and stored in the signal generation means. APPLE-1005, 6:35-39 (“The signal generation means 12 stores the drive signals S1 having a plurality of patterns.”), 2:18-28, 3:15-29; APPLE-1003, [106].

A POSITA would have understood and found obvious that, in the Wakuda-Ramsay combination, Wakuda’s control component (“control means 10”) is implemented in accordance with Ramsay’s teachings of processor and memory. APPLE-1003, [107]. For example, Ramsay’s “end user device 10” includes “processor 14” and “memory 16” as the control component for operating “haptic actuating device 18.” APPLE-1006, [0020], [0022]. “[P]rocessor 14 controls the functions of end user device 10 and can execute software stored in memory 16,” which stores “[f]iles associated with haptic effects”. *Id.*, [0024], [0027].

Notably, Wakuda-Ramsay’s disclosure satisfies one of Patent Owner’s means-plus-function constructions of “control component” alleged in litigation against Samsung Electronics. APPLE-1003, [108]; APPLE-1045, 20-21 (Patent Owner identifies “oscillator circuit; microcontroller with internal or external memory; processor; CPU; [and] microprocessor” as the corresponding structure).

The Wakuda-Ramsay combination includes “[p]rocessor 14 [that] may be a general-purpose or specific-purpose processor or microcontroller” and “controls the functions of end user device 10 and can execute software stored in memory 16,” and the processor executes “programmable haptic design software 30” that “can be implemented in hardware, software, firmware, or a combination thereof” using, for example, “discrete logic circuitry, an application specific integrated circuit (ASIC), a programmable gate array (PGA), a field programmable gate array (FPGA), etc., or any combination thereof,” in accordance with Ramsay’s teachings. APPLE-1006, [0025], [0043].

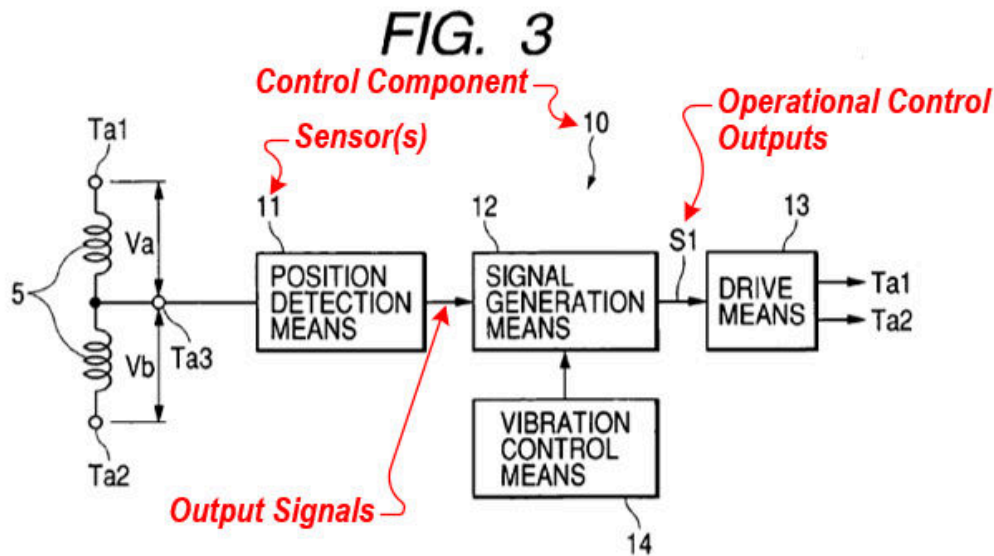
[2]

As discussed in [1f] above, Wakuda-Ramsay’s control component includes a microprocessor (“processor 14”) and a control program stored in an electronic memory (“software stored in memory 16”) within, or separate, the microprocessor. APPLE-1003, [109]; APPLE-1006, [0025], [0027], Figure 1 (illustrating processor 14 and memory 16 separately). As also discussed in [1f], Wakuda-Ramsay’s control program is 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 one or more stored values. APPLE-1003, [110].

[3]

Wakuda-Ramsay's control component (Wakuda's "control means 10" as implemented by Ramsay's processor and memory) receives output signals from sensors (as suggested by Wakuda's "detection signal of the middle point detected by the position detection means 12") within the vibration module (Wakuda's vibration generator system) during operation of the vibration module, and adjusts operational control outputs of the control component (Wakuda's signal generation means 12 that controls switching of current direction of the drive signal S1) according to the received output signals from the sensors (Wakuda's detection signal by the position detection means 12). APPLE-1003, [111].

Referring to Figure 3 below, Wakuda describe a closed-loop control to "generate a drive signal S1 tracking the resonance frequency of the movable body 6." APPLE-1005, 10:31-32; APPLE-1003, [112]. For example, Wakuda's "position detection means 11 detects that the movable body 6 has reached the neutral position ... that is, a middle point in the reciprocation stroke." *Id.*, 6:23-47. The detection signal of the middle point" is provided to the signal generation means 12, and "the signal generation means 12 performs control, such as switching of current direction of the drive signal S1." *Id.*



APPLE-1005, Figure 3

Further, a POSITA would have understood and found obvious that a plurality of sensors would be beneficially used for Wakuda's measurement of the movable body position. APPLE-1003, [113] (citing APPLE-1009). Indeed, Wakuda describes multiple positions of the "position detection means 11" to better detect movements of the "movable body 6" and thus "make[] it possible to generate a drive signal S1 following large changes in elastic forces of the energizing members 9, 9 even in the case where the movable body 6 involves a large sliding load, or the movable body 6 gets out of order much in natural frequency due to such large changes in elastic forces." APPLE-1005, 6:48-62. In particular, Wakuda contemplates using multiple sensors at "positions of maximum amplitudes in the X1 and X2 directions, at which movements of the movable body

6 stop, or other predetermined detected positions.” *Id.*, 6:58-62; APPLE-1003, [114]. Further, using multiple sensors was well-known to improve accuracy and reliability of measured parameters. APPLE-1003, [113].

In fact, the ’830 patent discusses no criticality of using multiple sensors, and simply attributes the described functionality to “one or more sensors” without distinguishing the use of a single sensor from multiple sensors. APPLE-1001, 6:15-16, 6:37, 6:44-51, cls. 3-4 (reciting “sensors” and “the one or more sensors,” respectively); APPLE-1003, [115].

*[4]*⁴

As discussed in [3] above, Wakuda-Ramsay’s control component adjusts the

⁴ The terms “the one or more operational control outputs,” “the received output signals,” “the sensors,” and “the one or more sensors” lack antecedent basis.

Petitioner has made a best effort to interpret the claim for the present proceeding, but reserves the right to raise the issue of indefiniteness in other proceedings involving the ’830 patent. Further, the term “desired” is ambiguous, rendering claim 4 indefinite. Yet, unpatentability of claim 4 can be determined here because the prior art expressly describes such features in its feedback control system. APPLE-1003, [116]-[117].

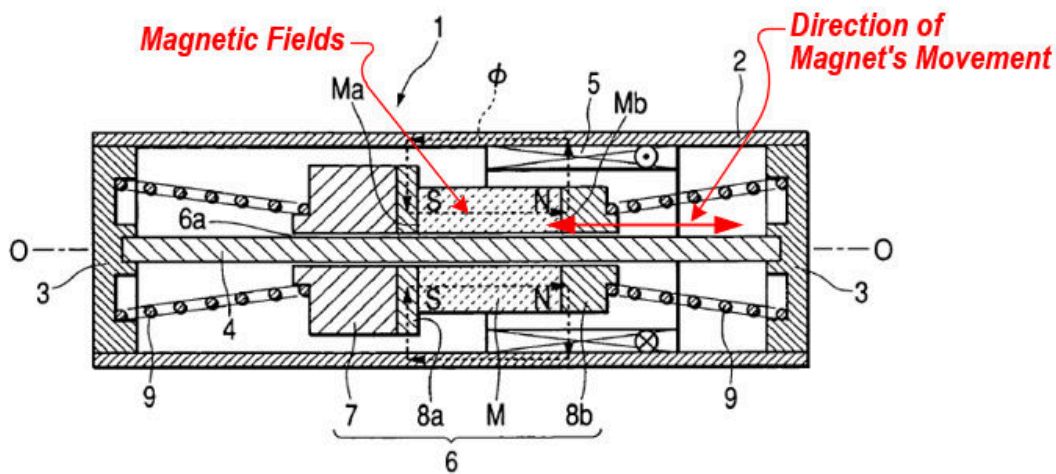
one or more operational control outputs of the control component according to the received output signals from the sensors. As a result, subsequent operation of the vibration module produces desired outputs (position measurements) from the one or more sensors corresponding to one or more operational control parameters (“drive signal S1”). APPLE-1003, [116]; APPLE-1005, 10:31-32, 6:23-26, 6:40-47. Particularly, a POSITA would have understood that the closed-loop operation of the vibration module based on the position measurements by “position detection means 11” would result in “desired” subsequent position measurements because the operation addresses cases “where the movable body 6 involves a large sliding load, or the movable body 6 gets out of order much in natural frequency due to such large changes in elastic forces.” APPLE-1005, 6:48-55; APPLE-1003, [117]. Further, Wakuda’s control technique makes it “possible to restrain the movable body 6 from resonating at the natural frequency and moving at a larger amplitude than a stroke, which is essentiality desired to control.” *Id.*, 5:37-40. Through this, a POSITA would have readily recognized that Wakuda’s sensor outputs, which correspond to amplitude, are “desired outputs” corresponding to operational control parameters (“drive signal S1”) generated by Wakuda’s control technique. APPLE-1003, [117].

[7]

As discussed in [1e] above, Wakuda’s driving component comprises one or

more electromagnetic coils (“coil 5”). APPLE-1003, [118]. As illustrated below, Wakuda’s coil 28 generates magnetic fields that include portions parallel to the directions in which the moveable component (“magnet M”) is driven by the driving component. *Id.*; APPLE-1005, 5:56-64, Figure 1B.

FIG. 1B



APPLE-1005, Figure 1B

[8a]

The Wakuda-Ramsay system has “a cylindrical-shaped casing” (tube) and “covers ... being mountable on both ends of the casing” (capped at both ends), as taught by Wakuda. APPLE-1005, 4:34-38; APPLE-1003, [119]. Further, the resulting system would include “[e]nergizing members” (movable-component-repelling components) that are “cone coil springs” (mechanical springs) and are “provided between both ends of the movable body 6 and inner surfaces of the covers.” *Id.*, 5:14-28.

[8b]

In the resulting system, the magnet (e.g., Wakuda's "magnet" as "movable body") slides within the "cylindrical-shaped casing" (tube) in accordance with Wakuda. APPLE-1005, 3:30-33, 4:48-63, 5:8-9, 5:32-35, 6:52-53; APPLE-1003, [120].

[8c]

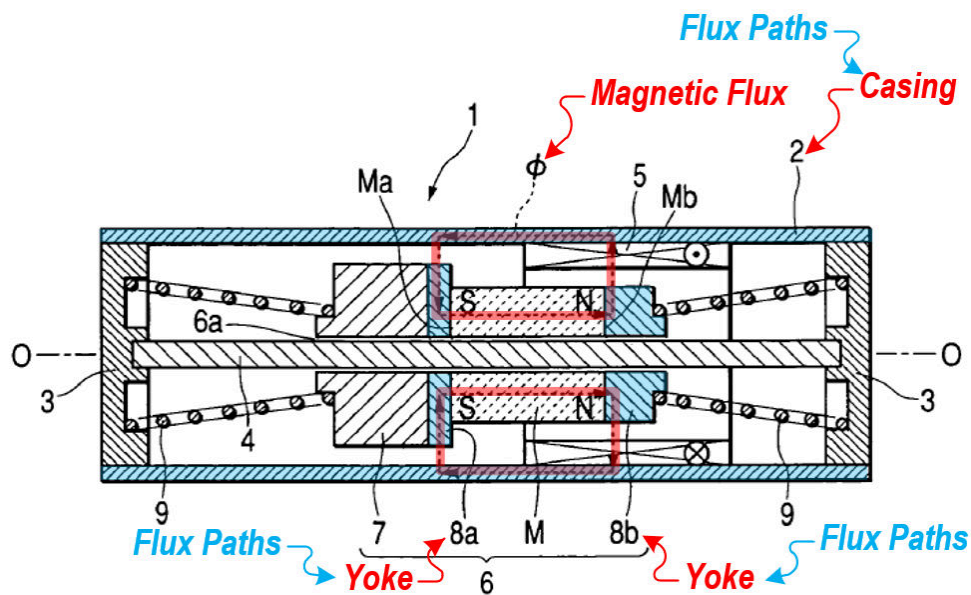
The resulting system includes an electromagnetic coil (Wakuda's "coil 5") as the driving component, which is "formed by winding a length of covered copper wire, such as enameled wire or the like, in a cylindrical shape," and when energized, "form[s] a moving-magnet type magnetic drive means" along with the magnet M. APPLE-1005, 4:42-44, 5:8-9; [1e], [7]; APPLE-1003, [121].

