

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NINTENDO CO., LTD., and
NINTENDO OF AMERICA INC.,
Petitioners

v.

RESONANT SYSTEMS, INC.,
Patent Owner

Case No.: IPR2025-01098
U.S. Patent No. 8,860,337
Issue Date: October 14, 2014

Title: LINEAR VIBRATION MODULES AND LINEAR-RESONANT
VIBRATION MODULES

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,860,337
PURSUANT TO 35 U.S.C. §§311-319 and 37 C.F.R. §42**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	REQUIREMENTS FOR IPR	2
A.	Grounds for Standing (37 C.F.R. §42.104(a))	2
B.	Lead and Backup Counsel and Service Information (37 C.F.R. §§42.8(b)(3-4), 41.10(a))	2
C.	Real-Parties-in-Interest (37 C.F.R. §42.8(b)(1)).....	4
D.	Related Matters (37 §C.F.R. §42.8(b)(2)).....	4
E.	Proof of Service (37 C.F.R. §42.8(b)(4)).....	7
F.	Payment of Fees	7
III.	IDENTIFICATION OF GROUNDS AND CLAIMS BEING CHALLENGED (§42.104(B))	8
IV.	'337 PATENT.....	10
A.	Brief Description	10
B.	Prosecution History	13
V.	CLAIM CONSTRUCTION	13
A.	Means-Plus-Function Terms	13
1.	“driving component”.....	14
2.	“control component”	15
VI.	LEVEL OF SKILL IN THE ART	18
VII.	GROUND 1: WAKUDA-RAMSAY-ROSSI-ALDRICH RENDERS OBVIOUS CLAIMS 2 AND 3.....	19
A.	Wakuda.....	19
B.	Ramsay	21
C.	Rossi	22
D.	Aldrich.....	23
E.	Motivations to Combine: Wakuda-Ramsay-Ross-Aldrich Combination	23
1.	Wakuda-Ramsay	23
2.	Wakuda-Ramsay-Rossi.....	27

3.	Wakuda-Ramsay-Rossi-Aldrich	30
F.	Analysis	34
1.	[2pre]: A linear vibration module comprising:.....	34
2.	[2a]: a housing;.....	34
3.	[2b]: a moveable component;.....	35
4.	[2c]: a power supply;	36
5.	[2d]: user-input features;.....	37
6.	[2e]: a driving component that drives the moveable component in each of two opposite directions within the housing; and	38
7.	[2f]: a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features,.....	39
8.	[2g]: wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.....	50
9.	[3]: The linear vibration module of claim 2 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.	52
VIII.	GROUND 2: FUKUMOTO-ALDRICH RENDERS OBVIOUS CLAIM 2.....	55
A.	Fukumoto.....	55
B.	Motivations to Combine.....	58
1.	Aldrich-Fukumoto.....	58
C.	Analysis	61
1.	[2pre]: A linear vibration module comprising:.....	61
2.	[2a]: a housing;.....	62
3.	[2b]: a moveable component;.....	63
4.	[2c]: a power supply;	64

5.	[2d]: user-input features;.....	64
6.	[2e]: a driving component that drives the moveable component in each of two opposite directions within the housing; and	66
7.	[2f]: a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features,.....	67
8.	[2g]: wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.....	77
IX.	GROUND 3: FUKUMOTO-ALDRICH-SAIKI-MASAHIKO RENDERS OBVIOUS CLAIM 3	78
A.	Saiki.....	78
B.	Masahiko	79
C.	Motivations to Combine.....	80
1.	Saiki with Fukumoto-Aldrich	80
2.	Masahiko with Fukumoto-Aldrich-Saiki	81
D.	Analysis	83
1.	[2pre]-[2g].....	83
2.	[3] (see claim listing)	83
X.	GROUND 4: FUKUMOTO RENDERS OBVIOUS CLAIM 2	85
XI.	GROUND 5: FUKUMOTO-SAIKI-MASAHIKO RENDERS OBVIOUS CLAIM 3.....	86
XII.	SECONDARY CONSIDERATIONS	87
XIII.	CONCLUSION.....	87

LISTING OF EXHIBITS

EXHIBIT NO.	DESCRIPTION
1001	U.S. Patent No. 8,860,337 to Elenga et al.
1002	U.S. Patent No. 8,860,337 File History
1003	Declaration of Dr. Pinhas Ben-Tzvi
1004	U.S. Patent No. 7,843,277 to Gregorio et al.
1005	U.S. Patent No. 7,005,811 to Wakuda et al. (“Wakuda”)
1006	U.S. Patent Application Publication No. 2008/0294984 to Ramsay et al. (“Ramsay”)
1007	U.S. Patent Application Publication No. 2006/0109256 to Grant et al.
1008	U.S. Patent Application Publication No. 2005/0134561 to Tierling et al.
1009	RESERVED
1010	U.S. Patent Application Publication No. 2008/0198139 to Lacroix et al.
1011	RESERVED
1012	RESERVED
1013	RESERVED
1014	RESERVED
1015	RESERVED
1016	RESERVED
1017	<i>Curriculum Vitae</i> of Dr. Pinhas Ben-Tzvi

Petition for *Inter Partes* Review of U.S. Patent No. 8,860,337

EXHIBIT NO.	DESCRIPTION
1018	Thorsten A. Kern, <i>Engineering Haptic Devices: A Beginner's Guide for Engineers</i> , Springer, 2009
1019	U.S. Patent No. 6,982,696 to Shahoian
1020	U.S. Patent No. 4,879,641 to Rossi et al. ("Rossi")
1021	Jack Aldrich, et al, <i>Controller for Driving a Piezoelectric Actuator at Resonance</i> , NASA Tech Briefs, April 2008 ("Aldrich")
1022	Declaration of June Munford re Aldrich ("Aldrich Decl.")
1023	U.S. Patent No. 7,027,032 to Rosenberg et al.
1024	U.S. Patent No. 5,736,797 to Motohashi et al.
1025	U.S. Patent No. 5,955,799 to Amaya et al.
1026	J. Peckol, <i>Embedded Systems, A contemporary Design Tool</i> , 2008
1027	<i>Apple Inc. v. Resonant Systems, Inc.</i> , IPR2024-00807, Paper 2 (PTAB Apr. 12, 2024) (Petition for <i>Inter Partes</i> Review)
1028	<i>Apple Inc. v. Resonant Systems, Inc.</i> , IPR2024-00807, Ex. 2008 (PTAB July 29, 2024) (Statutory Disclaimer of U.S. Patent No. 8,860,337 claims 1, 4, and 5)
1029	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00992, Paper 3 (PTAB June 14, 2023) (Petition for <i>Inter Partes</i> Review)
1030	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 3 (PTAB June 14, 2023) (Petition for <i>Inter Partes</i> Review)
1031	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00992, Ex. 2015 (PTAB May 22, 2024) (Statutory disclaimer of claims 15 and 16 of U.S. Patent No. 9,369,081)

Petition for *Inter Partes* Review of U.S. Patent No. 8,860,337

EXHIBIT NO.	DESCRIPTION
1032	Complaint for Patent Infringement Against Nintendo Co., Ltd., Dkt. No. 1, <i>Resonant Systems, Inc. d/b/a RevelHMI v. Nintendo Co., Ltd.</i> , Case No. 2:25-cv-00090 (E.D. Tex. Jan. 31, 2025)
1033	RESERVED
1034	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 1 (PTAB Mar. 10, 2025) (Petition for <i>Inter Partes</i> Review)
1035	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 4 (PTAB Mar. 10, 2025) (Petitioners' Motion for Joinder)
1036	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 8 (PTAB June 5, 2025) (Order Conduct of the Proceeding)
1037	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 9 (PTAB June 5, 2025) (Supplemental Brief in Support of Petitioner's Motion for Joinder)
1038	RESERVED
1039	U.S. Patent Publication No. 2009/0295739 to Nagara
1040	U.S. Patent Publication No. 2011/0133682 to Egger et al.
1041	U.S. Patent Publication No. 2008/0001484 to Fuller et al.
1042	RESERVED
1043	U.S. Patent Publication No. 2005/0275294 to Izumi et al.
1044	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 11 (PTAB June 16, 2025) (Patent Owner's Request for Discretionary Denial of Institution)

EXHIBIT NO.	DESCRIPTION
1045	<i>Nintendo Co., Ltd., and Nintendo of America, Inc. v. Resonant Systems, Inc.</i> , IPR2025-00680, Paper 12 (PTAB June 16, 2025) (Patent Owner’s Supplemental Reply Brief Opposing Petitioners’ Motion for Joinder)
1046	RESERVED
1047	Court’s Claim Construction Order, Dkt. No. 91, <i>Resonant Systems, Inc. d/b/a RevelHMI v. Apple, Inc.</i> , Case No. 7:23-cv-00077 (W.D. Tex. June 3, 2024)
1048	U.S. Patent No. 7,292,227 to Fukumoto et al. (“Fukumoto”)
1049	U.S. Patent No. 7,006,641 to Saiki et al. (“Saiki”)
1050	U.S. Patent No. 8,917,486 to Masahiko (“Masahiko”)
1051	Claim Construction Order, Dkt. No. 107 <i>Resonant Systems, Inc. v. Sony Group Corp. and Sony Interactive Entertainment Inc.</i> , Case No. 22-cv-00424-JRG (E.D. Tex. Aug. 28, 2024)
1052	STMicroelectronics, L298: Dual Full-Bridge Driver Datasheet (2000) (“STMicroelectronics”)
1053	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 11 (PTAB Oct. 16, 2023) (Patent Owner’s Preliminary Response)
1054	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 16 (PTAB Nov. 29, 2023) (Corrected Patent Owner’s Preliminary Sur-Reply)
1055	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 28 (PTAB Apr. 15, 2024) (Patent Owner’s Response)
1056	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 41 (PTAB Aug. 29, 2024) (Patent Owner’s Sur-Reply)

EXHIBIT NO.	DESCRIPTION
1057	<i>Apple Inc. v. Resonant Systems, Inc.</i> , IPR2024-00807, Paper 10 (PTAB Oct. 15, 2024) (Decision Granting Institution of <i>Inter Partes</i> Review)
1058	<i>Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. v. Resonant Systems, Inc.</i> , IPR2023-00993, Paper 48 (PTAB Jan. 8, 2025) (Final Written Decision Determining Some Challenged Claims Unpatentable)
1059	Exhibit 12 to Nintendo Co., Ltd.’s Opposed Motion to Stay Pending <i>Inter Partes</i> Review, Dkt No. 18-13, <i>Resonant Systems, Inc. v. Nintendo Co., Ltd.</i> , Case No. 2:25-cv-00090-JRG (E.D. Tex May 7, 2025)
1060	Exhibit 13 to Nintendo Co., Ltd.’s Opposed Motion to Stay Pending <i>Inter Partes</i> Review, Dkt. No. 18-14, <i>Resonant Systems, Inc. v. Nintendo Co., Ltd.</i> , Case No. 2:25-cv-00090-JRG (E.D. Tex May 7, 2025)
1061	File History of U.S. Patent 8,093,767
1062	File History of Provisional Patent Application No. 61/179,109
1063	U.S. Patent Publication No. 2008/0155415 to Yoon et al.
1064	Exar Databook, <i>XR-8038: Precision Waveform Generator</i> , Chapter 1 at 213–214 (1985)
1065	Water G. Jung, <i>IC Op-Amp Cookbook, Second Edition, The Art of Electronics, 2nd Edition</i> , Howard W. Sams & Co., Inc., at 360–362 (1974)
1066	Herbert Friedman, <i>99 Electronic Projects</i> , Lafayette Radio Electronics, at 126 (1971)
1067	Excerpts from Paul Horowitz and Winfield Hill, <i>The Art of Electronics, 2nd Edition</i> , Cambridge University Press (1980)

EXHIBIT NO.	DESCRIPTION
1068	Jacob Millman, <i>Micro-Electronics: Digital and Analog Circuits and Systems</i> , McGraw-Hill Book Company, at 651-653, (1979)
1069	Atmel Application Note, <i>AVR494: AC Induction Motor Control Using the constant V/f Principle and a Natural PWM Algorithm</i> (2005)
1070	Microchip, <i>AN899: Brushless DC Motor Control Using PIC18FXX31 MCUs</i> (2004)
1071	Texas Instruments, <i>DRV880x DMOS Full-Bridge Motor Drivers</i> (July 2008)
1072	Millman and Halkias, <i>Integrated Electronics: Analog and Digital Circuits and Systems</i> , McGraw-Hill, Inc., at 130-140 (1972)
1073	Mohan et al., <i>Power Electronics: Converters, Applications, and Design, 2nd ed.</i> , John Wiley & Sons, Inc., at 188-190, 386-387 (1995)
1074	Muhammad H. Rashid, <i>Power Electronics: Circuits, Devices, and Applications, 3rd ed.</i> , Prentice Hall, at 230-233 (2003)
1075	Mohamed A. El-Sharkawi, <i>Fundamentals of Electric Drives</i> , Brooks/Cole Publishing Company, at 73-74, 169-170, 258-259 (2000)
1076	Sedra and Smith, <i>Microelectronic Circuits, 4th ed.</i> , Oxford University Press, at 436-441, 994-1002, 1009-1013, 1049-1058 (1998)

LISTING OF CLAIMS

Claim 2	
[2pre]	A linear vibration module comprising:
[2a]	a housing;
[2b]	a moveable component;
[2c]	a power supply;
[2d]	user-input features;
[2e]	a driving component that drives the moveable component in each of two opposite directions within the housing; and
[2f]	a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features,
[2g]	wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.
Claim 3	
[3]	The linear vibration module of claim 2 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.