[14]

The Wakuda-Ramsay vibration module includes the flux paths, as taught by Wakuda. APPLE-1003, [122]. Wakuda renders obvious a magnetic flux created in the resulting actuator—Wakuda's "vibration generating means" structure.

§IV.A.3. Referring to Figure 1B below, Wakuda describes that "magnetic flux ϕ generated by the magnet M" defines a magnetic path through the yoke members 8a, 8b and the casing 2. APPLE-1005, 5:56-64. Notably, to create this magnetic path, Wakuda requires that the casing 2 and the yoke members 8a, 8b of the Wakuda-Ramsay's actuator be "made of a magnetic substance." *Id.*, 4:34-36,

4:51-54.

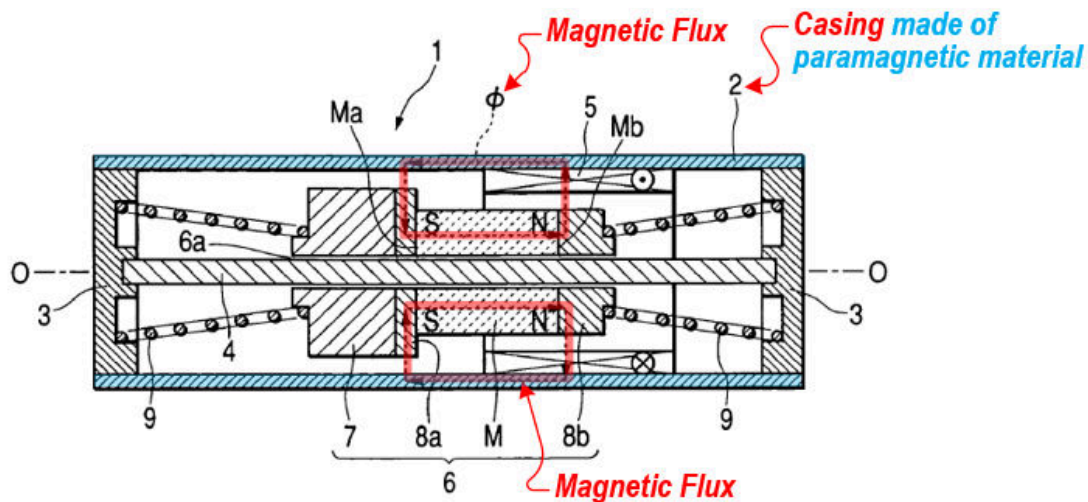


APPLE-1005, Figure 1B

A POSITA would have understood and found obvious that, in the resulting actuator, the casing, alone or along with the yoke members, corresponds to the flux paths because the casing and the yoke members are made of magnetic substance/material, thereby reducing the reluctance of the magnetic path defined at the actuator (i.e., magnetic circuits within the vibration module) despite air gaps between the actuator components (e.g., the casing 2 and the movable body 6 in Wakuda). APPLE-1003, [123]; APPLE-1005, 4:34-54. Indeed, the concept that air gap increases reluctance of a magnetic circuit was well-known. APPLE-1003, [123] (citing APPLE-1012). Therefore, it was well-known and obvious to shape and position the components of an actuator (or the materials thereof) that define a

magnetic path such that the components reduce magnetic reluctance and increase magnetic flux. *Id.*

Additionally, a POSITA would have understood and found obvious that a paramagnetic material would be beneficially used for Wakuda's "magnetic material" for the casing and the yoke members of the Wakuda-Ramsay's actuator. APPLE-1003, [124]; APPLE-1005, 4:34-54, 5:56-64. Indeed, paramagnetic materials are one of a few categorical options for magnetic materials. APPLE-1003, [124] (citing APPLE-1032 (describing paramagnets as one of four types of magnetic material), APPLE-1035, APPLE-1037). For example, a POSITA would have readily recognized that aluminum was a known example of a paramagnetic material, and that aluminum was widely used for the housing of haptic feedback actuators and user devices employing the actuators, which can be involved in creating a magnetic path. APPLE-1003, [124] (citing APPLE-1031, APPLE-1013).



APPLE-1005, Figure 1B

Several reasons would have motivated a POSITA to implement the casing of Wakuda-Ramsay's actuator using a paramagnetic material (e.g., aluminum). APPLE-1003, [125]. As described above, Wakuda describes that the casing in the Wakuda-Ramsay combination is "made of a magnetic substance." APPLE-1005, 4:34-36, 5:59-64. Therefore, a POSITA would have investigated example magnetic material for the casing such that the casing defines a part of the magnetic flux, as taught by Wakuda. APPLE-1003, [125]-[126]. As described above, a paramagnetic material was a well-known type of "magnetic substance" mentioned in Wakuda and provided adequate permeability to define the magnetic flux as identified in Wakuda. *Id.* (citing APPLE-1032, APPLE-1035, APPLE-1037).

Further, well-known paramagnetic materials (e.g., aluminum) were lighter than other popular magnetic materials like iron and steel, making it a superior

choice for applications where weight matters, such as Wakuda-Ramsay's portable handheld device. APPLE-1003, [127]. Therefore, a POSITA would have been motivated to use a paramagnetic material in the resulting system to better serve the objectives of Wakuda—namely, making portable handheld devices of small form factor. *Id.*; APPLE-1005, 1:11-14.

Moreover, paramagnetic materials (e.g., aluminum) were well-known to be naturally resistant to rust and corrosion, giving it a longer lifespan in harsh environments compared to other popular magnetic materials like iron and steel. APPLE-1003, [128] (citing APPLE-1027, APPLE-1028). Therefore, a POSITA would have been motivated to choose such paramagnetic materials for the casing of the resulting system, such as portable handheld devices, which are intended to be frequently exposed to various daily environments (e.g., high/low temperature, humidity, etc.). *Id.*

Additionally, paramagnetic materials (e.g., aluminum) were excellent conductors of electricity and heat, making it suitable for various electrical applications such as the Wakuda-Ramsay's actuator system. APPLE-1003, [129] (citing APPLE-1029, APPLE-1030).

Lastly, the implementation of Wakuda-Ramsay's actuator to use paramagnetic materials would have been predictable because doing so was the application of known techniques (known materials for actuator elements) to a

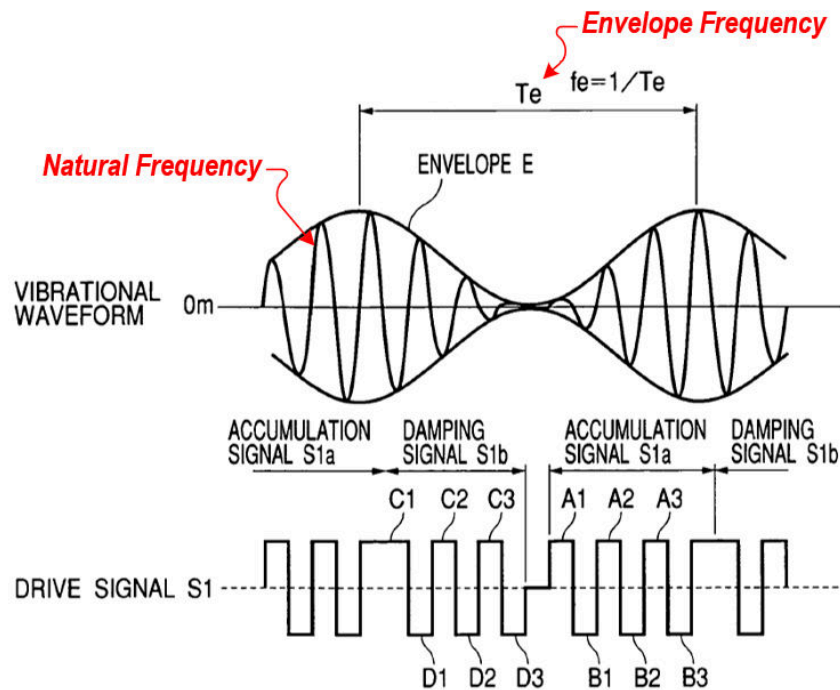
known device (Wakuda-Ramsay's actuator) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. 417. A POSITA would have had a reasonable expectation of success in making the proposed modifications because the modifications would have been implemented by merely applying paramagnetic materials to Wakuda-Ramsay's actuator. APPLE-1003, [130]. The combination would modify Wakuda-Ramsay's actuator only to the extent that it is necessary to implement the material of the casing of the actuator, and Wakuda-Ramsay's actuator would otherwise remain unchanged and perform intended operations. *Id.*

A POSITA would have readily understood that Wakuda's "magnetic path, along which the flux pass inside the casing 2 made of a magnetic substance" would achieve the same function as the '830 patent's "paramagnetic flux paths." APPLE-1003, [131]; APPLE-1005, 5:59-64; APPLE-1001, 14:3-19 ("lower-resistance path for magnetic flux, providing that they have adequate permeability and size to avoid saturation"); *In re Kuhle*, 526 F.2d 553, 555 (CCPA 1975) (use of claimed feature solves no stated problem and presents no unexpected result and "would be an obvious matter of design choice within the skill of the art"); *Ex parte Maeda*, Appeal No. 2010-009814 (Oct. 23, 2012) (informative). In fact, the '830 patent offers no evidence of unexpected results or a difference in function when using paramagnetic materials to define flux paths, other than what has been already

achieved by Wakuda-Ramsay's solution ("magnetic substance" for the casing). APPLE-1003, [131]; *In re Chu*, 66 F.3d 292, 298-99 (Fed. Cir. 1995) ("design choice" is appropriate where the applicant fails to set forth any reasons why the differences between the claimed invention and the prior art would result in a different function); *Ex parte Spangler*, Appeal No. 2018-003800 (Feb. 20, 2019) (informative) (affirming the examiner's obviousness rejection, which determined that claimed relative lengths and locations of two claimed components were a matter of obvious design choice because the specification did not suggest that the relative lengths or locations were critical to the claimed invention).

[15]

Wakuda-Ramsay's combination renders obvious that the control component ([1f]) causes the moveable component to simultaneously oscillate at multiple frequencies to thereby generate complex vibration modes. APPLE-1003, [132]. For example, Wakuda's vibration generator system operates the movable body at two frequencies, such as a natural/resonant frequency and an envelope frequency that is lower than the natural frequency. APPLE-1005, 2:18-46, 9:12-10:42, Figures 5-6.