I. INTRODUCTION

Petitioners Nintendo Co., Ltd., and Nintendo of America Inc. (collectively, “Nintendo” or “Petitioners”) respectfully request *Inter Partes* Review (“IPR”) of claims 2 and 3 (the “Challenged Claims”) of U.S. Patent No. 8,860,337 (“NINTENDO-1001” or the “’337 patent”). The Challenged Claims are (1) patentably indistinct from claims disclaimed by Patent Owner (“PO”) in one related patent; (2) patentably indistinct from claims held unpatentable by the Board in another related patent; and (3) the same claims on which the Board instituted a related IPR, finding a reasonable likelihood of success on **six** grounds. This Petition is only necessary because of PO’s pattern of obtaining near-identical claims in different, related patents, and asserting those claims against different defendants. The Board should institute this Petition and hold both Challenged Claims unpatentable based on the same conclusions that it has already reached in other proceedings.

Grounds 2-5 of this petition rely on the same art that the Board found to render obvious claims patentably indistinct from the Challenged Claims. *See Samsung Elecs. Co., Ltd., et al. v. Resonant Sys., Inc.*, IPR2023-00993, Paper 48, 18-24, 33-34, 57-62, 66-70 (PTAB Jan. 8, 2025) (finding claims 1, 15-17 unpatentable); §II.D.

Ground 1 of this petition relies on the same art upon which the Board instituted an IPR over the Challenged Claims. *See Apple Inc. v. Resonant Sys., Inc.*, IPR2024-

00807, Paper 10, 2, 7, 48 (PTAB Oct. 15, 2024) (instituting IPR of claims 2 and 3); §II.D.

What's more, the Board need not reach the merits of each ground. Under CFR 37 § 42.73 and common law estoppel, PO will be estopped from contesting patentability of the Challenged Claims with respect to Grounds 4-5 if the Federal Circuit affirms the Board's decision in IPR2023-00993.

PO, attempting to circumvent the PTAB's adverse ruling and its statutory disclaimer, asserted claims 2 and 3 of the '337 patent against Petitioner. Petitioner now challenges the same, already-found unpatentable (and disclaimed) limitations—applying the same prior art that the Board found renders these limitations unpatentable—that are simply re-packaged in the '337 patent. There is more than a reasonable likelihood Petitioner will prevail on at least one claim.

II. REQUIREMENTS FOR IPR

A. Grounds for Standing (37 C.F.R. §42.104(a))

Petitioner certifies that the '337 patent is available for IPR and that no law bars Petitioners from requesting IPR of the Challenged Claims on the below-identified grounds.

B. Lead and Backup Counsel and Service Information (37 C.F.R. §§42.8(b)(3-4), 41.10(a))

Petitioners provide the following designation of Lead and Back-Up counsel.

Lead Counsel	Backup Counsel
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Petitioners consent to service by electronic mail at the following addresses:

PTABDocketJJL2@orrick.com,

PTABDocketP2S7@orrick.com,

PTABDocketJ3B3@orrick.com,

PTABDocket9SA@orrick.com, and

Nintendo-Resonant_OHS@orrick.com.

Pursuant to 37 C.F.R. §42.10(b), Petitioner attaches a Power of Attorney.

C. Real-Parties-in-Interest (37 C.F.R. §42.8(b)(1))

Petitioners Nintendo Co., Ltd. and its subsidiaries (*e.g.*, Nintendo Technology Development Inc.) and Nintendo of America Inc. are the real parties-in-interest to this IPR petition.

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

According to USPTO assignment records, the '337 patent is currently assigned to Resonant Systems, Inc (“Resonant” or “PO”). On January 31, 2025, Resonant asserted the '337 patent against Nintendo Co., Ltd. *Resonant Sys., Inc. d/b/a RevelHMI v. Nintendo Co., Ltd.*, Civil Action No. 2:25-cv-00090-RSG (E.D. Tex.) (“District Court Case”).

In addition to this petition and the District Court Case, the following litigations or *inter partes* reviews related to the '337 patent are pending:

- *Meta Platforms, Inc. f/k/a Facebook, Inc. v. Resonant Sys., Inc. d/b/a RevelHMI*, No. IPR2025-00823 (PTAB).
- *Nintendo Co., Ltd. and Nintendo of Am. Inc., v. Resonant Sys., Inc. d/b/a RevelHMI*, No. IPR2025-00680 (PTAB). Petitioner is

concurrently filing with this petition a Notice of Multiple Petitions explaining the reasons for multiple petitions as well as the ranking of the petitions.

- *Apple Inc. v. Resonant Sys., Inc.*, IPR2024-00807 (PTAB, filed April 12, 2024).
- *Resonant Sys., Inc. d/b/a RevelHMI v. Meta Platforms, Inc.*, Civil Action No. 7:25-cv-00035-DC (W.D. Tex., filed January 31, 2025).
- *Resonant Sys., Inc. d/b/a RevelHMI v. Apple, Inc.*, Civil Action No. 7:23-cv-00077-ADA (W.D. Tex., filed June 1, 2023) (“Related Apple Litigation”).
- *Resonant Sys., Inc. d/b/a RevelHMI v. Sony Grp Corp. (Japan) and Sony Grp. Corp.*, Civil Action No. 2:22-cv-00424-JRG (E.D. Tex., filed October 26, 2022) (“Related Sony Litigation”).¹

Furthermore, U.S. Pat. No. 9,941,830 (the “’830 patent”) is related to the ’337 patent; it is a direct continuation of the ’337 patent and contains substantively the same claim limitations as the ’337 patent, as shown in an exhibit Nintendo filed with a motion to stay in the co-pending Nintendo litigation. *See* NINTENDO-1060.

¹ The court dismissed with prejudice on April 23, 2025.

The following litigations or *inter partes* reviews involving the '830 patent are pending or on appeal:

- *Samsung Elecs. Co., Ltd., and Samsung Elecs. Am., Inc. v. Resonant Sys., Inc.*, No. IPR2023-00993 (PTAB, filed June 14, 2023).
- *Apple Inc. v. Resonant Sys., Inc. d/b/a RevelHMI*, No. IPR2024-00806 (PTAB, filed Apr. 12, 2024).
- *Resonant Sys., Inc. d/b/a RevelHMI v. Apple, Inc.*, Civil Action No. 7:23-cv-00077-ADA (W.D. Tex., filed June 1, 2023) (“Related Apple Litigation”).
- *Resonant Sys., Inc. v. Sony Grp Corp. (Japan) and Sony Grp. Corp.*, Civil Action No. 2:22-cv-00424-JRG (E.D. Tex., filed October 26, 2022) (“Related Sony Litigation”).
- *Resonant Sys., Inc. v. Samsung Elecs. Co., Ltd., and Samsung Elecs. Am., Inc.* Civil Action No. 2:22-cv-00423-JRG (E.D. Tex., filed October 26, 2022).

Furthermore, U.S. Pat. No. 9,369,081 (the “’081 patent”) is related to the ’337 patent; it is a direct continuation of the ’337 patent and contains the same claim limitations as the ’337 patent, as shown in an exhibit Nintendo filed with a motion to stay in the co-pending Nintendo litigation. See NINTENDO-1059. PO disclaimed Claims 15 and 16 from the ’081 patent. See *Samsung Elecs. Co., Ltd. et*

al. v. Resonant Sys., Inc., IPR2023-00992, Paper 47, 2 (PTAB Jan. 8, 2025) (Final Written Decision). The petition in that IPR challenged claims 15-16 based on Fukumoto, the same prior art that forms Grounds 2-5 of this petition.

The following litigations or *inter partes* reviews involving the '081 patent are related to this petition:

- *Samsung Elecs. Co., Ltd. and Samsung Elecs. Am., Inc. v. Resonant Sys., Inc.*, No. IPR2023-00992 (PTAB, filed June 14, 2023).
- *Resonant Sys., Inc. v. Sony Grp Corp. (Japan) and Sony Grp. Corp.*, Civil Action No. 2:22-cv-00424-JRG (E.D. Tex., filed October 26, 2022) (“Related Sony Litigation”).
- *Resonant Sys., Inc. v. Samsung Elecs. Co., Ltd., and Samsung Elecs. Am., Inc.* Civil Action No. 2:22-cv-00423-JRG (E.D. Tex., filed October 26, 2022).

E. Proof of Service (37 C.F.R. §42.8(b)(4))

Petitioner has attached proof of service of this Petition on PO at the correspondence address of record for the '337 patent.

F. Payment of Fees

The USPTO is authorized to charge the fee specified by 37 C.F.R. §42.15(a), and any other required fees, to Deposit Account No. 15-0665.

III. IDENTIFICATION OF GROUNDS AND CLAIMS BEING CHALLENGED (§42.104(B))

The Challenged Claims are unpatentable based on the following references and grounds: (1) U.S. Pat. 7,005,811 (NINTENDO-1005, “Wakuda”); (2) U.S. Pub. 2008/0294984 (NINTENDO-1006, “Ramsay”); (3) U.S. Pat. 4,879,641 (NINTENDO-1020, “Rossi”); (4) Jack Aldrich, et al.’s *Controller for Driving a Piezoelectric Actuator at Resonance* (NINTENDO-1021, “Aldrich”); (5) U.S. Pat. 7,292,227 (NINTENDO-1048, “Fukumoto”); (6) U.S. Pat. 7,006,641 (NINTENDO-1049, “Saiki”); (7) U.S. Pat. 8,917,486 (NINTENDO-1050, “Masahiko”).

Ground	Claim(s)	§103
1	2, 3	Wakuda, Ramsay, Rossi, Aldrich
2	2	Fukumoto, Aldrich
3	3	Fukumoto, Aldrich, Saiki, Masahiko
4	2	Fukumoto
5	3	Fukumoto, Saiki, Masahiko

Dr. Ben-Tzvi provides supporting testimony in his Declaration (NINTENDO-1003).