APPLE-1005, Figure 5

Additionally, Ramsay describes that “one or more frequencies” can be entered for each haptic track. APPLE-1006, [0046]. Further, Ramsay enables users to “combine or mix different haptic tracks together if desired to provide a fuller haptic experience,” and such mixed track files can be stored in memory. *Id.*, [0030], [0027]. When multiple haptic tracks are mixed to overlap with one another in time, “two or more haptic tracks can be programmed to be simultaneous or partially overlapping in time in any desirable manner.” *Id.*, [0047]. Through these, a POSITA would have understood and found obvious that the Wakuda-Ramsay system would drive simultaneous oscillation of the movable component at two or more frequencies, as included in a single haptic track or in a mixed track

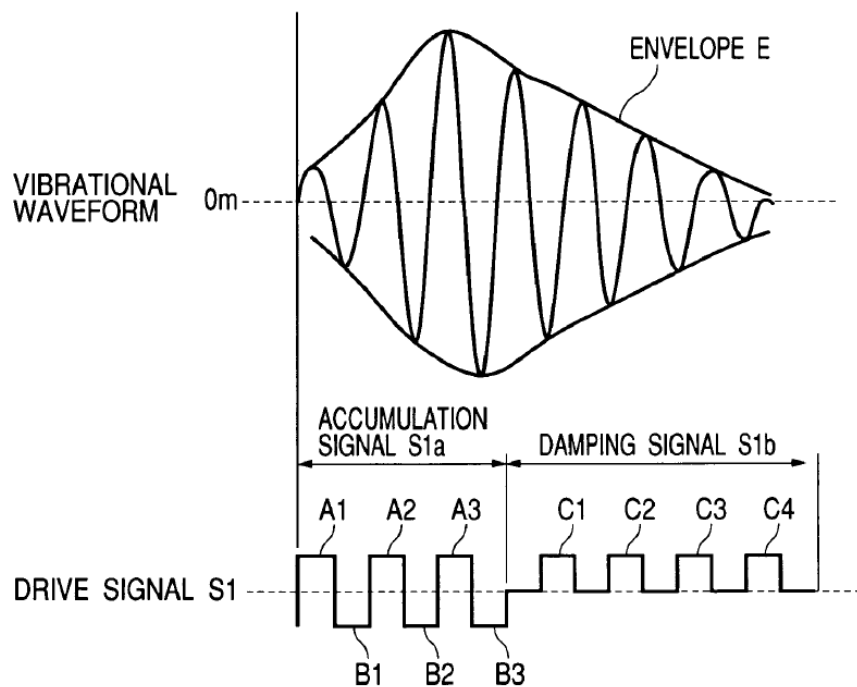
that combines multiple haptic tracks having different frequencies. APPLE-1003, [133]. A POSITA would also have recognized and found obvious that Ramsay's single haptic track having multiple frequencies or mixed haptic tracks with different frequencies combined would generate complex vibration modes, which would results in "a fuller haptic experience." *Id.*; APPLE-1006, [0030].

[16]

Wakuda-Ramsay's complex vibration modes include a primary oscillation frequency (natural/resonance frequency) modulated by a modulating oscillation frequency (lower envelope frequency in [15]); a beat frequency (the difference between the resonance frequency and the lower envelope frequency); and an aperiodic oscillation waveform (irregular waveform illustrated in Wakuda's Figure 6). APPLE-1003, [134].

Wakuda's "vibrational waveform of the movable body 6" includes a natural/resonance frequency (primary frequency) and an envelope frequency defined by "a line connecting peaks of amplitude of the movable body 6 together" and adjustable to be "bodily sensed." APPLE-1005, 9:12-48, Figure 5; APPLE-1003, [135]. Further, like the '337 patent, the difference between the higher resonance frequency and the lower envelope frequency is the beat frequency. APPLE-1003, [135] (citing APPLE-1001, 13:13-41, Figures 22A-23; APPLE-1005, 2:29-46).

Further, Wakuda contemplates the waveform of the envelope to be freely adjusted to be irregular and therefore aperiodic, by “changing contents of an accumulation signal S1a and a damping signal S1b” to create various feedback sensations. APPLE-1003, [136]; APPLE-1005, 9:49-62, 3:12-14, Figure 6 (illustrating “the envelope E is shaped to abruptly rise and gently converge.”).



APPLE-1005, Figure 6

It also would have been obvious to use Wakuda-Ramsay’s system to generate complex vibration modes that include additional aperiodic waveforms wherein the resonance frequency changes irregularly over time. APPLE-1003, [137]. The resonant frequency of an actuator was well-known to change depending on various factors, such as user’s interaction with a haptic-enabled

device. *Id.* (citing APPLE-1004, 3:50-4:5, 2:5-9). Therefore, the resonant frequency of the Wakuda-Ramsay system's complex vibration mode would have obviously varied when, for example, the user aperiodically changes the position of the device, how the device is held, and/or the shape of the device. APPLE-1003, [137]. The resulting waveform would have been an aperiodic waveform according to the irregular change of the resonance frequency. *Id.*

[17]

Wakuda's 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 specified by one or more stored values. [1f]; APPLE-1003, [138]. In the Wakuda-Ramsay combination, such frequency and amplitude parameters are independently specified by user input received from the user-input features (Ramsay's on-device user interface that allows the user to separately input frequency and amplitude). APPLE-1003, [138]; APPLE-1006, [0005], [0015].

Particularly, the Wakuda-Ramsay vibration module includes "on-device" "graphical user interface (GUI)" with a menu option, as taught by Ramsay. APPLE-1006, [0015], [0024], [0032], [0053]; APPLE-1003, [139]. Ramsay describes that, through GUI, "[c]ertain parameters or characteristics of a haptic output or haptic track can be created, entered, changed, modified, etc." and that such "modifiable parameters may include a frequency of vibration and amplitude

of vibration.” APPLE-1006, [0030], [0033], [0046], [0053]-[0055]. Therefore, a POSITA would have understood and found obvious that, through the GUI, the user can independently set and modify various parameters including “a frequency of vibration and amplitude of vibration.” *Id.*; APPLE-1003, [139].

[19pre]-[19f]

Supra, [1pre]-[1f] (explaining Wakuda-Ramsay provides the same limitations); APPLE-1003, [140].

[19g]

Supra, [14] (explaining Wakuda-Ramsay provides this limitation); APPLE-1003, [141].

[20pre]-[20f]

Supra, [1pre]-[1f] (explaining Wakuda-Ramsay provides the same limitations); APPLE-1003, [142].

[20g]

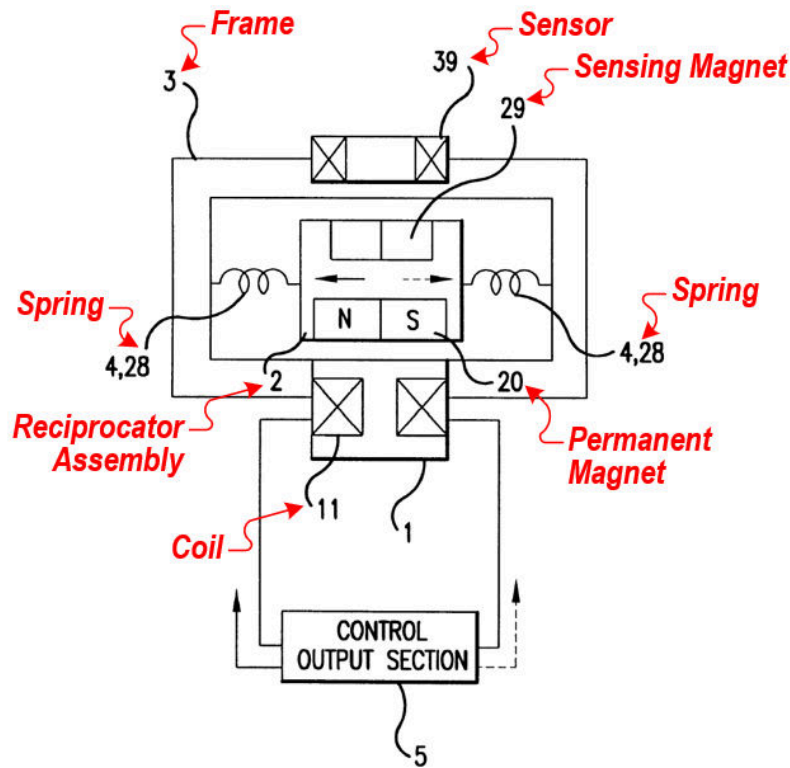
Supra, [15] (explaining Wakuda-Ramsay provides this limitation); APPLE-1003, [143].

B. GROUND 1B: Wakuda-Ramsay-Amaya Renders Obvious Claims 2-6 (Plain-and-Ordinary Meaning and Patent Owner’s Means-Plus-Function Construction)

1. Amaya

Amaya provides a “linear vibration motor” for not only “a reciprocating type electric shaver” but any other products. APPLE-1025, 3:58-62; APPLE-1003,

[67]-[68]. Like Wakuda's actuator, Amaya's motor includes frame 3, reciprocator assembly 2 with permanent magnet 20, springs 4, 28, coil 11, and sensor 39. *Id.*, 3:62-4:67, Figure 7.



APPLE-1025, Figure 7

Amaya's motor further includes "detection system" that "detects a characteristic of the vibration system indicative of the resonant frequency thereof under current load conditions," and "control system" that "is responsive to feedback signals generated by the detection system to control the magnitude and direction of the current flowing through the coil 11 in such a manner as to maintain resonant operation of the vibration system." APPLE-1025, 5:5-23; APPLE-1003,

[69]-[72].

2. Wakuda-Ramsay-Amaya

In the predictable combination, Amaya's feedback control is implemented in Wakuda-Ramsay's system that utilizes sensor feedback to "vibrate the vibration system in synchronization with a characteristic (resonant) frequency of the vibration system." APPLE-1003, [144]-[145]; APPLE-1025, 5:1-5. The combined system includes Amaya's "detection system" and "control system." APPLE-1025, 5:5-13; APPLE-1003, [145]. Particularly, Wakuda-Ramsay's "detection system" includes Amaya's sensing magnet 29 and sensor 39, in which a current induced "varies in accordance with the amplitude of the reciprocating vibration, the location of the reciprocator assembly 2, and/or the velocity and direction of the movement of the reciprocator assembly 2." APPLE-1025, 5:14-49. Wakuda-Ramsay's "control system" includes Amaya's "control output section 5 that controls the magnitude and direction of the current flowing through the coil 11 in accordance with a current (voltage) induced in the sensor 39 when the reciprocator assembly 2 is in vibration." *Id.*, 5:19-23.

Multiple reasons would have prompted a POSITA to implement Amaya's feedback control in Wakuda-Ramsay's system. APPLE-1003, [146]. Particularly, a POSITA would have combined Wakuda-Ramsay and Amaya to avail the system of a known feedback algorithm to achieve vibration at a resonant frequency,

thereby improving Wakuda-Ramsay's system with the known benefits from the algorithm. *Id.* Indeed, Wakuda already describes a feedback control that uses the "position detection means", and provides the detection signal to the signal generation means that "performs control, such as switching of current direction of the drive signal." APPLE-1005, 6:40-47. Because Wakuda's description is at a high level, a POSITA would have looked for other references like Amaya for implementation details of Wakuda's position detection means and signal generation means. APPLE-1003, [146].

A POSITA would have understood that Amaya's solution applied in the resulting system would further achieve Wakuda's purposes. APPLE-1003, [147]. Wakuda describes its "position detection means" as a way to "generate a drive signal S1 following large changes in elastic forces of the energizing members 9, 9 even in the case where the movable body 6 involves a large sliding load, or the movable body 6 gets out of order much in natural frequency due to such large changes in elastic forces." APPLE-1005, 6:48-55. Indeed, Amaya's feedback control technique provides "the driving current can be applied to flow through the coil 11 in the appropriate direction, even if the reciprocator assembly 2 is so heavily loaded as to be temporarily stopped." APPLE-1025, 7:33-36, 8:3-14, 1:39-64, 6:19-29; APPLE-1003, [147].

A POSITA would have had a reasonable expectation of success in making

the proposed modifications because Wakuda-Ramsay and Amaya describe substantially the same vibration architectures and controlling techniques. APPLE-1003, [148]; APPLE-1004, 2:3-9; APPLE-1006, [0026]. Combining Wakuda-Ramsay and Amaya was the application of known techniques (Amaya's feedback control) to a known system (Wakuda-Ramsay's vibration generator structure and operation) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. at 417. Amaya's system is compatible with Wakuda-Ramsay's entire disclosure so that the resulting system still can perform generating a drive signal tracking the resonance frequency of the movable body and freely setting the frequency of vibrations based on a waveform of envelope for a lower frequency than the natural frequency of the movable body. APPLE-1003, [148]; APPLE-1005, 10:22-42.