Each applied reference, except for Masahiko, 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 ’337 patent claims priority. Petitioners do not concede that the Critical Date is May 18, 2009, but have applied references, other

than for Masahiko, 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)
Ramsay	11/27/2008	§102(a)
Rossi	11/7/1989	§102(b)
Aldrich	4/2008 (NINTENDO-1022)	§102(b)
Fukumoto	8/3/2001 (PCT filed), 2/14/2002 (published)	§102(b)
Saiki	2/28/2006	§102(b)

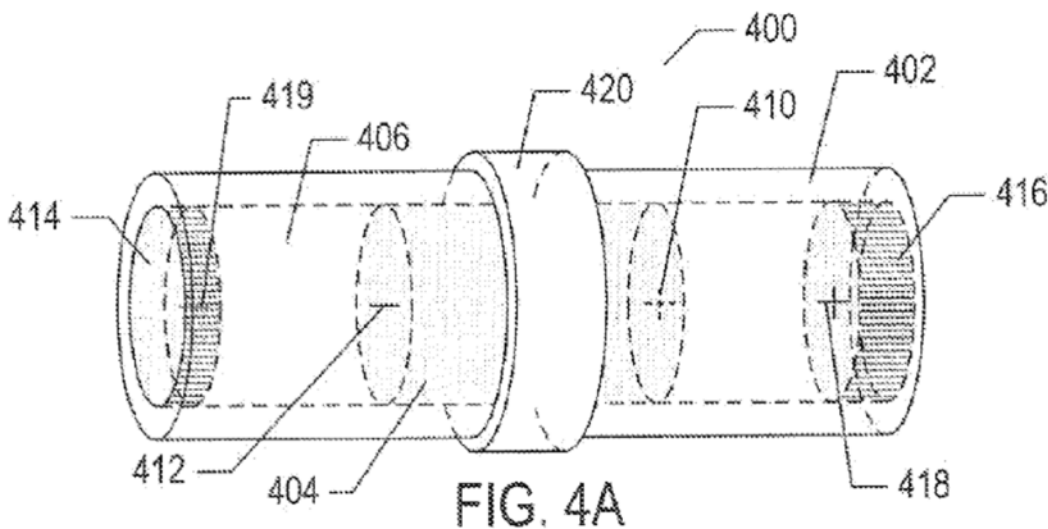
Masahiko qualifies as prior art for claim 3 because that claim is entitled to a priority date no earlier than January 6, 2012, and Masahiko was filed on July 26, 2011. In the '337 patent, Figures 22B and 23 and the description at 13:16–41 appear to be the only possible written description support for claim 3. In the '337 patent's priority chain, this figure and associated description were not present in the May 18, 2009, provisional (*see* NINTENDO-1062) or May 18, 2010, non-provisional (*see* NINTENDO-1061); instead, they first appeared in the January 6, 2012, application. NINTENDO-1003, ¶203; NINTENDO-1002. Thus, Claim 3's priority date is no earlier than January 6, 2012, and Masahiko qualifies as prior art for claim 3. PO did not contest Masahiko's prior art status in IPR Case No. IPR2023-00993 regarding

the '830 patent, a related child patent of the '337 patent. NINTENDO-1053-1056 (PO's substantive briefing).

IV. '337 PATENT

A. Brief Description

The '337 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.” NINTENDO-1001, 1:14-19. “[T]he vibrational forces are produced by a linear oscillation of a weight or component within the LVM [linear vibration module].” *Id.*, 4:17-32. An exemplary module is depicted in Figure 4A and includes “a cylindrical housing 402 within which a solid, cylindrical mass 404, or weight, can move linearly along the inner, hollow, cylindrically shaped chamber 406 within the cylindrical housing or tube 402.” *Id.*, 4:49-52.



Id., Fig. 4A.

Mass 404 and disks 414 and 416 are magnets. *Id.*, 4:52-59. The magnets are oriented such that the left disk 414 and the left side of mass 412 are negative polarities, and the right disk 416 and the right side of mass 410 are positive polarities. *Id.* A coil of conductive wire 420 encircles the housing “at approximately the midpoint of the cylindrical housing.” *Id.*, 5:2-4.

“[B]y a combination of a magnetic field with rapidly reversing polarity, generated by alternating the direction of current applied to the coil, and by the repulsive forces between the weight magnet and the disk-like magnets at each end of the hollow, cylindrical chamber, the weight linearly oscillates back and forth within the cylindrical housing 402, imparting a directional force at the ends of the cylindrical chamber with each reversal in direction.” *Id.*, 5:27-34. “The frequency of the oscillation of the solid, cylindrical mass is determined by the frequency at which the direction of the current applied to the coil is changed.” *Id.*, 5:43-45.

“FIG. 6 provides a block diagram of the LRVM” and includes a CPU 602 that “receives inputs from the user controls 606 that together comprise a user interface.” *Id.*, 5:66-6:2, 6:11-21. A control routine executing on the CPU sets the “mode” and “strength” variables based on user controls. *Id.*, 8:10-15. The “mode” variable “indicates the current operational mode of the device,” and the “strength” variable is “a numerical value corresponding to the current user-selected strength of operation, corresponding to the electrical current applied to the coil[.]” *Id.*, 6:52-55.

The amplitude of the vibrational forces generated by the LRVM is related to the current applied to the coil. *Id.*, 5:35-39. Thus, the “strength” variable allows the user to control the vibrational amplitude. NINTENDO-1003, ¶¶66-75, 128.

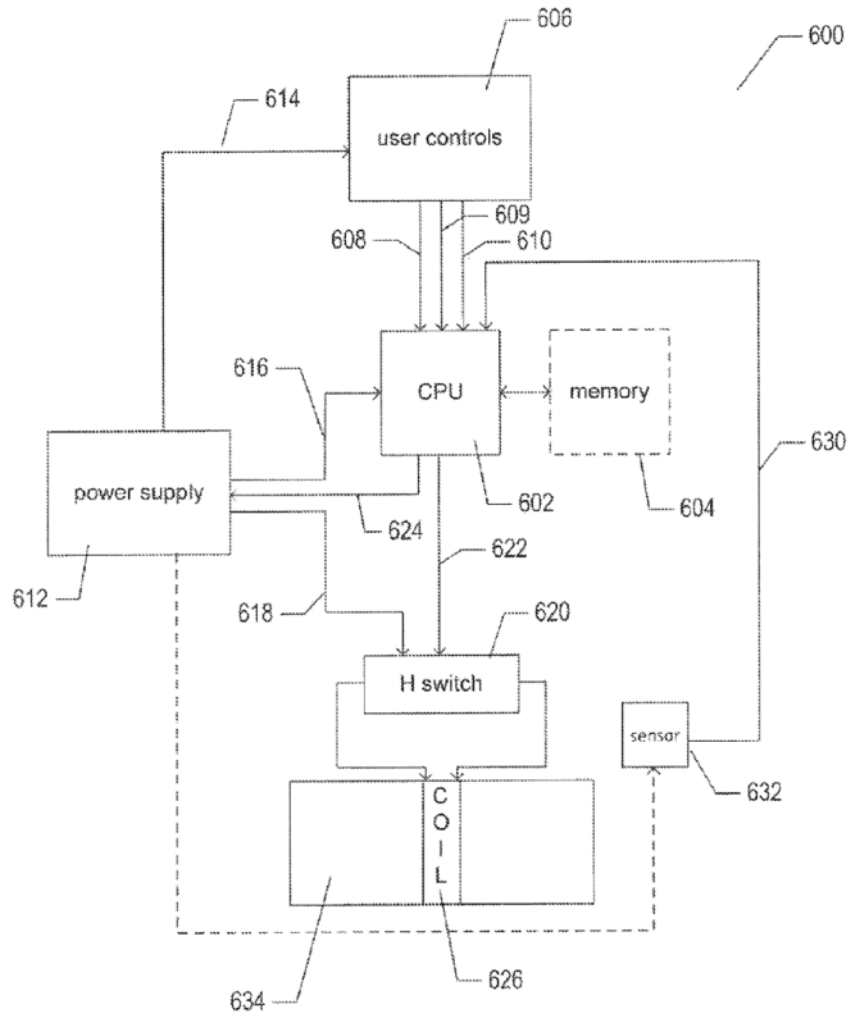


FIG. 6

NINTENDO-1001, Fig. 6.

B. Prosecution History

The Examiner issued one office action with prior art rejections and indication of allowable claims. NINTENDO-1002, 51-57. In response, Applicant rewrote the allowable claims in independent form without substantive argument. *Id.*, 25-35.

V. 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 (which various forums have adopted), the Board need not construe the claims to resolve unpatentability. *Id.*

A. Means-Plus-Function Terms

Certain claims recite “control component” and “driving component.” These terms do not recite “means for” and thus a presumption exists that these terms are not subject to 35 U.S.C. §112(f). The presumption is overcome for these “component” limitations in the Challenged Claims. *See* MPEP §2181. A District Court in the Related Sony Litigation determined that these terms are means-plus-function terms (NINTENDO-1051, 9-16), and the PTAB agreed with the parties that the terms are means-plus-function in an institution decision on the ’337 patent (NINTENDO-1057, 10-12) and in a FWD for the related ’830 patent (NINTENDO-1058, 9-14); *see also* NINTENDO-1051, 1047, 1057-1058 (parties agreeing

regarding MPF). This petition demonstrates unpatentability by applying the means-plus-function meanings of these terms. The corresponding analysis and construction under 35 U.S.C. §112(¶6) for each term is provided below. *See* NINTENDO-1003, ¶¶25-33.

1. “driving component”

As PO agreed in related proceedings, the term “driving component that drives the moveable component to oscillate within the housing” in claim 2 is a means-plus-function limitation. NINTENDO-1047, 2; NINTENDO-1057, 10-11; *see also* NINTENDO-1058, 9-10. The term uses a non-structural generic placeholder (“component”) defined only by functional limitations (“driv[ing] the moveable component to oscillate within the housing,” *i.e.*, the structure’s function). *Id.* The ’337 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). NINTENDO-1001, 5:2-34, 5:54-59, 6:32-35, 9:11-52, 9:64-10:22, 14:5-9. NINTENDO-1003, ¶¶28-29. This is consistent with PO’s agreed-to construction and the constructions of the term by the PTAB and District Court in other proceedings. *See* NINTENDO-1047, 2;

NINTENDO-1057, 12; NINTENDO-1058, 10. For purposes of analysis, the petition treats the above structures and their equivalents as the corresponding structure.

2. “control component”

As PO agreed in related proceedings, “control component” in claim 2 is a means-plus-function limitation. NINTENDO-1051, 9-10; NINTENDO-1047, 5; NINTENDO-1057, 11-13; *see also* NINTENDO-1058, 10-11. The term uses a non-structural general placeholder (“component”) defined by a specified function (remainder of limitation).

The ’337 patent shows in Figures 5A-6 that the that device is controlled using a switch (such as an H-bridge) and a processor (or CPU) which is programmed to perform steps of Figures 7A-C. *See* NINTENDO-1001, Figs. 5A-7C, 5:45-65, 6:2-8, 6:43-8:30, 13:3-41. The Court in the Related Apple Litigation correctly construed “control component” (without addressing the disclaimer, *see infra*) as a means-plus-function term with the following structure: “a microcontroller, a processor, a microprocessor, or a CPU that performs the algorithm shown in Steps 706 through 716 in Figure 7A, with reference to the steps shown in Figures 7B and 7C, or the algorithm described in the corresponding text, *See, e.g.* 7:10–7:24, 7:32–8:30 and/or equivalents thereof.” NINTENDO-1047, 5. The petition shows how the prior art discloses the claims under this construction (the “Full Construction”).

Although this construction includes the steps disclosed in the '337 patent for the “control program” to perform the function of the claim, (see, *e.g.*, NINTENDO-1001, 6:43-47), the term has been construed in other proceedings differently. **First**, in IPR2024-00807, the Board determined at institution that the structure requires a processor and memory performing only an abridged two-step algorithm: “1) operating a timer or its equivalent to flip the polarity of a control value periodically corresponding to a user-selected frequency and input the control value to an H-bridge switch circuit to change the direction of the current through the coil as supplied by the power supply, and 2) computing an output value corresponding to a user-selected amplitude of oscillation and outputting the value to the claimed power supply so that the power supply outputs an appropriate current amplitude to a coil.” NINTENDO-1057, 20. That algorithm reads on the same steps as the Full Construction *except* that it excludes monitoring Steps 710 and 712. See NINTENDO-1001, Fig. 7A. This construction will be referred to as the “Abridged Construction.” Because every “control component” that meets the Full Construction’s requirements also meets the Abridged Construction, the prior art combinations that render the claim obvious under the Full Construction also renders the claim obvious under the Abridged Construction. The petition additionally explains which prior art in the grounds is unnecessary if the Abridged Construction is adopted.

Second, the Court in the Related Sony Litigation adopted a construction like the Abridged Construction and applied a disclaimer made by the applicant during prosecution of the related '830 patent that requires the “control component” be located “within the device” (*i.e.*, within the “vibrating module”). NINTENDO-1051, 11-16.² To overcome the examiner’s prior art rejection during prosecution of the related '830 patent, the applicant confirmed that the “control component” of the “claimed vibration module ... is *not* separate and *is* contained within the module.”

² The Court in the Related Sony Litigation construed the term to require an oscillator circuit and microcontroller with memory but described the relevant algorithm as: “(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 and equivalents thereof.” NINTENDO-1051, 16. This construction appears to focus on only the control steps of Steps 714 and 716 depicted at Figure 7A and 7C. *Id.*; NINTENDO-1001, Figs. 7A, 7C. The Board in IPR2023-00993 adopted a substantially similar construction in the context of the related '830 patent, but due to claim differences (*i.e.*, the '830 patent claim involves “stored values” rather than “user input”) referred to Step 702 of Figure 7A for the “first algorithmic step.” NINTENDO-1058, 12.

Id., 13. Because the applicant's statements were a part of characterizing "the invention as a whole," the Court held that these statements also apply to the claims of the '337 patent. *Id.*, 15-16. This petition additionally explains below how this additional requirement is disclosed or made obvious by the prior art. Again, because PO may dispute disclaimer, this petition explains aspects of the combination that are unnecessary if the Board finds no disclaimer.

Regardless of how "control component" is construed, this petition shows below that the claims are rendered unpatentable and identifies where and how the structure (including algorithm) or their equivalents correspond to the prior art. *Infra*, Grounds 1 ([2f]-[2g]) (§§VII.F.7-VII.F.8), 2 ([2f]-[2g]) (§§VIII.C.7-VIII.C.8); 4 (§X); 37 CFR §42.104(b)(3); NINTENDO-1003, ¶¶30-32.

VI. LEVEL OF SKILL IN THE ART

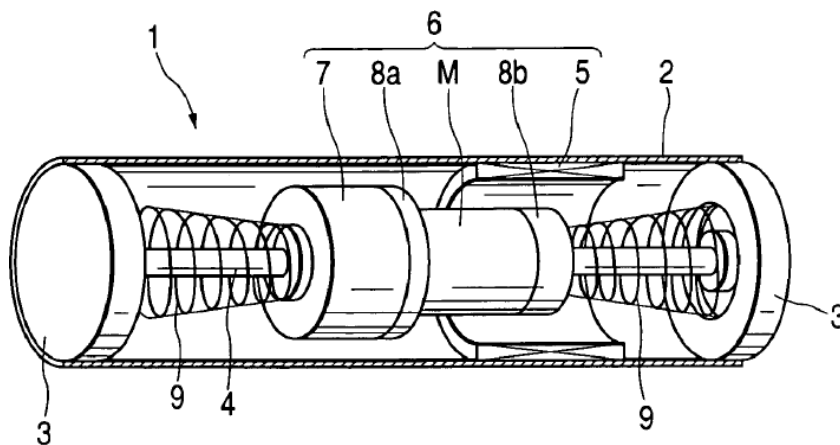
A person of ordinary skill in the art at the time of the '337 patent ("POSITA") would have had a degree in mechanical engineering, electrical engineering, physics, or a related technical field, and at least 2-3 years of experience related to the design or development of systems incorporating linear actuators or an equivalent level of skill, knowledge, and experience (*e.g.*, an advanced degree may replace some of the professional experience). NINTENDO-1003, ¶¶49-51.

**VII. GROUND 1: WAKUDA-RAMSAY-ROSSI-ALDRICH
RENDERS OBVIOUS CLAIMS 2 AND 3**

The PTAB instituted an IPR on Claims 2 and 3 based on Wakuda-Ramsay-Rossi-Aldrich. NINTENDO-1057, 7.

A. Wakuda

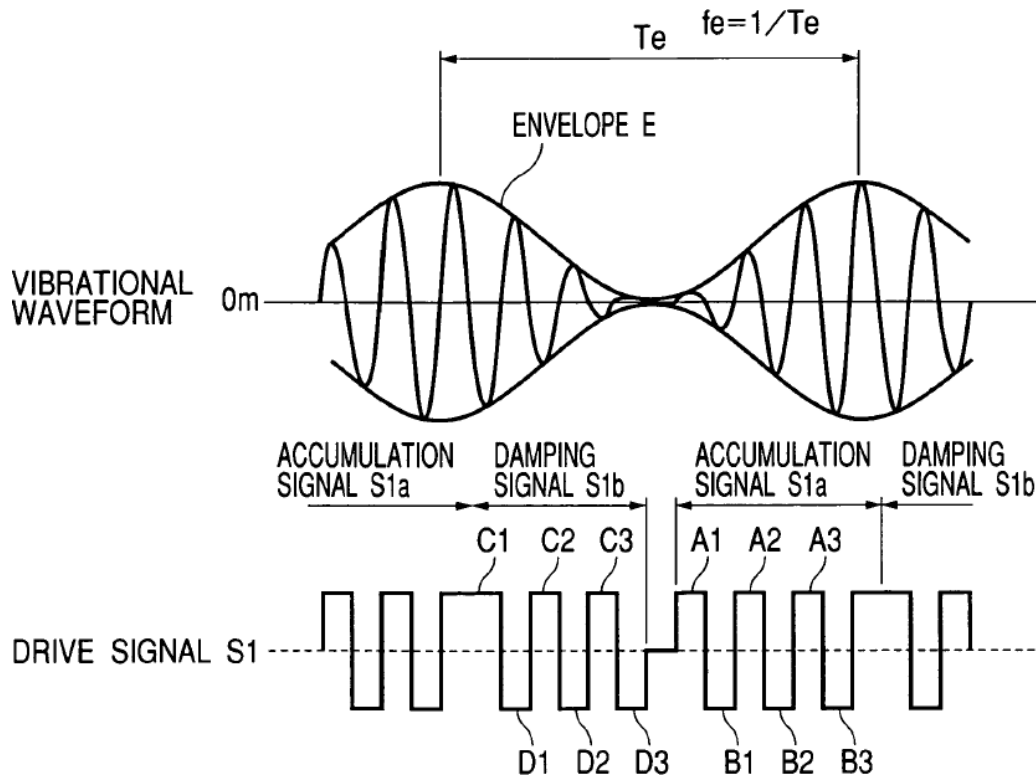
Wakuda provides “a vibration generator system, which can generate vibrations at a frequency that can be bodily sensed by humans.” Wakuda, 2:13-17. Wakuda’s “vibration genera[tor] means 1” includes “cylindrical-shaped casing 2,” “covers 3,” “coil 5,” “movable body 6” including weight 7 and magnet M, and “energizing members 9” (*e.g.*, “cone coil springs”). *Id.*, 4:30-5:26.



Id., Fig. 1A.

Wakuda generates “drive signal S1” for driving the movable body, which includes “an accumulation signal S1a” that “excites resonant vibrations at the natural frequency in the movable body 6,” and “a damping signal S1b” thereafter. Wakuda, 7:9-17, 8:40-48, Figure 4. The drive signal S1 may assume various waveforms and controls both the direction and amount of current to the coil. *Id.*, 6:63-7:8, 7:61-63,

8:7-14, 9:40-48. 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 S1a, and damping with time for the damping signal S1b.” *Id.*, 8:63-67, 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.



Id., Fig. 5.

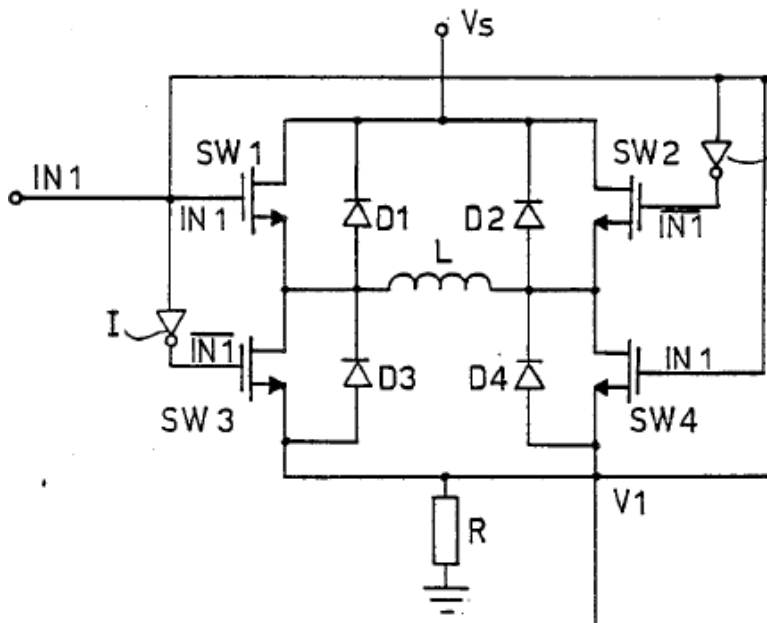
B. Ramsay

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.” Ramsay, Abstract. “[T]he user may access programmable haptic design software 30 via GUI 24” to modify “parameters or characteristics of a haptic output” that “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,” and “combine or mix different haptic tracks together if desired to provide a fuller haptic experience.” *Id.*, [0015], [0030], [0037], [0046]-[0047].

C. Rossi

Rossi’s H-bridge switching circuit includes “two pairs of analog switches arranged in a bridge configuration.” Rossi, Abstract; 1:65-3:55, Figs. 4, 6, claims 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.* Further, Rossi’s H-bridge switch includes a “supply node Vs” voltage, where the load is switched between the supply voltage and volage at the “virtual ground nodes.” *Id.*, 2:4-12.



Id., Fig. 6 (partial).

D. Aldrich

Aldrich describes a feedback control algorithm to drive an actuator to “one of the resonance peaks and eventually to oscillate about the peak.” Aldrich, 1-3. 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 of frequency is accepted and another such change 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.*

E. Motivations to Combine: Wakuda-Ramsay-Ross-Aldrich Combination

1. Wakuda-Ramsay

A POSITA would have been motivated to combine Wakuda with Ramsay’s disclosures with a reasonable expectation of success. *See* NINTENDO-1057, 22-24. Petitioner is not proposing bodily incorporation between Ramsay and Wakuda. Rather, Wakuda’s system is implemented to enable a user to specify parameters (*e.g.*, frequency and amplitude) associated with haptic effects, according to Ramsay’s disclosures. NINTENDO-1003, ¶¶89-91.

In the resulting system, Wakuda’s “small-sized terminal devices, such as portable telephones, PDA, portable game equipment[,]” are implemented to store

the user-specified haptic effects that can be selected and used in generating desired haptic feedback. *Id.*; Wakuda, 1:11-14. Ramsay discloses that these “terminal devices” (or “end user device” in Ramsay)—such a “mobile handset, cell phone, personal digital assistant (PDA), ... hand-held video gaming device, ... or other suitable electronic device”—are equipped with “input/output devices” and “memory.” NINTENDO-1003, ¶89; Ramsay, [0018]-[0019], [0022]-[0025], Figs. 1-2.

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.” Ramsay, [0015]; NINTENDO-1003, ¶90. The memory device in Wakuda-Ramsay (*e.g.*, the “memory” of the “terminal devices”/“end user device”) would store “a 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 “also store haptic track files created or modified by the user and [] also store mixed track files, which include multiple haptic tracks combined together.” Ramsay, [0025]-[0028]; NINTENDO-1003, ¶90. The resulting system would allow users to “access[] programmable haptic design software 30 via GUI 24 and open[] a file to be edited,” and to “interact with programmable haptic design software 30 by input and output

mechanisms of GUI,” as taught by Ramsay. Ramsay, [0037]; NINTENDO-1003, ¶90.

A POSITA would have been motivated to modify Wakuda’s vibration generator system to be user-configurable per Ramsay for several reasons. NINTENDO-1003, ¶¶92-93. First, Wakuda discloses that its vibration generator system is used in “terminal devices” such as “portable telephones, PDA, portable game equipments [sic], and so on.” Wakuda, 1:11-16. A POSITA would have looked for references like Ramsay to expand the functionalities of haptic devices (such as Wakuda’s) to allow end users to freely create and customize haptic effects, allowing users to make and use customized haptic feedback to enhance their experiences on their devices. NINTENDO-1003, ¶92; Ramsay, [0014]-[0015]. With Ramsay’s disclosures, 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.” NINTENDO-1003, ¶92; Ramsay, [0014]-[0015]. 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. NINTENDO-1003, ¶92; Ramsay, [0053]-[0057].

Further, Wakuda-Ramsay enables 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. Ramsay, [0030], [0047]. A POSITA would have recognized that more vibrant haptic effects would result from the combination that enables independent controlling of the frequency and amplitude for oscillation. NINTENDO-1003, ¶93 (citing NINTENDO-1018, 257). More complex haptic responses could be implemented and used to provide more immersive experiences in games played on the “portable game equipment[]” and “hand-held video gaming device[s], game module[s], [and] game console[s]” disclosed by Wakuda and Ramsay. NINTENDO-1003, ¶93; Wakuda, 1:11-16; Ramsay, [0019].

A POSITA would have had a reasonable expectation of success because Wakuda and Ramsay describe the same techniques for controlling a linear actuator to produce desired output. NINTENDO-1003, ¶94; Wakuda, 3:42-44; Ramsay, [0026]. A POSITA would have recognized that making the proposed combination of Wakuda-Ramsay requires only routine knowledge of software implementation techniques, which were well within the POSITA’s skill. NINTENDO-1003, ¶94. The proposed modification merely involves implementing Ramsay’s software solutions in Wakuda’s hardware configuration without substantially changing Wakuda’s other structures. *Id.* The combination modifies Wakuda’s system only to the extent that it is necessary to implement Ramsay’s software tools. *Id.* A POSITA would have recognized that Wakuda’s and Ramsay’s purposes (*e.g.*, providing vibrational feedback for the same kinds of devices) are compatible, and Wakuda-

Ramsay would have accomplished those purposes in similar ways. *Id.* The benefits of each of Wakuda and Ramsay would be achievable in parallel. *Id.* Combining Wakuda and Ramsay was merely the application of known techniques (Ramsay’s software solution for user-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).