3. Analysis

[2]

Supra, Ground 1A, [2] (explaining Wakuda-Ramsay provides [2]); APPLE-1003, [149]-[151].

[3]

Supra, Ground 1A, [3] (explaining Wakuda-Ramsay provides [3]); APPLE-1003, [152].

Additionally, the resulting system would include Amaya's closed-loop

feedback control based on sensor measurements, which operates in the way that claim 3 recites. APPLE-1003, [153]. As described above (§IV.B.2), Amaya's linear vibration motor includes "a detection system that detects the displacement, velocity, or acceleration of the reciprocator and produces a feedback signal indicative thereof, and a control system that controls the amount of electric power supplied to a coil of the electromagnet in response to the feedback signal."

APPLE-1025, 1:36-51, 2:23-34.

[4]

See Ground 1A, [4] (explaining Wakuda-Ramsay provides [4]); APPLE-1003, [154].

Additionally, as discussed in [3] above, according to Amaya's detecting and controlling operations, the vibration system in the resulting system is driven "at the current resonant frequency," which causes the detection system to detect the "characteristics of the vibration system" (desired outputs from the one or more sensors) that corresponds to the "current resonant frequency" (corresponding to one or more operational control parameters). APPLE-1025, 1:36-51, 2:23-25; APPLE-1003, [155].

[5a]

As described in Amaya, the resulting system has "[t]he amplitude of the reciprocating movement" (strength of vibration) as a characteristic of the vibration

system (one or more operational control parameters), which “varies as an inverse function of load on the motor.” APPLE-1003, [156]; APPLE-1025, 2:16-18, 5:28-31 (“The terminology amplitude of the reciprocating vibration ... mean the magnitude of the range of reciprocating movement.”), 2:36-38 (“the at least one characteristic of the vibration system is the displacement ... of the driven member.”). Indeed, the ’830 patent aligns with this disclosure, describing “a strength of vibration, which corresponds to the current applied to the coil.” APPLE-1001, 6:30-31; APPLE-1003, [157] (citing APPLE-1025).

[5b]

The Wakuda-Ramsay-Amaya system has the “characteristic frequency of the vibration system” (frequency at which the control component drives the moveable component to oscillate) as the “characteristic of the vibration system” (operational control outputs), as taught by Amaya. APPLE-1025, 2:23-26; APPLE-1003, [158]. Particularly, Amaya describes that the “detection system detects at least one characteristic of the vibration system that is related to a characteristic frequency of the vibration system, and produces a feedback signal indicative of a value of the at least one characteristic.” APPLE-1025, 2:23-26, 5:1-9.

Further, Wakuda-Ramsay-Amaya’s control component would have been implemented according to Amaya’s “control system” that, “in responsive to the feedback signal,” operates to “controllably vary the driving current flowing

through the coil” (dynamically adjusting the power supplied to the driving component) “to drive the vibration system in resonance with the characteristic frequency” (to produce oscillation of the movable component at a resonant frequency for the vibration module). APPLE-1025, 2:26-34, 5:9-12, 6:12-18; APPLE-1003, [159]. Indeed, Amaya describes the timing of allowing the flow of the driving current, and further describes “[t]he time t may be dynamically adjusted in accordance with the detected velocity or acceleration of the reciprocator assembly 2.” APPLE-1025, 6:48-7:14, 1:46-50.

[6a]

As discussed in [5a] above, Amaya describes “[t]he amplitude of the reciprocating movement” (strength of vibration) as a characteristic of the vibration system (one or more operational control parameters), which “varies as an inverse function of load on the motor.” APPLE-1025, 2:16-18, 5:28-31; APPLE-1003, [160].

Further, the resulting system includes various modes of operations as described in Amaya, such as “start-up mode of the motor,” “back-up mode of operation,” and “primary mode of operation.” APPLE-1025, 2:27-42, 9:12-18; APPLE-1003, [161]. Indeed, Amaya’s control system “determines the existence of a condition that renders the detection system non-functional, and drives the vibration system at a prescribed frequency when it is determined that the condition

exists, during a back-up mode of operation.” APPLE-1025, 2:27-34. Amaya describes that “the condition is the start-up mode of the motor and/or the amplitude of the reciprocating movement of the driven member falling below a prescribed minimum threshold level.” *Id.*, 2:38-42. Further, Amaya describes that “[t]he control system is responsive to the feedback signal, during a primary mode of operation, to controllably vary the driving current flowing through the coil.” *Id.*, 2:26-34. Therefore, in the resulting system, a mode of operation (or whether it is currently “during a primary mode of operation”) would be considered to be one or more operational control parameters, as taught by Amaya. APPLE-1003, [161].

[6b]

Wakuda-Ramsay-Amaya’s operational control outputs (e.g., Amaya’s “characteristic of the vibration system”) is a control output that determines a current supplied by the power supply to the driving component (e.g., Amaya’s control system configured to “controllably vary the driving current flowing through the coil in such a manner as to drive the vibration system in resonance with the characteristic frequency”) and a frequency at which the control component drives the moveable component to oscillate (e.g., Amaya’s “control[ing] the ... direction of the current flowing through the coil 11 in such a manner as to maintain resonant operation of the vibration system” or Wakuda’s drive signal configured to cause oscillation at a frequency and an amplitude in the “envelope” form ([1f])).

APPLE-1003, [162]; APPLE-1025, 2:26-34, 5:9-12, 6:12-18; [1f]. Indeed, varying the driving current flowing through the coil involves determining a current supplied by the power supply to the driving component. APPLE-1003, [162]-[163]; APPLE-1025, 1:46-50. And the frequency of the signals/pulses is the frequency at which the control component drives the moveable component to oscillate. [1f].

C. GROUND 1C: Wakuda-Ramsay-Tierling Renders Obvious Claims 15, 16, 20 (Plain-and-Ordinary Meaning and Patent Owner's Means-Plus-Function Construction)

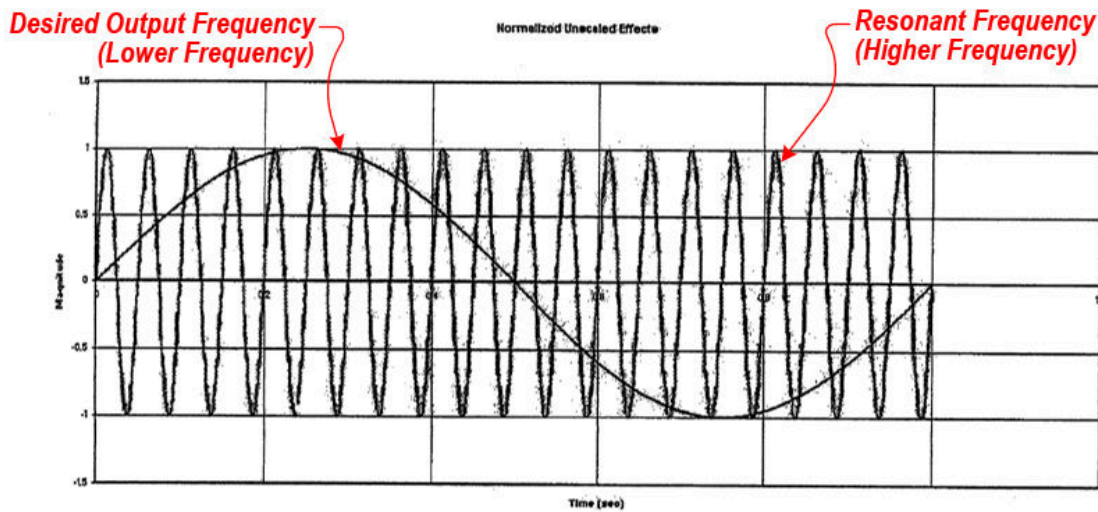
1. Tierling

Tierling provides “mapping drive signals to haptic sensations” at user interface devices, such as wireless phone. APPLE-1008, [0002]-[0003]; APPLE-1003, [73]-[74]. Tierling’s “[e]ffect mappings ... can alter or control effect components or parameters of a haptic sensation, such as amplitude, waveshape, frequency, phase, duration, or delay of the haptic feedback to be output by a haptic device.” APPLE-1008, [0031]. Such effect parameters can be controlled “by way of synthesis or other combination” and “output simultaneously or in sequence.” *Id.* “In cases where haptic feedback components are synthesized, the frequency of a first component can be modulated by the frequency of a second component.” *Id.*

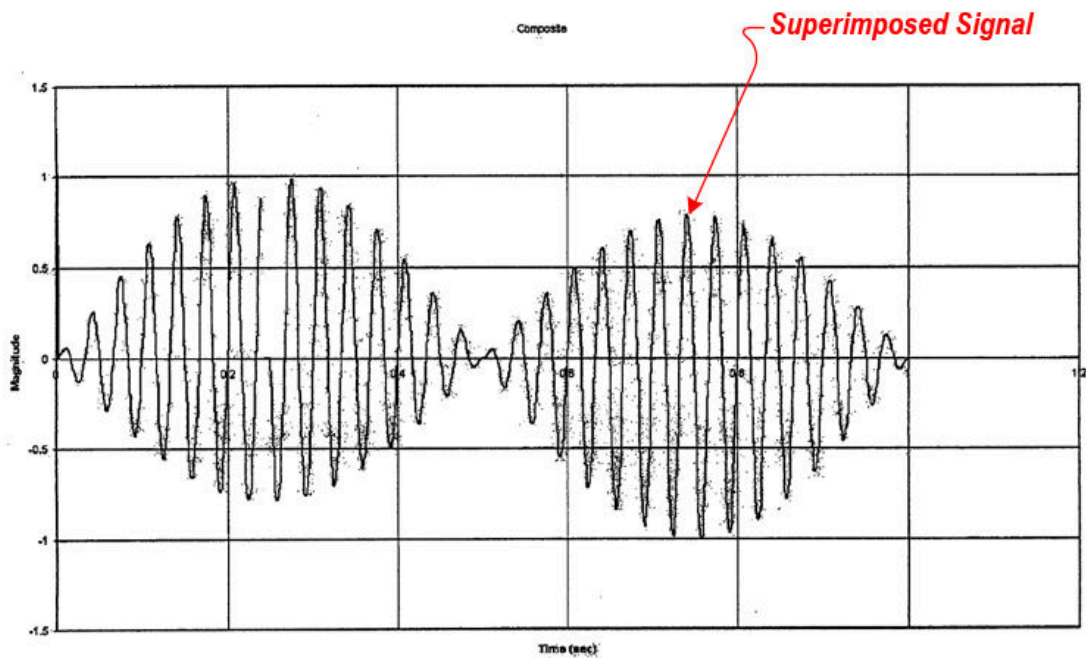
In one implementation, Tierling’s system operates at both “a desired output frequency and a resonant frequency of a haptic device,” which are superimposed

on each other. APPLE-1008, [0110]-[0112], Figures 9-10; APPLE-1003, [75].

Therefore, Tierling's harmonic haptic device can be driven "without losing the low-frequency components." *Id.*



APPLE-1008, Figure 9



APPLE-1008, Figure 10

2. Wakuda-Ramsay-Tierling

In the predictable combination, Wakuda-Ramsay's system plays Tierling's haptic effects using Tierling's effect mapping functionalities. APPLE-1003, [164]-[165]. A POSITA would have been motivated to play Tierling's haptic effects using Wakuda-Ramsay's system because Wakuda-Ramsay refers to haptic effects, which are based on the resonance frequency and haptic effect parameters such as amplitude/magnitude and frequency, but provides limited examples of a desired haptic effect. Accordingly, a POSITA would have naturally investigated other references like Tierling (from the same assignee as Ramsay's) to further examples of desired haptic effects that are based on the resonance frequency and relevant parameters such as amplitude/magnitude and frequency. APPLE-1003, [165]; APPLE-1008, [0031]. A POSITA would have understood that Tierling's example haptic effects were applicable to Wakuda-Ramsay's system. APPLE-1003, [165].

The resulting system would have benefited from Tierling's effect mapping technique, which "can drive a harmonic haptic device," like Wakuda-Ramsay's vibration generator system, "without losing the low-frequency components." APPLE-1008, [0110], [0030]-[0031]; APPLE-1003, [166] (citing APPLE-1017).

The Wakuda-Ramsay-Tierling combination was the application of a known technique (Tierling's effect mapping) to a known system (Wakuda-Ramsay's haptic feedback system) ready for improvement to yield predictable results

(benefits articulated above). *KSR*, 550 U.S. at 417. A POSITA would have appreciated that the Wakuda-Ramsay-Tierling combination does not change the relevant features of either reference. APPLE-1003, [167].

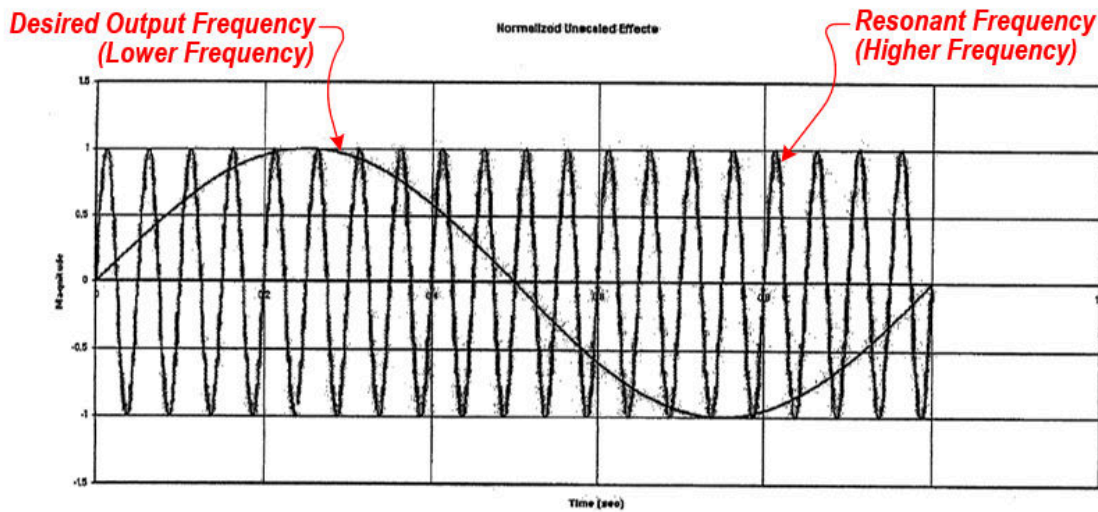
A POSITA would have had a reasonable expectation of success in making these modifications based on the structural similarity in Wakuda-Ramsay and Tierling because the modifications would have been implemented largely through incorporating software instructions for executing Tierling’s functionalities. APPLE-1003, [168]. Furthermore, the combination modifies Wakuda-Ramsay’s system only to the extent that it is necessary to implement the software functionalities of Tierling. *Id.* Accordingly, Wakuda-Ramsay’s system otherwise remains unchanged and performs its intended operations. *Id.*

3. Analysis

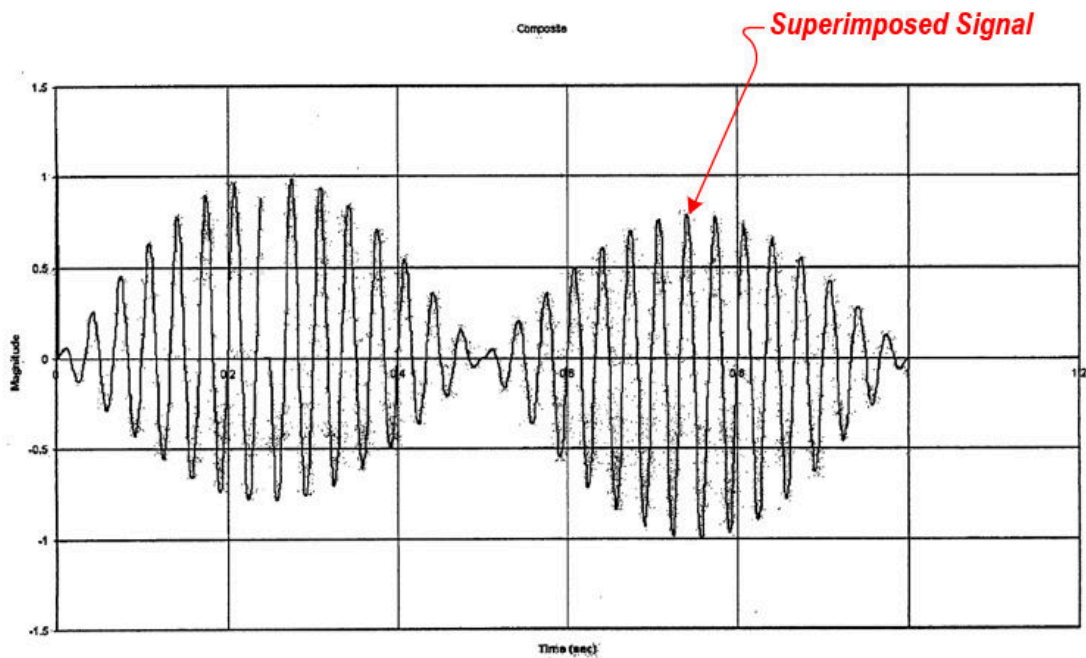
[15]

Wakuda-Ramsay-Tierling’ control component (Wakuda-Ramsay’s control component modified to include Tierling’s effect mapping) drives simultaneous oscillation of the movable component (Wakuda-Ramsay’s magnet/mass) at two or more frequencies (the resonance frequency and a frequency lower than the resonant frequency) to generate complex vibration modes (shown below). APPLE-1003, [169]-[170]; APPLE-1008, [0110] (“multiplying the low-frequency desired output sinusoidal waveform with the higher frequency resonant mode waveform”),

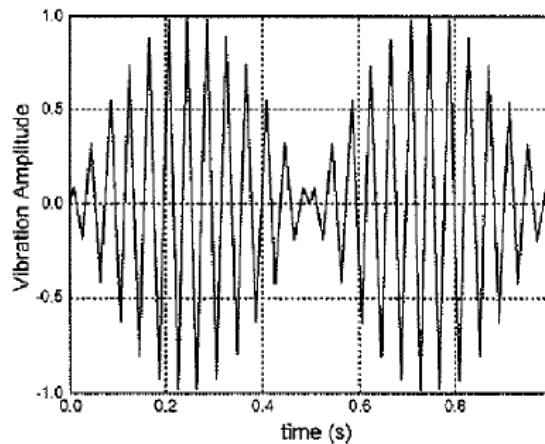
[0031]. Tierling's superimposed signal matches the '830 patent's disclosure of "complex vibrational mode." APPLE-1001, 13:31-59, Figure 22B (below); APPLE-1003, [171].



APPLE-1008, Figure 9



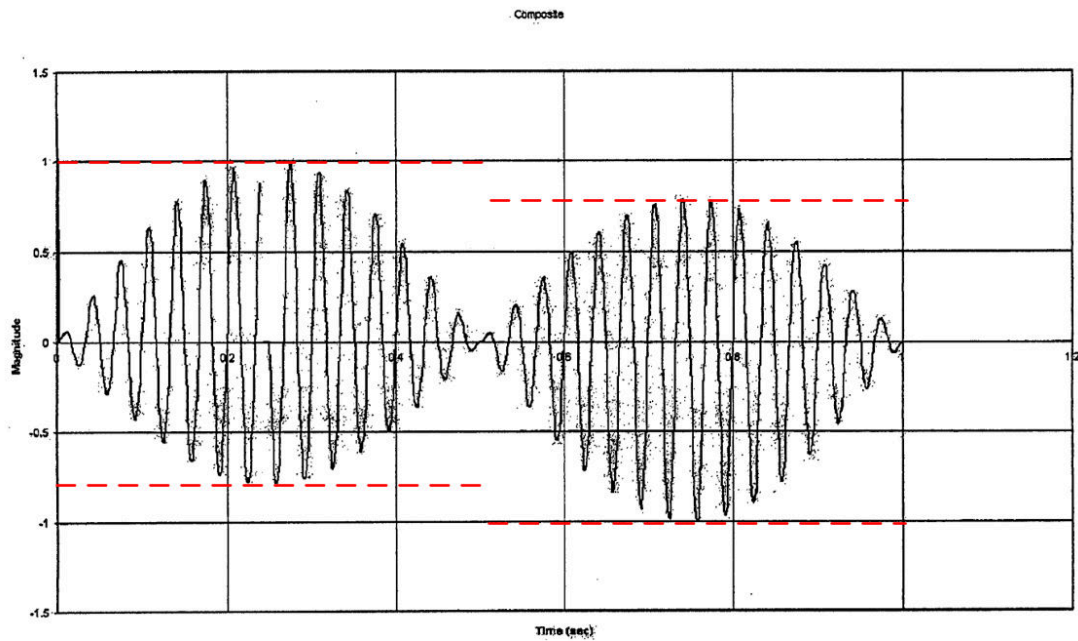
APPLE-1008, Figure 10



APPLE-1001, Figure 22B

[16]

Wakuda-Ramsay-Tierling's complex vibration modes include a primary oscillation frequency (the resonance frequency) modulated by a modulating oscillation frequency (a lower desired frequency in [15]); a beat frequency (the difference between the resonance frequency and the lower desired frequency, which is illustrated in Tierling's Figure 10 below); and an aperiodic oscillation waveform (the waveform having an irregular amplitude illustrated in Tierling's Figure 10). APPLE-1003, [172].



APPLE-1008, Figure 10

As discussed in [15] above, “the frequency of [a higher resonance frequency] can be modulated by the frequency of [a lower, desired frequency],” and the difference between the higher and lower frequencies is the beat frequency. APPLE-1003, [173]; APPLE-1008, [0031], [0110]-[0112]; Figures 9-10.

Further, as shown in Figure 10 above, the amplitude of the beat frequency (indicated by red dashed lines) is irregular and therefore aperiodic. APPLE-1003, [173]. Additionally, Tierling’s effect mapper 306 uses three different transformation matrices—(1) “an initiation transformation matrix” to provide “initiation transformed effect instructions, such as a lead-in effect,” (2) “a sustaining transformation matrix that transforms the incoming effect instructions 502 into transformed effect instructions,” providing “the middle portion of each of

the transformed effect instructions,” and (3) “a termination transformation matrix that transforms the effect instructions into termination transformed effect instructions,” providing “such termination effects as a braking pulse, or the like.” APPLE-1008, [0096]-[0098]. A POSITA would have understood that Tierling’s three different transformation matrices were designed to provide different haptic effects during each cycle (based on different amplitudes and frequencies, etc.), thereby generating an aperiodic oscillation waveform. APPLE-1003, [174].

It also would have been obvious to use Wakuda-Ramsay-Tierling’s system to generate complex vibration modes that include additional aperiodic waveforms wherein the resonance frequency changes irregularly over time depending on various factors, such as a user’s interaction with a haptic-enabled device. APPLE-1003, [175].

[20pre]-[20f]

Supra, Ground 1A, [1pre]-[1f] (explaining Wakuda-Ramsay provides the same limitations); APPLE-1003, [176].

[20g]

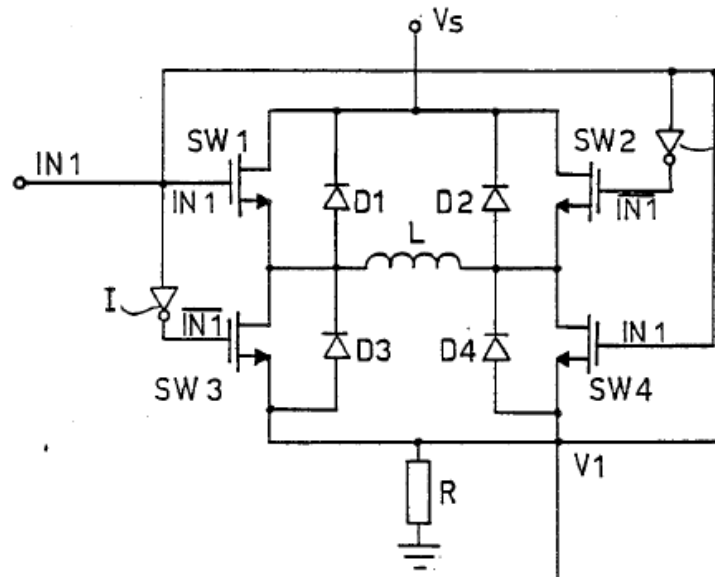
Supra, [15] (explaining Wakuda-Ramsay-Tierling provides this limitation); APPLE-1003, [177].