2. Wakuda-Ramsay-Rossi

A POSITA would have been motivated to combine Wakuda-Ramsay with Rossi’s disclosures with a reasonable expectation of success. *See* NINTENDO-1057, 34-36. In the proposed combination, Wakuda-Ramsay’s actuator system includes a switch (*e.g.*, H-bridge switch circuit having a control signal input and “supply node” voltage V_s), 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. NINTENDO-1003, ¶¶95-98. The combination would have predictably oscillated 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 implement Rossi’s switch in the Wakuda-Ramsay system. NINTENDO-1003, ¶¶96-101. First, although

Wakuda describes applying current through the coil in opposite directions to oscillate the movable body, Wakuda-Ramsay does not expressly disclose any specifics about the circuit that would be used for switching the current flow. Wakuda, 6:4-10. A POSITA implementing the Wakuda-Ramsay system would have investigated other resources, like Rossi, for disclosures of conventional solutions to provide oscillating power. NINTENDO-1003, ¶¶96-99; Wakuda, 6:4-10; Rossi, 1:65-2:11, 3:43-55, Figs. 4, 6. An H-bridge switch was a “well-known” circuit to implement a change in current flow to oscillate the moveable body such as the moveable body in a system like Wakuda-Ramsay’s. NINTENDO-1003, ¶96; NINTENDO-1019, 7:47-50 (“well-known H-bridge circuit”).

Furthermore, Rossi discloses a simple and reliable way to control the amplitude of the signal to allow precise control of the vibrational strength of a connected actuator. NINTENDO-1003, ¶100. Specifically, Rossi discloses a “supply node” (voltage V_s) supplied to the H-bridge switch such that the “bridge configuration [] switch[es] the load L between the supply node V_s , and virtual ground nodes.” Rossi, 2:4-12. Variation of the “supply voltage” provides the ability to adjust “the magnitude ... of the electric current flowing through the load L of the H-bridge stage” and thus the power output of the load. NINTENDO-1003, ¶100; Rossi, 3:6-18, Fig. 5.

A POSITA would have recognized the benefits from Rossi's straightforward disclosures 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. NINTENDO-1003, ¶99; Rossi, Abstract, 1:65-3:54; Figs. 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. Rossi, 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. NINTENDO-1003, ¶101. A POSITA would have recognized that Rossi's disclosure of using a control signal from the "processor" that is split and inverted to control the H-bridge switches would be a simple and reliable way to produce complementary internal signals. *Id.*

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 required largely routine circuit design considerations and software instructions. NINTENDO-1003, ¶102. The combination of Wakuda-Ramsay would provide a "drive signal S1" to the "drive means 13," where the "drive signal S1" would be the

“driving signal IN1” and a signal to the power supply to provide the necessary supply voltage “Vs” to the H-Bridge switch shown in Rossi implemented in “drive means 13.” NINTENDO-1003, ¶102; Wakuda, 6:30-39, Fig. 3; Rossi, 1:65-2:12, Fig. 1. The POSITA would have also 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.

3. Wakuda-Ramsay-Rossi-Aldrich

A POSITA would have been motivated to combine Wakuda-Ramsay-Rossi with Aldrich’s disclosures with a reasonable expectation of success. See NINTENDO-1057, 34-36. In the proposed 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. NINTENDO-1003, ¶¶103-107. 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.*; Wakuda, 10:27-32, 6:48-55. 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. NINTENDO-1003, ¶103; Aldrich, 2. According to Aldrich, if the increment or decrement results in an increased vibration strength, the direction of change of frequency is accepted and another such change 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.*

The resulting system would implement Aldrich's hill-climb technique using a Boolean value to indicate whether the frequency was being increased. NINTENDO-1003, ¶¶104-105. Using 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 NINTENDO-1026, 29).

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 (a mere design choice), which facilitates digitally processing the signals, and efficient computation and processing of the force values represented by the sensor signals. NINTENDO-1003, ¶106; Aldrich, 2. 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. NINTENDO-1003, ¶¶108-110. First, the Wakuda-Ramsay-Rossi-Aldrich combination utilizes a known feedback algorithm for targeting a resonant frequency, thereby improving the resulting system with the known benefits from the algorithm. *Id.*, ¶108. A POSITA would have looked to Aldrich because while 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 lacks implementation details of how to do this. *Id.*; Wakuda, 6:40-62, 10:22-42. A POSITA would have understood the shortage of details and in working to implement and improve Wakuda-Ramsay-Rossi's monitoring/adjusting method, the POSITA would have predictably looked to other disclosures like those in Aldrich for such details, especially where Aldrich explicitly describes driving an actuator at/near resonance using known control algorithms. NINTENDO-1003, ¶108; Aldrich, 1-3.

Second, the Wakuda-Ramsay-Rossi-Aldrich combination would implement feedback control according to Aldrich's technique that continuously updates the control outputs throughout operation of the system. NINTENDO-1003, ¶109. Aldrich's algorithm continuously facilitates comparison of current and previous parameters throughout device operation so that the control outputs can be adjusted

to maintain oscillation at/near resonance frequency, furthering the explicit objectives of Wakuda-Ramsay-Rossi and Aldrich. *Id.*

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; *NINTENDO-1003*, ¶110.

A POSITA would have had a reasonable expectation of success because of the applicability of Aldrich’s method to Wakuda-Ramsay-Rossi’s resonant system architectures, and because the necessary modifications would have been largely implemented in software. *NINTENDO-1003*, ¶111. Sensor outputs would be received and processed by Wakuda-Ramsay-Rossi’s processor using at least Aldrich’s “hill-climbing control algorithm” “to find and remain within the vicinity of the resonance.” Aldrich, 2. 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. *NINTENDO-1003*, ¶111. Implementing Aldrich’s algorithm as a control program would have consisted of routine software changes using known techniques. *Id.*

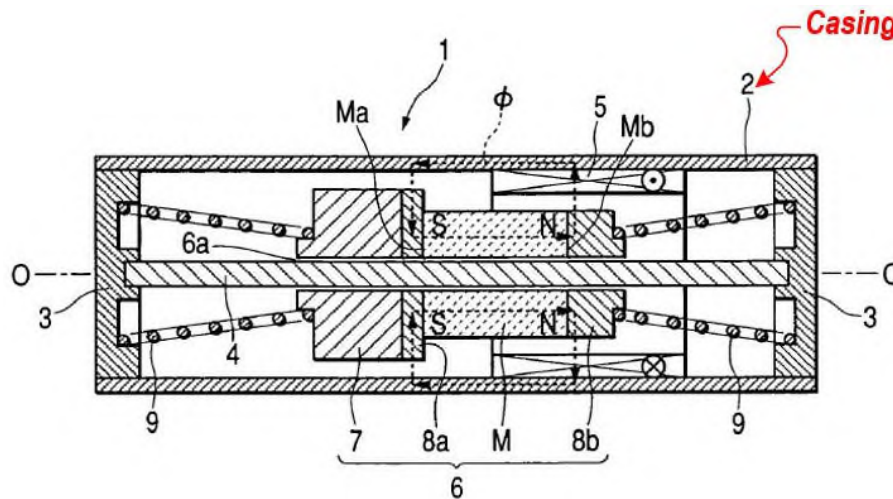
F. Analysis

1. [2pre]: A linear vibration module comprising:

As the Board preliminarily found, to the extent it is limiting, Wakuda-Ramsay-Rossi-Aldrich renders it obvious. See NINTENDO-1057, 25-31, 34-36. Wakuda discloses a “bodily sensed vibration generator system mountable on small-sized information terminal devices, such as portable telephones, PDA, portable game equipment[.]” Wakuda, 1:11-16, 3:42-45 (“the movable body reciprocates linearly”); NINTENDO-1003, ¶112. According to Wakuda, the resulting system includes “vibration generator means 1” that includes “casing 2,” “covers 3,” “coil 5,” “movable body 6,” and “control means 10.” Wakuda, 4:30-5:24, 6:11-62. The linear vibration module in the resulting system further includes “input/output devices” as taught by Ramsay. NINTENDO-1003, ¶112; Ramsay, [0022]-[0024]; §VII.E.

2. [2a]: a housing;

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious *a housing*. See NINTENDO-1057, 25-31, 34-36. Specifically, Wakuda’s “casing 2” is the claimed *housing* in the resulting system. NINTENDO-1003, ¶¶113-114; Wakuda, 4:34-38.

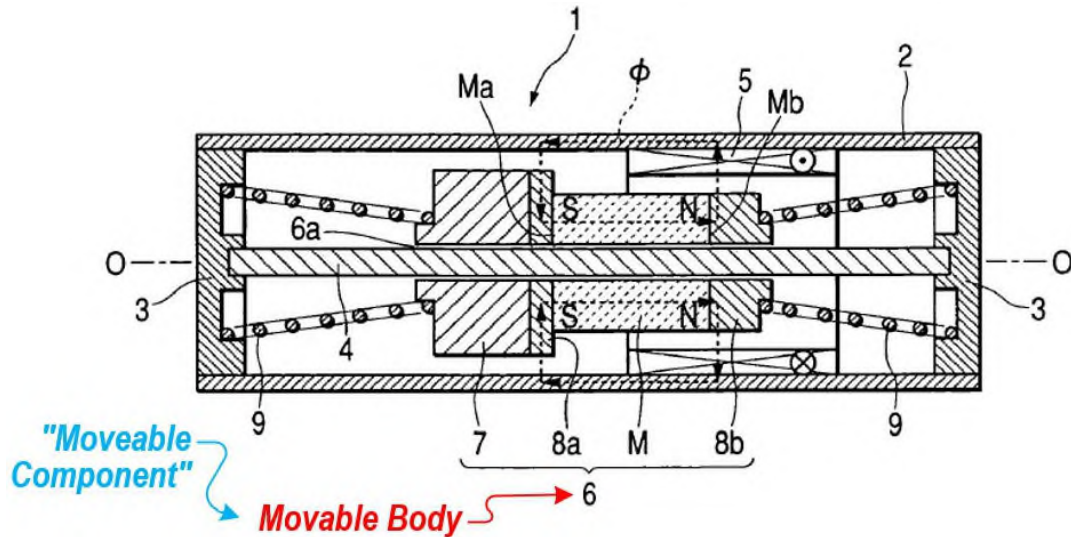


Wakuda, Fig. 1B.³

3. [2b]: a moveable component;

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious *a moveable component*. See NINTENDO-1057, 25-31, 34-36. Specifically, Wakuda discloses that it uses a “movable body 6” including “weight 7” and “magnet M”. Wakuda discloses its “movable body 6 moves in the X1 direction or the X2 direction.” Wakuda, 5:34-35. Wakuda’s “movable body” is the claimed *moveable component*. NINTENDO-1003, ¶115; Wakuda, 4:48-57.

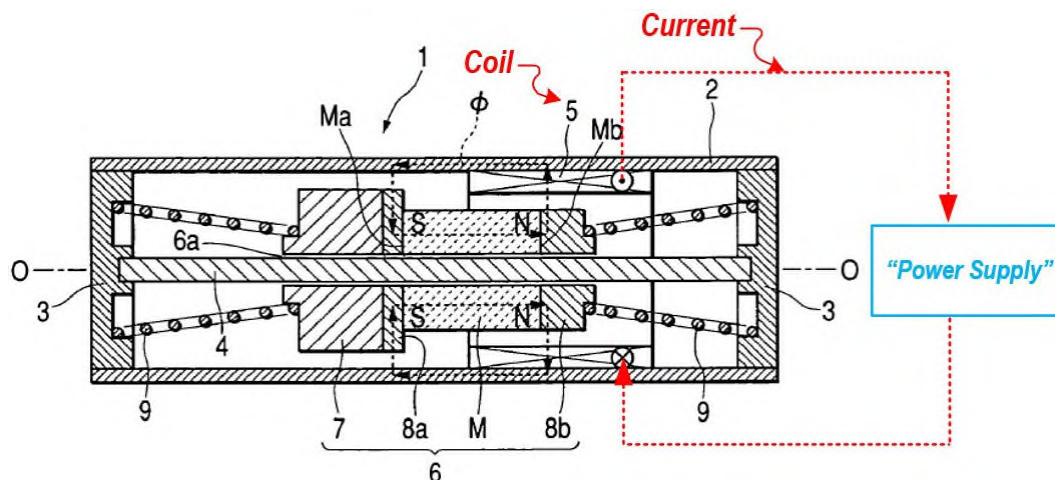
³ All annotations in the figures reproduced hereafter are added unless otherwise indicated.



Wakuda, Fig. 1B.

4. [2c]: a power supply;

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious *a power supply*. See NINTENDO-1057, 25-31, 34-36. Specifically, Wakuda's device (and the resulting system) would require a power supply to supply current to "coil 5." Wakuda, 4:42-47. Per below, Wakuda describes that current is supplied to the coil to generate a magnetic force. *Id.*, 6:4-10. Thus, a POSITA would have understood that Wakuda's system includes a power supply. NINTENDO-1003, ¶¶116-117.



Wakuda, Fig. 1B.

Furthermore, a POSITA would have understood that “terminal devices, such as portable telephones, PDA, portable game equipment[.]” would require and were well-known to include a battery or otherwise connect to a power source to supply power to the device and the components within it. Wakuda, 1:11-14; NINTENDO-1003, ¶117.

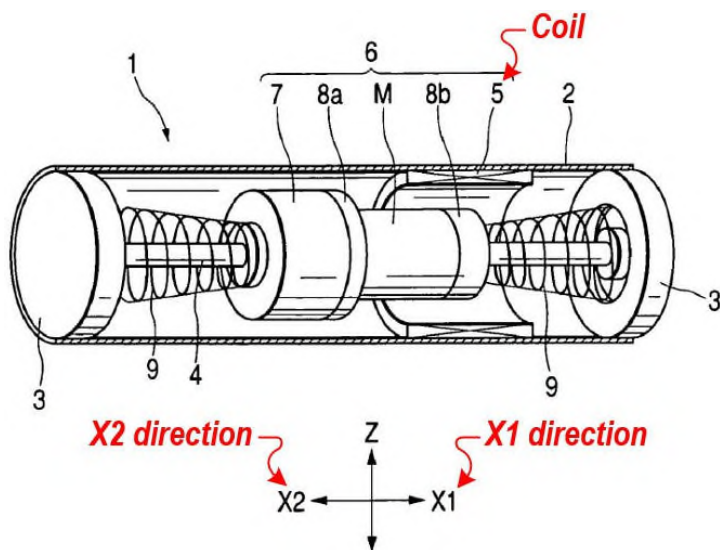
5. [2d]: user-input features;

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious *user-input features*. See NINTENDO-1057, 25-31, 34-36. Specifically, Wakuda discloses that its vibration generator may be used in “terminal devices, such as portable telephones, PDA, portable game equipment[.]” which a POSITA would have understood include user input features. Wakuda, 1:11-16; NINTENDO-1003, ¶¶118-119 (citing NINTENDO-1010). Even without this understanding, Ramsay discloses that similar “end user device[s]” such as “mobile handset, cell phone,

personal digital assistant (PDA)” include “input/output devices.” Ramsay, [0019], [0022], [0024] (“keyboards, keypads,” “touch screen,” “touch pads, buttons, sliders”).

6. [2e]: a driving component that drives the moveable component in each of two opposite directions within the housing; and

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious *a driving component*. See NINTENDO-1057, 25-31, 34-36. Under the MPF construction, the “driving component” is a coil or electromagnet. §V.A.1. Wakuda discloses a coil (“coil 5”) as a *driving component*:



Wakuda, Fig. 1A; 4:42-47, 5:1-13.

Wakuda also discloses that the *driving component drives the moveable component in each of two opposite directions within the housing*. Wakuda discloses that “a magnetic force F is generated by the magnetic flux ϕ and the current in the X2 direction to be able to give to the movable body 6 a driving force in the X2

direction. Also, a driving force in the X1 direction can be given to the movable body 6 by feeding a reverse current to the coil 5.” Wakuda, 6:4-10, Figs. 1A-1B. Thus, Wakuda discloses that the *driving component* (“coil 5”) *drives the movable component* (“magnetic force F is generated ... to give to the movable body 6 a driving force”) *in each of the two opposite directions* (in the “X1 direction” and “X2 direction”) *within the housing*. NINTENDO-1003, ¶¶120-121.

7. **[2f]: a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features,**

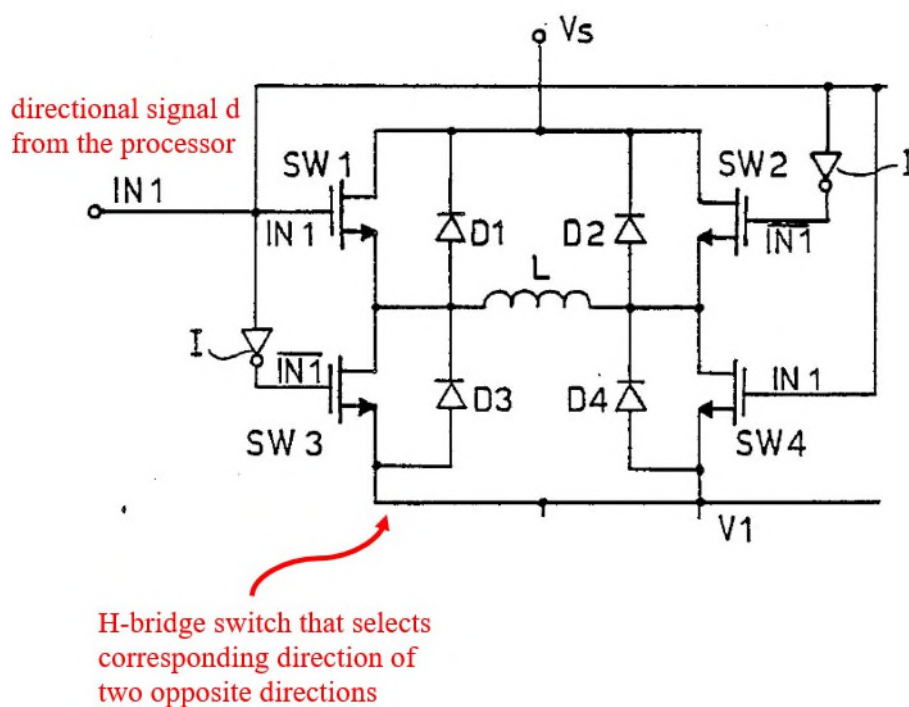
Wakuda-Ramsay-Rossi-Aldrich renders obvious this limitation whether the Full Construction or the Abridged Construction is adopted.⁴ The Board preliminarily found this combination renders obvious the Full Construction. See NINTENDO-1057, 25-31, 34-36.

First, the resulting system would include the structure of Wakuda’s “vibration control means 14” implemented using a “processor” and “memory” as the control

⁴ If the Board adopts the Abridged Construction, Aldrich is unnecessary to the combination and the combination of Wakuda-Ramsay-Rossi renders obvious this limitation and the entirety of claims 2-3.

component, as taught in Ramsay. Wakuda, Fig. 3, 6:23-62; Ramsay, [0020]-[0024], [0027]; NINTENDO-1003, ¶¶122-123.

In view of Rossi, the resulting system would include a H-bridge switch to switch the current direction. NINTENDO-1003, ¶¶124, 126; §VII.E.2. A POSITA would have found obvious that the processor is programmed to provide a control output to the H-bridge switch for controlling the direction of the drive signal through the coil and to provide the necessary a supply voltage “Vs” to the coil. *Id.* A control signal is output from the processor to a transistor of the H-bridge switch to control whether the transistor is in an open or closed state, providing the direction signal, and another signal is output from the processor to the power supply to determine the supply voltage to provide to the coil. *Id.* The switch receives a directional signal (*e.g.*, at “IN1”) that selects a corresponding direction of the opposite directions in which the driving component drives the moveable component and a supply voltage (*e.g.*, at “Vs”) determined by a power signal to the device’s power supply. *Id.*; Rossi, 1:65-2:15; 3:43-55, Figs. 1, 6.



Id., Fig. 6 (partial).

If the *control component* must be situated *within the linear vibration module* (see §V.A.2), the Wakuda-Ramsay-Rossi-Aldrich combination renders this obvious. Wakuda does not explain where its “Vibration Control Means” is in the device and just shows a relationship between components in a block diagram. NINTENDO-1003, ¶125; Wakuda, Fig. 3, 6:23-39. A POSITA would have found it obvious to place the Vibration Control Means processor and memory *within the vibration module* as a well-known method of implementation in similar systems. See NINTENDO-1003, ¶¶125-126; NINTENDO-1004, 2:18-35 (processor in haptic feedback system); NINTENDO-1008, Figs. 1-2, [0045]-[0048] (“interface device” with haptics may include “haptic device controller”). A POSITA would have understood this common practice would simplify integration of the linear vibration

module into, *e.g.*, “terminal devices, such as portable telephones, PDA, portable game equipments [sic], and so on.” Wakuda, 1:11-16. It would enable the linear vibration module to take care of its own basic functionality rather than requiring an external processor. NINTENDO-1003, ¶125. It would also enable the vibration module to be sold as a standalone unit for integration into other devices, reduce electromagnetic interference, and provide improved performance. *Id.*

As for the algorithm, the Wakuda-Ramsay-Rossi-Aldrich combination renders obvious that the processor is programmed with the algorithm described in the Full Construction (*i.e.*, Steps 706 through 716 of Figure 7A). See §V.A.2; NINTENDO-1001, Figs. 7A-7C; NINTENDO-1003, ¶¶126-127.

The software of the processor in the combined system relies upon certain variables relevant to the algorithm described in the Full Construction. NINTENDO-1003, ¶128 (citing NINTENDO-1024, Ramsay); §VII.E.3. In the combined system, the variables (*e.g.*, mode and strength) include values representing selections made by user input to the user-input features, as taught by Ramsay. *Id.*

The combination includes a current operational **mode** of the device. NINTENDO-1003, ¶¶128-131. Indeed, the combined system uses multiple different “haptic tracks” (operational modes) based on haptic parameters including frequency and amplitude as taught by Ramsay. *Id.*; Ramsay, [0028], [0030], [0034], [0042], [0049], [0058]. Ramsay describes “ROM 28 may be configured to store a library of

preset haptic tracks.” *Id.*, [0028]. 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. NINTENDO-1003, ¶¶130-131. Further, the combined system would operate based on one of the haptic tracks (*i.e.*, mode) created or modified by the user through GUI (*i.e.*, the mode set to values representing selections made by user input to the user-input features), as taught by Ramsay. *Id.*; §§VII.B, VII.E.1. 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. NINTENDO-1003, ¶131; Ramsay, [0035]-[0039], [0047], [0057]-[0059]. Ramsay describes multiple haptic tracks being mixed to drive simultaneous oscillation of the movable component at two or more frequencies. §§VII.B, VII.E.1; [2g] (§VII.F.8). Ramsay also describes “a library of preset haptic tracks” having different haptic parameters and/or that are combined. Ramsay, [0028].

The combination includes a ***strength*** variable (magnitude). NINTENDO-1003, ¶¶132-133. Ramsay describes that a magnitude variable is user-configurable through GUI. Ramsay, [0022]-[0026], [0030]-[0033], [0046], [0053]-[0055]; §§VII.B, VII.E.3; NINTENDO-1003, ¶132. The combined system operates based

on one of the strength settings (as part of the predefined or user-configured haptic effects) when it is powered on. NINTENDO-1003, ¶132.

The combination also includes **sensed values** that include previously-sensed (**lvl0**) and currently-sensed (**lvl1**) vibrational strength values. NINTENDO-1003, ¶134. 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. *Id.*; Aldrich, 2 (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). NINTENDO-1003, ¶134.

The combination includes a **frequency (freq)** at which current is changed in the coil, and the directional **control signal (d)** from the processor. NINTENDO-1003, ¶135; Aldrich, 1-3 (“excitation frequency”). 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). NINTENDO-1003, ¶135. 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.” Wakuda, 7:26-43. 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. NINTENDO-1003, ¶135.

The combination includes a ***Boolean value (inc)*** that indicates that the frequency is being increased. NINTENDO-1003, ¶136; §VII.E.3. 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. NINTENDO-1003, ¶136.