D. GROUND 2A: Wakuda-Ramsay-Rossi-Aldrich Renders Obvious Claims 1-8, 14, 15-17, 19, 20 (Both Parties’ Means-Plus-Function Constructions)

If the Board applies the means-plus-function construction described above (§II.C), claims 1-8, 14, 15, 17, 19, and 20 are obvious based on the Wakuda-Ramsay-Rossi-Aldrich combination. A POSITA would have found it obvious to combine Wakuda and Ramsay for the reasons described above. §IV.A (Wakuda-Ramsay combination). As discussed below, a POSITA would have further found it obvious to implement the combination in accordance with Rossi's switch circuit and Aldrich's suggestions of a "hill-climbing" control algorithm to tune the frequency input to maintain oscillation at a resonant frequency. APPLE-1003, [178]-[179].

1. Rossi

Rossi's H-bridge switching circuit includes "two pairs of analog switches arranged in a bridge configuration." APPLE-1020, Abstract; 1:65-3:55, Figures 4, 6, cls. 1, 3, 4. The H-bridge circuit includes a "driving signal IN1" input, which is split, and a portion passed through an "inverter I" to generate an internal "driving signal IN1" and an "inverted signal thereof $\overline{\text{IN1}}$." *Id.*; APPLE-1003, [76]-[79].



APPLE-1020, Figure 6 (partial)

2. Aldrich

Aldrich describes a feedback control algorithm to drive an actuator to “one of the resonance peaks and eventually to oscillate about the peak.” APPLE-1021, 11-12; APPLE-1003, [80]-[83]. The drive frequency is incremented or decremented. *Id.* If the increment or decrement results in an increased output (e.g., current/voltage ratio), the direction of change (increase or decrease) of frequency is accepted and another such change (increment or decrement) is made during the following sampling period. *Id.* If, on the other hand, the increment or decrement results in a decrease in output, the direction of change of frequency during the following sampling period is reversed. *Id.* This process is repeated during oscillation to maintain oscillation about a resonant frequency. *Id.*

3. Wakuda-Ramsay-Rossi-Aldrich

(a) Wakuda-Ramsay-Rossi

In the predictable combination, Wakuda-Ramsay's actuator system includes a switch (e.g., H-bridge switch circuit) having a control signal input, splitter and control signal inverter, in accordance with Rossi, that receives the control signal from the processor, in accordance with Wakuda-Ramsay's feedback control. APPLE-1003, [180]. Such a configuration would have yielded the predictable result of oscillating the actuator's magnet by switching the polarity of drive signals generated based on Wakuda-Ramsay closed-loop concepts for feedback control. *Id.*

Several reasons would have motivated a POSITA to modify Wakuda-Ramsay's system based on Rossi's teachings of switch. Indeed, Wakuda describes applying current through the coil in opposite directions to oscillate the movable body. APPLE-1005, 6:4-10. Further, an H-bridge switch was a well-known example circuit to implement a change in current flow to oscillate the movable body in a system like Wakuda-Ramsay's. APPLE-1003, [181]; APPLE-1023, 7:47-50 ("well-known H-bridge circuit"). Although Wakuda-Ramsay does not explicitly describe complete implementation details of a switching circuit, prior art systems such as Rossi demonstrated the conventional knowledge of implementing such a circuit to provide oscillating power. APPLE-1003, [182]; APPLE-1020,

1:65-2:11, 3:43-55, Figures 4, 6.

A POSITA would have been motivated to implement Rossi's switch in the Wakuda-Ramsay system for several reasons. APPLE-1003, [183]-[184]. First, as discussed above, Wakuda-Ramsay does not expressly disclose specifics for switching the current flow for driving the movable body in opposite directions, and therefore a POSITA would have looked toward other teachings like Rossi for implementation details in furtherance of Wakuda-Ramsay's objectives. *Id.*, [185]; APPLE-1005, 6:4-10. A POSITA would have recognized the benefits from Rossi's straightforward teachings of providing complementary drive signals for respective sets of the four H-bridge transistors, such that current/voltage is applied in one of two opposite directions through the coil. APPLE-1003, [185]; APPLE-1020, Abstract, 1:65-3:54; Figures 4, 6. Rossi explicitly indicates the predictable benefit of a configuration that is effective to "functionally switch the load L between the supply node Vs, and virtual ground nodes," thereby reliably driving the movable magnet head of the actuator. APPLE-1020, 2:4-12.

Second, a POSITA would have been motivated to combine Wakuda-Ramsay and Rossi to avail the system of a simple, cost-effective, and reliable circuit design. APPLE-1003, [186]. A POSITA would have recognized that Rossi's controlling the four transistors of the H-bridge using a control signal from the "processor" that is split and inverted would reliably result in complementary internal signals, which

promotes simplicity in the control signal generation and the circuit to deliver the drive signal to the coil. *Id.*

Third, a POSITA would have recognized that combining Rossi and Wakuda-Ramsay was the application of known techniques (Rossi's H-bridge circuit implementation) to a known device (Wakuda-Ramsay's system that switches polarity of current) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. at 417. A POSITA would have had a reasonable expectation of success in making the proposed modifications based on the similarity of the function of the H-Bridge switch circuit in Rossi and Wakuda-Ramsay, and because the modifications would have been implemented largely through routine circuit design considerations and software instructions for generating the control signal. *APPLE-1003*, [187].

(b) Wakuda-Ramsay-Rossi-Aldrich

In the predictable combination, Aldrich's control algorithm is implemented in Wakuda-Ramsay-Rossi's system that utilizes sensor feedback to control vibration output about a resonant frequency. *APPLE-1003*, [188]. In the combined system, sensor outputs would be processed using Aldrich's control algorithm techniques, thereby achieving Wakuda's goal of "generat[ing] a drive signal S1 tracking the resonance frequency of the movable body." *Id.*; *APPLE-1005*, 10:27-32, 6:48-55; *Intel Corporation v. PACT XPP Schweiz AG*, 61 F.4th

1373, 1381 (Fed. Cir. March 13, 2023) (reversing Board and finding that Petitioner “just had to show that [secondary reference’s feature] was a ‘suitable option’ to replace [primary reference’s feature],” and not that it was an “‘improvement’ in the categorical sense”). For example, to generate control signals that maintain oscillation at/near resonance, the drive frequency would be incremented or decremented, and a currently measured vibration strength parameter, would be compared with a previously measured vibration strength parameter. APPLE-1003, [188]; APPLE-1021, 2. According to Aldrich, if the increment or decrement results in an increased vibration strength, the direction of change (increase or decrease, respectively) of frequency is accepted and another such change (increment or decrement, respectively) is made during the following sampling period. *Id.* If the increment or decrement results in a decrease in vibration strength, the direction of change of frequency during the following sampling period is reversed. *Id.*

Further, the resulting system would implement Aldrich’s hill-climb technique using a Boolean value to indicate whether the frequency was being increased. APPLE-1003, [189]. The use of Boolean values to track such a parameter was conventional, and would have been selected as a matter of routine implementation based on Aldrich’s switching between incrementing and decrementing frequency. *Id.* (citing APPLE-1026, 29). Indeed, based on Aldrich’s

description of reversing the direction of frequency change, a POSITA would have predictably utilized a Boolean variable to track the direction of frequency change.

Id.; APPLE-1021, 2.

Additionally, the resulting system would implement Aldrich's hill-climb technique in a feedback control loop in which local variables are set to default variables. APPLE-1003, [190]. A POSITA would have recognized and found it obvious to set local variables to default values so that the control signal is generated to produce oscillation, which is then adjusted as appropriate through feedback control. *Id.* A POSITA would have been motivated to set default values for these specific local variables to facilitate initiation of the actuator close to expected and/or user-selected operating parameters. *Id.*

Further, a POSITA would have been prompted to utilize integer values when processing sensor signals. In the combined system, the sensor signals are an integer value, which facilitates digitally processing the signals, and efficient computation and processing of the force values represented by the sensor signals. APPLE-1003, [191]; APPLE-1021, 2. The use of integer values amounted to a mere design choice (between integer or non-integer values). APPLE-1003, [191]. Moreover, a POSITA would have readily recognized the efficiency and effectiveness of utilizing an integer value associated with the sensor signals. *Id.*

Multiple reasons would have prompted a POSITA to implement Aldrich's "hill-climbing" control algorithm in the Wakuda-Ramsay-Rossi system. APPLE-1003, [192]-[193].

First, a POSITA would have combined Wakuda-Ramsay-Rossi and Aldrich to avail the system of a known feedback algorithm for targeting a resonant frequency, thereby improving Wakuda-Ramsay-Rossi's system with the known benefits from the algorithm. APPLE-1003, [194]. Although Wakuda describes detecting a position of the movable body to generate a drive signal for driving the movable body in the manner that tracks the resonant frequency of the movable body, Wakuda generally lacks implementation details of doing so. *Id.*; APPLE-1005, 6:40-62, 10:22-42. Understanding the shortage of details and thus attempting to implement and improve Wakuda-Ramsay-Rossi's monitoring/adjusting method, a POSITA would have predictably looked to other teachings like Aldrich for such details, especially where Aldrich explicitly describes driving an actuator at/near resonance using such control algorithm techniques. APPLE-1003, [194]; APPLE-1021, 1-3.

Second, a POSITA would have combined Wakuda-Ramsay-Rossi and Aldrich to implement feedback control according to Aldrich's technique that continuously updates the control outputs throughout operation of the system. APPLE-1003, [195]. Aldrich's algorithm continuously facilitates comparison of

current and previous parameters throughout device operation so that the control outputs (e.g., frequency of the control signal) can be adjusted to maintain oscillation at/near resonance frequency, furthering the explicit objectives of Wakuda-Ramsay-Rossi and Aldrich. *Id.*

Third, this combination was the application of known techniques (Aldrich's "hill-climbing" feedback control algorithm) to a known system (Wakuda-Ramsay-Rossi's system that uses feedback control) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. at 417; *APPLE-1003*, [196].

Moreover, a POSITA would have had a reasonable expectation of success in making the proposed modifications based on the applicability of Aldrich's method to the resonant system architectures in Wakuda-Ramsay-Rossi, and because the modifications would be largely implemented via software executed by the microprocessor. *APPLE-1003*, [197]. In the combined system, sensor outputs would have been received and processed by Wakuda-Ramsay-Rossi's processor using at least a "hill-climbing control algorithm" "to find and remain within the vicinity of the resonance," in accordance with Aldrich's suggestions. *APPLE-1021*, 2. For example, it would have been obvious to a POSITA to modify Wakuda-Ramsay-Rossi's processor to include a control program based on Aldrich's algorithm. *APPLE-1003*, [197]. Implementing Aldrich's algorithm as a

control program for applying continuous feedback control about a resonant frequency would have been a routine software change, requiring application of known coding techniques. *Id.*

4. Analysis

[1pre]-[1e]

Supra, Ground 1A, [1pre]-[1e] (explaining Wakuda-Ramsay provides the same limitations); APPLE-1003, [198]-[200].

[1f]

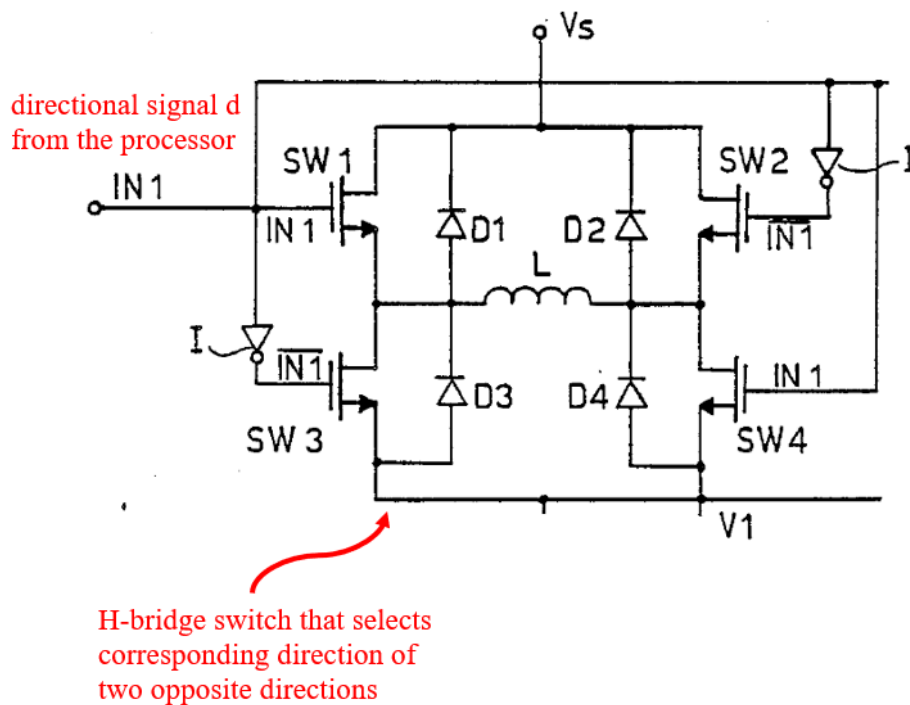
Under the means-plus-function construction (§II.C.1), Wakuda-Ramsay-Rossi-Aldrich's vibration module includes the recited control component. APPLE-1003, [201].

As shown in [1f], the resulting system would include “processor 14” and “memory 16” as the control component, as taught in Ramsay. Ground 1A; APPLE-1006, [0020], [0022], [0024], [0027]; APPLE-1003, [202].

Further, the combination includes a switch (e.g., H-bridge switch) according to Rossi. APPLE-1003, [203]. A POSITA would have found obvious that, based on the Wakuda-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. *Id.* For example, a control signal is output from the microprocessor to a transistor of the H-bridge switch to control

whether the transistor is in an open or closed state, providing the direction signal.

Id. In the resulting system, the switch receives a directional signal (e.g., at “IN1”) that selects a corresponding direction of the two opposite directions in which the driving component drives the moveable component. *Id.*; APPLE-1020, 1:65-2:15; 3:44-55.



APPLE-1020, Figure 6 (partial)

Moreover, the Wakuda-Ramsay-Rossi-Aldrich combination provides that the processor is programmed with the algorithm described in Figures 7A-7C of the '830 patent under the means-plus-function construction. §II.C.1; APPLE-1003, [204].

Step 702 of the '830 patent's algorithm begins execution upon a power-on event. APPLE-1001, 6:57-60. In the combined system, the software instructions of the processor similarly begins execution upon a power-on event invoked by a user through a power button or other user control. APPLE-1003, [205]. Indeed, the combined system includes user-input features as taught by Wakuda-Ramsay ([1d]), which a POSITA would have readily recognized included a power on/off button and were used to power on/off the system. *Id.*

In the '830 patent's step 702, "various local variables are [then] set to default values." APPLE-1001, 6:60-7:3. Similarly, the software of the processor in the combined system sets the same local variables to default values. APPLE-1003, [206]-[208], [84]-[85] (citing APPLE-1024, APPLE-1006); §IV.D.3.(b) (describing the POSITA's motivation for this implementation).

Moreover, in the resulting system, the set-point values include variables consistent with the seven variables recite by the '830 patent, according to the means-plus-function construction. APPLE-1003, [209]-[210].

For example, the combination includes a current operational *mode* of the device. APPLE-1003, [211]-[213]. Indeed, the combined system uses multiple different "haptic tracks" (operational modes) based on haptic parameters including frequency and amplitude as taught by Ramsay. *Id.*; APPLE-1006, [0028], [0030], [0034], [0042], [0049], [0058]. Particularly, Ramsay describes "ROM 28 may be

configured to store a library of preset haptic tracks.” APPLE-1006, [0028].

Accordingly, the combined system would operate based on one of the stored pre-defined haptic effects (*default operational mode*), such as an effect in which feedback control maintains oscillation at the mechanical resonant frequency, when initialized. APPLE-1003, [214]-[215] (describing predictable benefits of a variable to indicate to the control program the operational mode). Additionally, the combined system includes one or more alternative or complex modes of operation that systematically and/or periodically alter the frequency or produce various complex, multi-component vibrational modes. APPLE-1003, [215] (describing example multi-component vibrational techniques that “combine haptic tracks” and/or that systematically/periodically alter the output over time); APPLE-1006, [0035]-[0039], [0047], [0057]-[0059]. For example, as discussed above, Ramsay describes multiple haptic tracks being mixed to drive simultaneous oscillation of the movable component at two or more frequencies. Ground 1A, [15]. Ramsay also describes “a library of preset haptic tracks” having different haptic parameters and/or that are combined. APPLE-1006, [0028].

The combination includes a *strength* variable (magnitude). APPLE-1003, [216]. For example, Ramsay describes that a magnitude variable is user-configurable through GUI. APPLE-1006, [0022]-[0026], [0030]-[0033], [0046], [0053]-[0055]; Ground 1A, [17]; APPLE-1003, [216] (citing APPLE-1023,

APPLE-1025). Accordingly, the combined system would operate based on one of the strength settings (as part of the predefined haptic effects) when it is powered on. APPLE-1003, [216]-[217].

The combination also includes *sensed values* that include previously-sensed (lv0) and currently-sensed (lv1) vibrational strength values. The combined system includes a currently sensed vibration strength value and a previously sensed vibration strength value that are compared in carrying out the control algorithm. APPLE-1003, [218]; APPLE-1021, 12 (describing evaluation of frequency change results in increase or decrease of vibration output). The variables are initialized with default values that provide a starting point for operation (e.g., zero). APPLE-1003, [218].

The combination includes a *frequency* (freq) at which current is changed in the coil, and the directional *control signal* (d) from the microprocessor. APPLE-1003, [219]; APPLE-1021, 1-3 (“excitation frequency”). In the combination, the frequency variable is initialized with default values to provide a starting point for operation (e.g., based on the stored “haptic effect” or “haptic track,” or an assumed resonant frequency). APPLE-1003, [219]. For example, Wakuda describes use of a default frequency value upon initialization based on “the natural frequency (resonance frequency) of the movable body 6” that is “determined by a mass of the movable body 6 and the spring constants (spring constants in the neutral position

shown in FIG. 1) of the energizing members 9.” APPLE-1005, 7:26-43. Further, the directional signal, for example, is initialized with a default value (e.g., high or low), which is then reversed during operation to induce oscillation according to the feedback control program. APPLE-1003, [219] (describing obvious design choice of initialize direction signal d as high or low) (citing APPLE-1019, APPLE-1020).

The combination includes a *Boolean value* (inc) that indicates that the frequency is being increased. APPLE-1003, [220]. The Boolean value tracks the status of frequency increase/decrease to implement the comparison in accordance with Aldrich’s control algorithm, as a matter of routine implementation. *Id.* (citing APPLE-1026).

In the ’830 patent’s step 704, the control program “waits for the next event.” APPLE-1001, 7:3-7. In the combined system, the software executing on the microprocessor waits for the next event, such as a sensor input to be used in determining the control signal, or a user input to power down the device or modify haptic effect characteristics. APPLE-1003, [221]; APPLE-1006, [0022]-[0026], [0030]-[0033], [0046], [0053]-[0055]; Ground 1A, [17]. When sensor signals are received by the microprocessor, the control outputs are adjusted accordingly. APPLE-1003, [221] (citing APPLE-1005, 6:40-47). Indeed, use of a loop or event handler in a feedback control system were known and a conventional technique readily implemented by a POSITA in order to operate in accordance with the

respective event. APPLE-1003, [222] (citing APPLE-1026).

In the '830 patent's step 712, the control program algorithm calls a "monitor" routine," which is illustrated in Figure 7B. APPLE-1001, 7:29-31. The "monitor" routine is a simple and known routine for implementing a feedback loop to maintain operation of a vibration module at or near resonance. APPLE-1003, [223]. The combined system executes the same algorithm. §IV.D.3 (Wakuda-Ramsay-Rossi-Aldrich combination). Particularly, a POSITA would have found it obvious, especially based on Aldrich's feedback control to operate at a resonant frequency, to compare vibration parameters while incrementing or decrementing the drive frequency. APPLE-1003, [223].

The combined system includes one or more sensors, as taught by Wakuda. APPLE-1003, [224]; APPLE-1005, 6:40-62 ("position detection means"); Ground 1A, [3]. Therefore, the software executed by the microprocessor in the combined system receives signals from the sensors, indicative of vibrational strength, and compares a current sensed vibration strength value and a previous sense vibration strength value to tune the input frequency about a resonant frequency, consistent with steps 736-750 of Figure 7B of the '830 patent. APPLE-1003, [224]; APPLE-1021, 1-3.

For example, in accordance with Aldrich's suggestions, a current sensed vibration strength value at an incrementally increased control signal frequency is

compared with a previous sensed vibration strength value. APPLE-1003, [225].

When the vibration strength has increased with increased frequency input, “then the direction of change . . . of frequency is accepted and another such change . . . is made during the following sampling period.” APPLE-1021, 2. This is the same as steps 738-740 of the ’830 patent. APPLE-1003, [225].

Similarly, when the vibration strength has not increased with increased frequency input, the control program determines that the resonant frequency has been exceeded. APPLE-1003, [226]; APPLE-1021, 2. The “direction of change of frequency during the following sampling period is reversed,” such that the frequency is decremented, and the process continues. APPLE-1021, 2. This is the same as steps 742-744 of the ’830 patent. APPLE-1003, [226]. The combined system proceeds in a similar manner when decrementing the input frequency, following steps 746-752 of the ’830 patent. *Id.*, [227].

In the combined system, the currently and previously sensed sensor signals are processed and stored as integer values. As discussed above, the use of integer values amounts to a known technique mere design choice (e.g., between integer or non-integer values). §IV.D.3 (Wakuda-Ramsay-Rossi-Aldrich combination); APPLE-1003, [228].

In the ’830 patent’s step 714, the control program calls a “control” routine, which is illustrated in Figure 7C, “when the event corresponds to a change in the

user input through the user interface.” APPLE-1001, 7:31-34, 8:20-32. In the combined system, the user input provides a change in vibration strength (e.g., in accordance with Ramsay), and the user input is received during a monitoring period so that the input is processed and implemented. APPLE-1003, [229]-[231]. Particularly, the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user input. *Id.*

In the '830 patent's step 718, the control program determines whether there has been a power down event. APPLE-1001, 7:34-38. Similar to the power on event described above, a POSITA would have readily recognized that the combined system executes a power-down event in response to user input (e.g., Wakuda-Ramsay's user-input features) that turns the device “off.” APPLE-1003, [232].

In the co-pending litigation, Patent Owner alleged the “control component” as a means-plus-function limitation and identified the corresponding structure as “oscillator circuit; microcontroller with internal or external memory; processor; CPU; microprocessor; and equivalents thereof,” and “[w]here the corresponding structure is a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: (a) set the mode and strength to default values or values representing selections made by user input to the user input features; and (b)

provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component.” APPLE-1046, 12-13; APPLE-1047, 19-23. Similarly, in litigation against Samsung Electronics, Patent Owner alleged the “control component” as a means-plus-function limitation and identified the corresponding structure as “[if an algorithm is required] . . . a processor, CPU, or microprocessor, the processor/CPU/microprocessor is programmed with an algorithm comprising the following steps: (a) set the mode and strength to [default values or] values representing selections made by user input to the user input features; and (b) provide a corresponding output to the power supply so that the power supply provides a corresponding output to the driving component” or “[i]n the alternative, if the Court finds that a three-step algorithm is necessary, . . . (1) set the mode and strength to [default values or] values represented by selections made by user input to the user input features, (2) provide a corresponding output to the power supply, and (3) provide a corresponding output to an H-bridge switch.” APPLE-1045, 14-15, 19-22. Notably, these means-plus-function interpretations are subsumed within this Petition’s mapping in Ground 2A, which identifies the narrowest disclosure of the ’830 patent as the corresponding structure. §II.C.1; APPLE-1003, [233].