In the ’337 patent’s step 704⁵, the control program “waits for [the] next event.” NINTENDO-1001, 6:61-65. In the combined system, the software executing on the microprocessor waits for the next event, such as elapsing of a timer used to flip the drive signal so the direction of movement of the movable body can be reversed, 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. NINTENDO-1003, ¶137; Wakuda, Figs. 4-6; Ramsay, [0022]-[0026], [0030]-[0033], [0046], [0053]-[0055]. When sensor signals are received by the

⁵ This step is not required by the Full Construction. §V.A.2. It is referenced because the events depicted by steps of 706, 710, and 714, which are encompassed by the Full Construction, are the “events” for which the control program waits. *Id.*; NINTENDO-1001, 6:61-7:24.

microprocessor, the control outputs are adjusted accordingly. NINTENDO-1003, ¶137 (citing Wakuda, 6:40-47). 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. *Id.*, ¶138 (citing NINTENDO-1026).

In the '337 patent's step 706-708, the expiration of a timer triggers the control program algorithm to output a flipped signal d to cause the oscillator circuit (*e.g.*, H-bridge switch) to reverse its output and apply a reverse force on the movable weight, to achieve the desired frequency. NINTENDO-1001, Fig. 7A, 7:10-17. This is taught or rendered obvious by Wakuda as shown in Figure 4 where the Drive Signal S1 is reversed from a "forward direction" to "reverse direction" according to the desired vibrational waveform frequency. Wakuda, Fig 4, 6:63-7:25. A POSITA would have found it obvious to achieve this by using a timer in the combined system, where the timer flips the directional signal (*e.g.*, at "IN1") to Rossi's switch with the desired frequency. NINTENDO-1003, ¶139; NINTENDO-1026, 8-9, 31-32 (discussing timers).

In the '337 patent's steps 710-712, the control program's algorithm calls a "monitor" routine, at a certain frequency (*i.e.*, upon expiry of a monitor timer) which is illustrated in Figure 7B. NINTENDO-1001, 7:19-21. Aldrich similarly discloses that its control algorithm is a "digital control system" which must operate at a

specific sampling rate (*i.e.*, how frequently the process is executed based on the “sampling period”). Aldrich, 2. A POSITA would have found it obvious to execute the process at the sampling rate by using a timer, resetting the timer at the end of the monitor process (step 754). NINTENDO-1003, ¶140; NINTENDO-1026, 8-9, 31-32. This would have provided the processor time to perform other tasks while also ensuring the monitor routine (Aldrich’s algorithm) is executed frequently enough to operate correctly. NINTENDO-1003, ¶140.

The ’337 patent’s “monitor” routine is a simple and known routine for implementing a feedback loop to maintain operation of a vibration module at or near resonance. NINTENDO-1003, ¶141; NINTENDO-1001, Fig. 7B, 7:32-8:9. The combined system executes the same (or at least an equivalent) algorithm. See §VII.E.3. A POSITA would have found it obvious, based on Aldrich’s feedback control to operate at a resonant frequency, to compare current and desired vibration parameters while incrementing or decrementing the drive frequency to adjust towards the desired frequency. NINTENDO-1003, ¶141; Aldrich, 2-3.

Wakuda discloses the use of one or more sensors to store sensed values (step 730). NINTENDO-1003, ¶142. Wakuda describes a closed-loop control to “generate a drive signal S1 tracking the resonance frequency of the movable body 6.” Wakuda, 10:31-32; NINTENDO-1003, ¶142. 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.” Wakuda, 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.* Further, Wakuda discloses selecting between different modes of operation, *i.e.*, a default mode operating the vibration generator such that it “excites resonant vibrations at the natural frequency in the movable body” (*id.*, Fig. 4, 6:63-66, 7:9-12) or operating the vibration generator pursuant to one of a “plurality of [waveform] patterns ... selected on the basis of a command from the vibration control means” (*id.*, 6:30-39, Figs. 5-6) (steps 732-734). NINTENDO-1003, ¶142. 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 730-754 of Figure 7B of the ’337 patent. NINTENDO-1003, ¶142; Aldrich, 1-3.

In accordance with Aldrich’s disclosure, a current sensed vibration strength value at an incrementally increased control signal frequency is compared with a previous sensed vibration strength value. NINTENDO-1003, ¶143; §VII.E.3. 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.” Aldrich, 2-3. This discloses steps 736-740 of the ’337 patent. NINTENDO-1003, ¶143.

When the vibration strength has not increased with increased frequency input, the control program determines that the resonant frequency has been exceeded. NINTENDO-1003, ¶144; Aldrich, 2. The “direction of change of frequency during the following sampling period is reversed,” such that the frequency is decremented, and the process continues. Aldrich, 2. This discloses steps 742-744 of the ’337 patent. NINTENDO-1003, ¶144. The combined system proceeds in a similar manner when decrementing the input frequency, disclosing steps 746-752 of the ’337 patent. *Id.*, ¶145; Aldrich, 2.

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). §VII.E.3; NINTENDO-1003, ¶146.

In the ’337 patent’s step 714-716, the control program calls a “control” routine (step 716), which is illustrated further in Figure 7C, “when the event corresponds to a change in the user input through the user interface.” NINTENDO-1001, 7:21-24, 8:10-22. In the combined system, the user input determines the mode and provides a change in vibration strength (step 760) which includes outputting a signal to the power supply to adjust the supply voltage to the H-bridge (*e.g.*, in accordance with

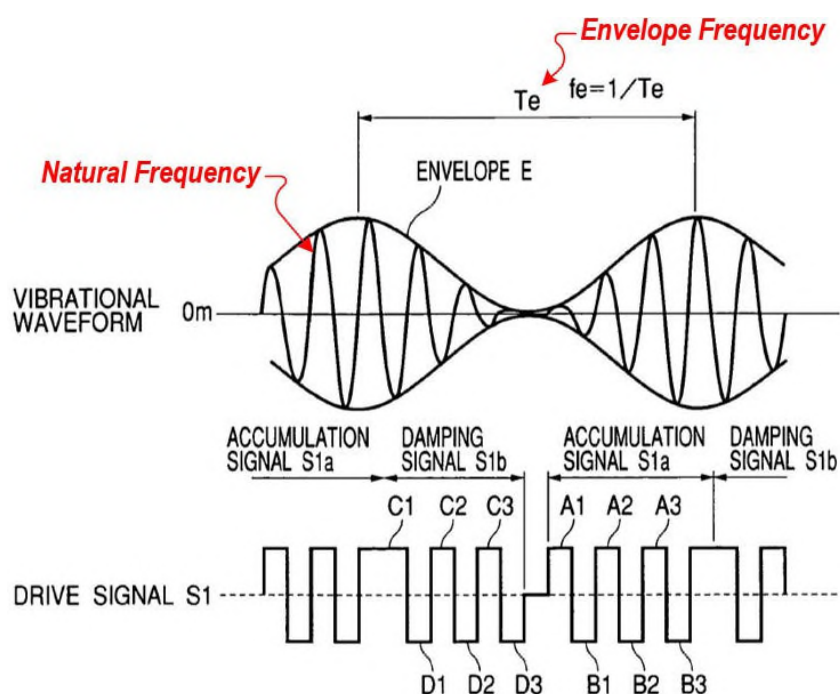
Ramsay and Rossi, §§VII.E.1, VII.E.2, VII.F.5) (step 762), and the user input is received during a monitoring period so that the input is processed and implemented, requiring a reset of the monitor timer's interval (step 764). NINTENDO-1003, ¶147. Particularly, the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user input. *Id.*

Should the Abridged Construction's two-step algorithm be adopted (§V.A.2), Aldrich is unnecessary and the combination of Wakuda-Ramsay-Rossi discloses or renders obvious this limitation. NINTENDO-1003, ¶148. As explained above, in Wakuda-Ramsay-Rossi, Wakuda's control component ("control means") is implemented in a processor and memory based on Ramsay's disclosures. §§VII.F.7, VII.E.1; NINTENDO-1003, ¶148. Further, the Wakuda-Ramsay-Rossi combination includes a switch (*e.g.*, H-bridge switch) according to Rossi. §§VII.F.7, VII.E.2; NINTENDO-1003, ¶148.

8. [2g]: wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.

As the Board preliminary found, Wakuda-Ramsay-Rossi-Aldrich renders obvious that the *control component* ([2f] (§VII.F.7)) causes the moveable component to simultaneously oscillate at multiple frequencies to thereby generate complex vibration modes (*drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes*).

NINTENDO-1003, ¶149; *see also* NINTENDO-1057, 25-31, 34-36. Wakuda discloses that its 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. Wakuda, 2:18-46, 9:12-10:42, Figs. 5-6.



Id., Fig. 5.

Additionally, Ramsay discloses that “one or more frequencies” can be entered for each haptic track. Ramsay, [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].

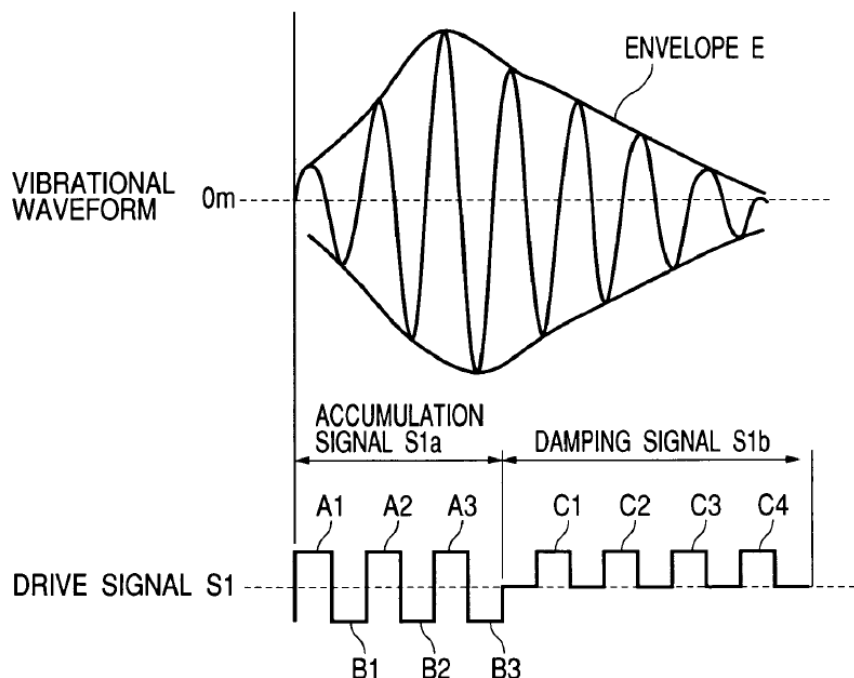
A POSITA would have understood and found obvious that the Wakuda-Ramsay system drives simultaneous oscillation of the movable component at two or more frequencies, as included in a single haptic track or in a mixed track that combines multiple haptic tracks having different frequencies. NINTENDO-1003, ¶¶150-151. 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 result in "a fuller haptic experience." *Id.*; Ramsay, [0030].

9. [3]: The linear vibration module of claim 2 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.

As the Board preliminarily found, Wakuda-Ramsay-Rossi-Aldrich renders obvious complex vibration modes that include *a primary oscillation frequency* (natural/resonance frequency) *modulated by a modulating oscillation frequency* (lower envelope frequency in [2g] (§VII.F.8)); *a beat frequency* (*e.g.*, the vibrational waveform illustrated in Wakuda's Figure 5 caused by the interference of slightly different frequencies); *and an aperiodic oscillation waveform* (irregular and non-repeating waveform illustrated in Wakuda's Figure 6). NINTENDO-1003, ¶152; Wakuda, Fig. 6; *see also* NINTENDO-1057, 31, 34-36.

Wakuda discloses that a “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.” Wakuda, 8:63-67, 9:12-48, Fig. 5; NINTENDO-1003, ¶153. Further, like the ’337 patent, the difference between the higher resonance frequency and the lower envelope frequency produces the beat frequency. *Id.*, ¶153 (citing NINTENDO-1001, 13:13-41, Figures 22A-23; Wakuda, 2:29-46, Figs. 4-6).

Further, Wakuda discloses that the waveform of the envelope may be freely adjusted to be irregular and non-repeating, and therefore aperiodic, by “changing contents of an accumulation signal S1a and a damping signal S1b” to create various feedback sensations. NINTENDO-1003, ¶154; Wakuda, 9:49-62, 3:12-14, Fig. 6.