[2]-[8], [14], [15]-[17], and [19]

Wakuda-Ramsay-Rossi-Aldrich renders obvious claims 2-8, 14, 15-17, and

19 obvious, as taught by Wakuda-Ramsay. Ground 1A; APPLE-1003, [234].

[20]

As discussed in §II.C.1, under the means-plus-function construction, the corresponding structure for “control component” in claim 20 is identical to the corresponding structure for “control component” in claims 1 and 19, except that the algorithm is further designed for the additional function of “driving simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.” Such additional algorithm is described at column 13 of the ’830 patent. APPLE-1001, 13:20-59; APPLE-1003, [235].

As discussed in [1f] above, Wakuda-Ramsay-Rossi-Aldrich provides the additional algorithm for the “complex vibration modes.” APPLE-1003, [236]. For example, the resulting system includes one or more alternative or complex modes of operation that systematically and/or periodically alter the frequency or produce various complex, multi-component vibrational modes. *Id.*; Ground 2A ([1f], [15]); APPLE-1006, [0035]-[0039], [0047], [0057]-[0059].

Additionally, Wakuda-Ramsay-Rossi-Aldrich provides the other limitations of claim 20, as taught by Wakuda-Ramsay. Grounds 1A; APPLE-1003, [237].

In the co-pending litigation, Patent Owner alleged the “control component” in claim 20 as a means-plus-function limitation and identified the same corresponding structure as in claims 1 and 19 (except for oscillator circuit and

default values). APPLE-1046, 12-13; APPLE-1047, 19-23. Patent Owner further identifies that, as the corresponding structure, “the algorithm comprises the following additional step: (c) drive simultaneous oscillation of the moveable component at two or more frequencies.” *Id.* Notably, this means-plus-function interpretation is covered by this Petition’s mapping based on the Wakuda-Ramsay-Rossi-Aldrich combination above because Patent Owner’s interpretation is a broader version of the ’830 patent’s disclosed algorithm. §II.C.1; APPLE-1003, [238].

E. GROUND 2B: Wakuda-Ramsay-Rossi-Aldrich-Tierling Renders Obvious Claims 15, 16, 20 (Both Parties’ Means-Plus-Function Constructions)

Except for the means-plus-function construction discussed in Ground 2A, Ground 2B is substantially the same as Ground 1C. APPLE-1003, [239].

Additionally, under the means-plus-function construction, Wakuda-Ramsay-Rossi-Aldrich-Tierling provides the additional algorithm for the “complex vibration modes” in claim 20, based on Tierling’s teachings as discussed in Ground 1C ([15]). APPLE-1003, [240]; APPLE-1008, [0108], [0031], Figures 9-10. Similarly, Wakuda-Ramsay-Rossi-Aldrich-Tierling covers Patent Owner’s identification of means-plus-function limitation because Patent Owner’s interpretation is a broader version of the ’830 patent’s disclosed algorithm. §II.C.1; Ground 2A ([20]); APPLE-1003, [240].

V. DISCRETIONARY CONSIDERATIONS

A. The *General Plastic* Factors Favor Institution

The '830 patent is currently being challenged in instituted IPR2023-00993 filed by Samsung Electronics Co., Ltd., et al. ("Samsung"), and also in pre-instituted IPR2024-00570 filed by Sony Interactive Entertainment Inc. et al. ("Sony"). The instant petition is entirely distinct—it is being filed by an entirely separate party, and this petition uses completely different prior art, claim construction, and priority date treatment than were used in the earlier petitions by Samsung and Sony. *Compare* IPR2023-00993, Paper 2, 3-4 *with* §II.B-C; *compare* IPR2024-00570, Paper 1, 8-12 *with* §II.B-C. For these reasons, the *General Plastic* factors favor institution. *General Plastic*, IPR2016-01357, Paper 19, 16.

1. Factors 1, 2, 4, and 5: Apple Never Petitioned This Patent

Apple is a separate company from Samsung and Sony sued separately by Patent Owner in separate Courts. The Apple and Samsung/Sony products Patent Owner accuses of infringing the '830 patent are not related to one another. Moreover, Apple and Samsung/Sony did not cooperate in any way in preparing either the previously filed IPR2023-00993 and IPR2024-00570 or this petition. Unlike in *Valve I* and *II*, Apple is a wholly separate and unrelated entity from Samsung and Sony, and the record is devoid of evidence that the companies share

accused products—or even suppliers or components. *Valve Corp.*, IPR2019-00062, Paper 11, 9-10 (“*Valve I*”); *Valve Corp.*, IPR2019-00064, Paper 10, 10 (“*Valve II*”). In fact, these facts are nearly opposite facts to those present in the Board’s precedential *Valve* decision.

Because the evidence does not show a significant relationship between Apple and Samsung or between Apple and Sony, “*General Plastic* factors 1, 2, 4, and 5 weigh against discretionary denial.” *Volkswagen Group of America*, IPR2022-01537, Paper 8, 11. Where, as here, “there is no indication of a significant relationship under *Valve* and factor 1 between Petitioner and the” prior petitioner, “Petitioner did not file a second petition following-on to a first petition under factors 2, 4, and 5.” *Id.* “In other words, this is not a case where we need to address concerns that Petitioner is ‘strategically stag[ing] [its] prior art and arguments in multiple petitions’ in order to refine its positions based on lessons learned from Petitioner’s filing of an earlier petition.” *Id.* (citing *General Plastic*, Paper 19, 17; *Code200*, IPR2022- 00861, Paper 18, 5).

While developing defenses against three other patents in the copending litigation (§VIII.B), Apple has independently uncovered at least Rossi and Aldrich, which supply non-cumulative evidence supporting strong motivation rationales with Wakuda and Ramsay under different claim constructions than Samsung’s or Sony’s.

During the pendency of Samsung's petition in IPR2023-00993, which was filed on 6/14/2023, Petitioner was still vetting the prior art and worked diligently on refining Grounds 1-2 in the intervening months. Rossi and Aldrich were only discovered by the IPR counsel in December 2023. In the litigation between Apple and Patent Owner, both sides argue that means-plus-function constructions should be employed. Aldrich is critical to address the corresponding structure disclosed in the specification. Yet, Petitioner did not uncover Aldrich until the very end of 2023. Petitioner's timing and diligence was reasonable under the circumstances and did not result in unfair tactical advantages. Sony's petition in IPR2024-00570 was filed on 2/16/2024, less than two months before the instant petition is filed.

2. Factor 3: The Different Prior Art at Issue Between the Proceedings Ensures No Advantage Is Gained

Patent Owner filed its POPR in IPR2023-00993 on 10/16/2023. However, as noted above, the prior art references relied upon in IPR2023-00993 are entirely distinct from the prior art references that form the basis for this Petition. Thus, knowledge of the arguments raised in the POPR of IPR2023-00993 does not confer any advantage to Apple. No POPR has been filed in IPR2024-00570.

3. Factors 6 and 7: The Distinct Grounds and Lack of Significant Relationship Ensure the Board's Resources and Ability to Render a Decision Within the Statutory Timeframe Are Not Significantly Impacted

There are no common prior art references between this petition and IPR2023-00993/IPR2024-00570. Moreover, because Apple and Samsung/Sony share no significant relationship, the rights of Apple to pursue this petition will not in any way be impacted by the outcome of IPR2023-00993/IPR2024-00570. Thus, any Final Written Decision in IPR2023-00993/IPR2024-00570 is unlikely to have a significant impact on the merits or conduct of an instituted IPR from this petition. And while the Board will expend resources necessary to hear this alternative petition, the expenditure of those resources is justified by Apple's independent and distinct basis under §314 to file an IPR petition and the fees that Apple is paying to have this petition heard on the merits.

Furthermore, it's entirely possible for Patent Owner to settle with Samsung/Sony and seek termination of IPR2023-00993/IPR2024-00570 at any time during its pendency, after Apple's statutory bar date. Apple's basis under §314 to have the Board consider the patentability of the '830 patent should not be put in tension with and potentially curtailed by Patent Owner and Samsung's/Sony's distinct right to settle their dispute outside of Apple's control.

B. The *Advanced Bionics* Test Favors Institution

Each of the Petition's references, except for Amaya, was not considered during prosecution and is not cumulative of the references considered. Although Amaya was cited on the face of the '830 patent, there is no evidence that the Office

substantially considered Amaya among the references listed on the cover of the '830 patent. This Petition thus does not involve the same or substantially the same art or arguments previously presented, ending the *Advanced Bionics* inquiry in favor of institution. *Advanced Bionics*, IPR2019-01469, Paper 6, 8-9.

C. The *Fintiv* Factors Favor Institution

This Petition's merits are compelling, and the evidence presented is substantial, counseling against discretionary denial under *Fintiv*.

Factor 1 is neutral or favors institution. Apple requested a stay pending resolution of a Motion to Transfer to the Northern District of California. While the PTAB does not infer how the district court would rule should a stay be requested, the pending motion at least increases the likelihood of a stay. *Hulu*, IPR2021-00298, Paper 11, 10-11 (May 19, 2021).

Factor 2 favors institution. The Board will likely issue its Final Written Decision around October/November 2025, within about two months of the currently-scheduled trial date (8/4/2025) and likely before the media time-to-trial in WDTX (October 2025, based on 28.3-months median time). The currently-scheduled trial date is uncertain and subject to change due to a number of factors. Indeed, the case was recently transferred from the docket of Judge Counts to Judge Albright, with the impact on the schedule not yet resolved. Moreover, a Motion to Transfer to the Northern District of California, and a Motion to Stay while the

transfer motion is considered, both remain pending. APPLE-1036.

Factor 3 favors institution because Petitioner has diligently filed this Petition nearly two months ahead of the one-year time bar, while the litigation remains in its early stages. By the anticipated institution deadline in October 2024, the co-pending litigation will still be in early stages—expert and fact discovery will be months away from concluding. *Id.* Moreover, a Motion to Transfer Venue is still pending. APPLE-1036.

Factors 4 and 5 are neutral. Resolution is expected around the time of a decision in the District Court, which mitigates against duplication of effort and serves efficiency and integrity goals. The same parties are in the co-pending litigation.

Factor 6 favors institution because this petition's merits are compelling for the reasons described herein, demonstrating unpatentability of the claims based on multiple grounds and claim constructions.

VI. PAYMENT OF FEES

Petitioner authorizes the Office to charge any fees to Deposit Account No. 06-1050.

VII. CONCLUSION

Petitioner respectfully requests institution of IPR.

VIII. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Apple Inc. is the petitioner and real party-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for *inter partes* review for the '830 patent. The '830 patent is the subject of *Resonant Systems, Inc. d/b/a Revel HMI v. Apple, Inc.*, 7-23-cv-00077 (WDTX) filed June 1, 2023. The '830 patent is the subject of *Resonant Systems, Inc. v. Samsung Electronics Co., Ltd. et al.* 2-22-cv-00423 (EDTX) filed October 26, 2022, *Resonant Systems, Inc. v. Sony Group Corporation (Japan) et al.* 2-22-cv-00424 (EDTX) filed October 26, 2022. The '830 patent is the subject of *Samsung Electronics Co., Ltd. et al v. Resonant Systems, Inc.* IPR2023-00993 (PTAB) filed June 14, 2023; *Samsung Electronics Co., Ltd. et al v. Resonant Systems, Inc.* IPR2023-01025 (PTAB) filed June 14, 2023; and *Sony Interactive Entertainment Inc. et al. v. Resonant Systems, Inc.*, PTAB-IPR2024-00570 (PTAB) filed February 16, 2024.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR50095-0179IP2@fr.com.

Respectfully submitted,

Dated: April 12, 2024

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,996 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated: April 12, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on April 12, 2024, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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