Wakuda, Fig. 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. NINTENDO-1003, ¶155. It was well known that the resonant frequency of an actuator changes depending on various factors, such as a user's interaction with a haptic-enabled device. *Id.* (citing NINTENDO-1004, 3:50-4:5, 2:5-9). Therefore, the resonant frequency of the Wakuda-Ramsay-Ross-Aldrich 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. NINTENDO-1003, ¶155. The resulting waveform would have been an aperiodic waveform

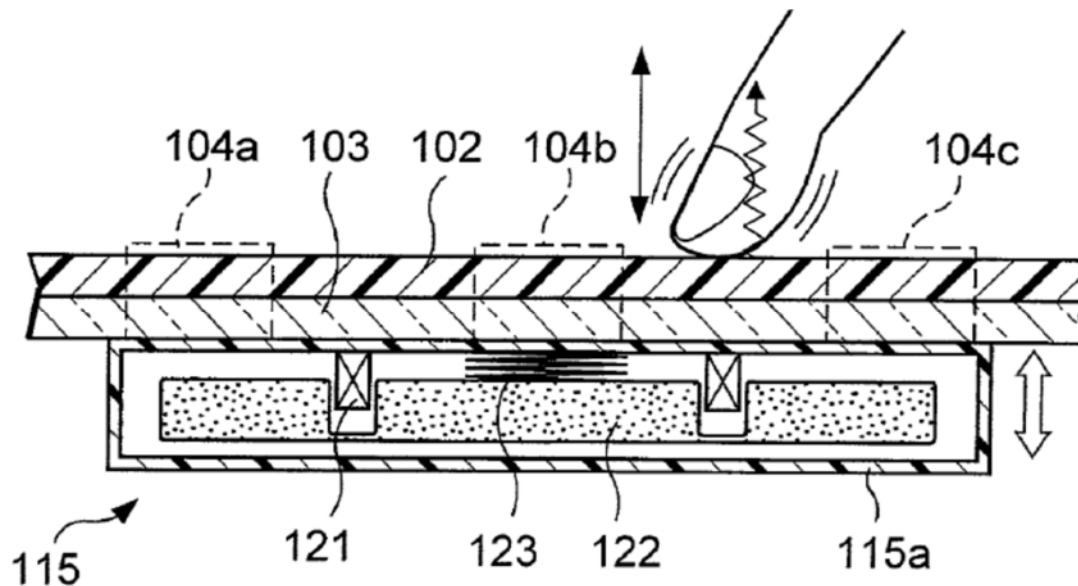
according to the irregular change of the resonance frequency and would have helped convey more realistic or complex tactile sensations. *Id.*

VIII. GROUND 2: FUKUMOTO-ALDRICH RENDERS OBVIOUS CLAIM 2

The PTAB found unpatentable the same limitations in the related '830 patent based on Fukumoto. NINTENDO-1058, 18-34, 67.

A. Fukumoto

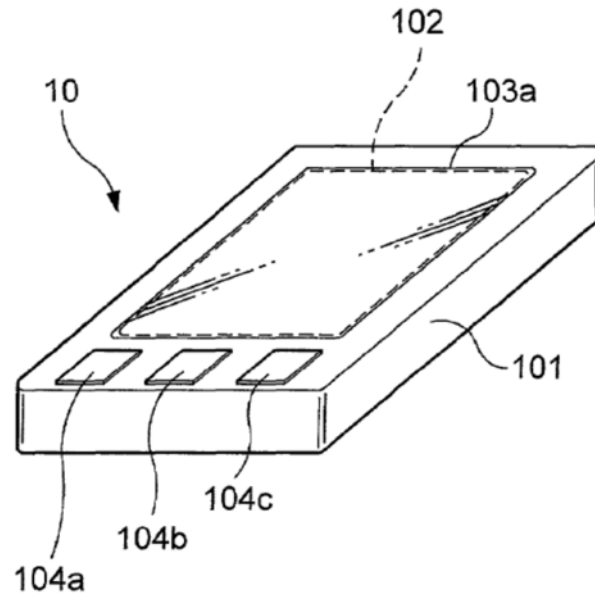
Fukumoto discloses an electronic device, *e.g.*, PDA or mobile phone, with an oscillatory actuator that generates vibration when receiving an input to a touch panel or operation key. Fukumoto, Abstract, 1:13–19, 17:60–65. Figure 3 shows a cross-sectional view:



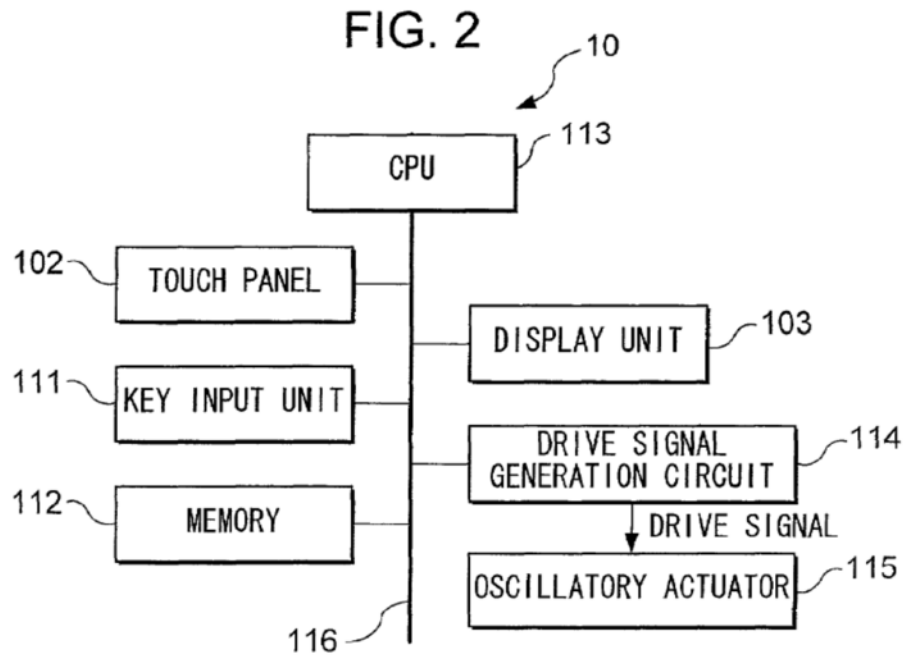
Id., Fig. 3, 14:27–16:37. Fukumoto’s “oscillatory actuator” contains case 115a, moveable weight 122 supported by spring 123, and coil 121. *Id.*, 14:38–15:4. In

Fukumoto, “movable weight 122 linearly reciprocates in the vertical direction in the figure by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal) is applied to the coil 121.” *Id.*, 14:57–60.

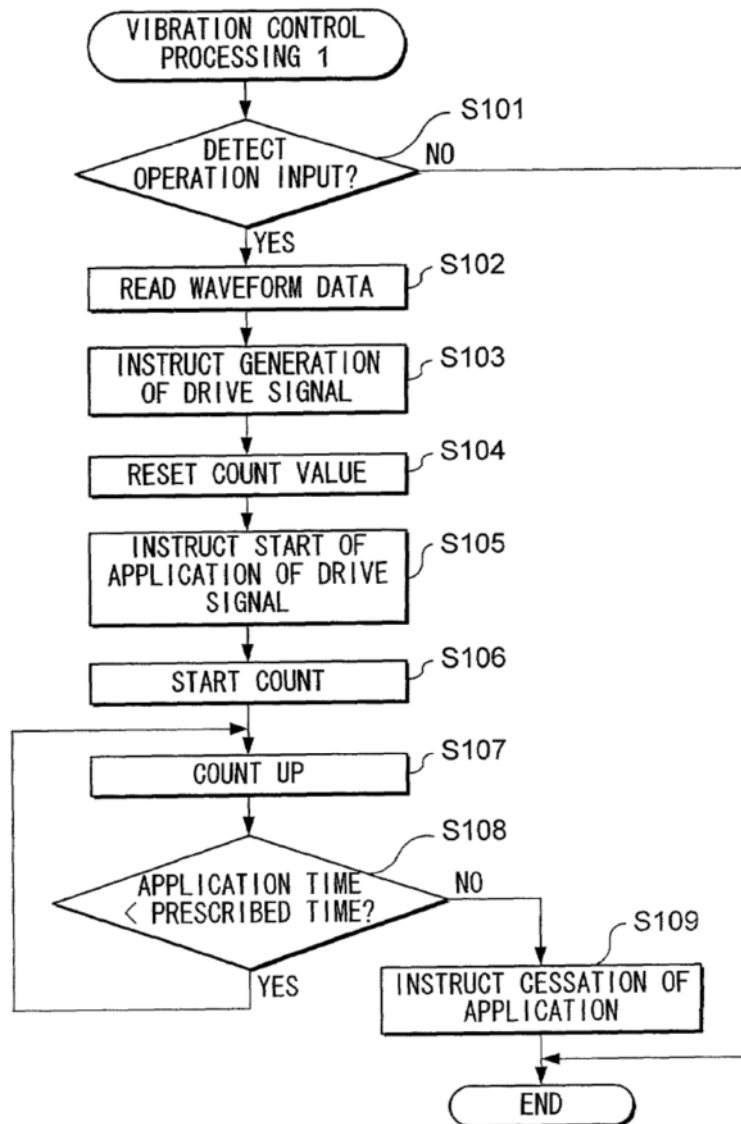
Figure 1 depicts user input buttons 104a–c and touch panel 102:



Fukumoto, Fig. 1, 13:41–53. Figure 2 depicts the PDA hardware in Figure 1:



Id., Fig. 2, 13:54–14:26. Figure 5 provides a flow chart illustrating Fukumoto's operation:



Id., Fig. 5, 16:60–19:3.

B. Motivations to Combine

1. Aldrich-Fukumoto

A POSITA would have been motivated to combine the disclosures of Aldrich and Fukumoto with a reasonable expectation of success. In the proposed combination, Aldrich’s control algorithm is implemented in Fukumoto’s system to use sensor feedback (Fukumoto discloses using an “encoder” to sense vibrator

position, *see* Fukumoto, 19:61-20:8) to control vibration output about a resonant frequency. NINTENDO-1003, ¶¶157-158. Sensor outputs would be processed using Aldrich’s control algorithm techniques, thereby helping Fukumoto achieve a target “frequency f_0 of the drive signal” used to cause the device to resonate and “thereby imparting larger vibration to the user using small drive power.” Fukumoto, 16:38-50. 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. NINTENDO-1003, ¶¶157-158; Aldrich, 2; *see also* §VII.E.3 (benefits of Aldrich’s algorithm in achieving a desired vibration strength and implementation details).

Multiple reasons would have prompted a POSITA to implement Aldrich’s “hill-climbing” control algorithm in Fukumoto’s system. NINTENDO-1003, ¶¶159-161. First, the Fukumoto-Aldrich combination utilizes a known feedback algorithm for targeting a resonant frequency, thereby improving the resulting system with the known benefits from the algorithm. *Id.*, ¶159. A POSITA would have looked to Aldrich because while Fukumoto describes a need to apply a drive signal of a specific frequency to cause resonance and “impart[] larger vibration to the user using small drive power,” Fukumoto lacks implementation details of how to do this. *Id.*; Fukumoto, 16:38-50. A POSITA would have understood the shortage of details

and, in working to implement and improve Fukumoto's monitoring/adjusting method, the POSITA would have predictably looked to other disclosures like those in Aldrich for such details, especially where Aldrich explicitly describes driving an actuator at/near resonance using known control algorithms. NINTENDO-1003, ¶159; Aldrich, 1-3.

Second, the Fukumoto-Aldrich combination would implement feedback control according to Aldrich's technique that continuously updates the control outputs throughout operation of the system. NINTENDO-1003, ¶160. 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 objective of Fukumoto and Aldrich. *See id.*; NINTENDO-1048, 16:38-50.

This combination was the application of known techniques (Aldrich's "hill-climbing" feedback control algorithm) to a known system (Fukumoto's system that uses a CPU to control a drive circuit to drive an oscillatory actuator) ready for improvement to yield predictable results (benefits articulated above). *KSR*, 550 U.S. at 417; NINTENDO-1003, ¶161.

A POSITA would have had a reasonable expectation of success based on the applicability of Aldrich's method to Fukumoto's resonant system architecture, and

because the modifications would be largely implemented via software executed by Fukumoto's CPU. NINTENDO-1003, ¶162. Sensor outputs would be received and processed by Fukumoto's processor using at least Aldrich's "hill-climbing control algorithm" "to find and remain within the vicinity of the resonance." Aldrich, 2. It would have been obvious to a POSITA to modify Fukumoto's processor to include a control program based on Aldrich's algorithm. NINTENDO-1003, ¶162. 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.*

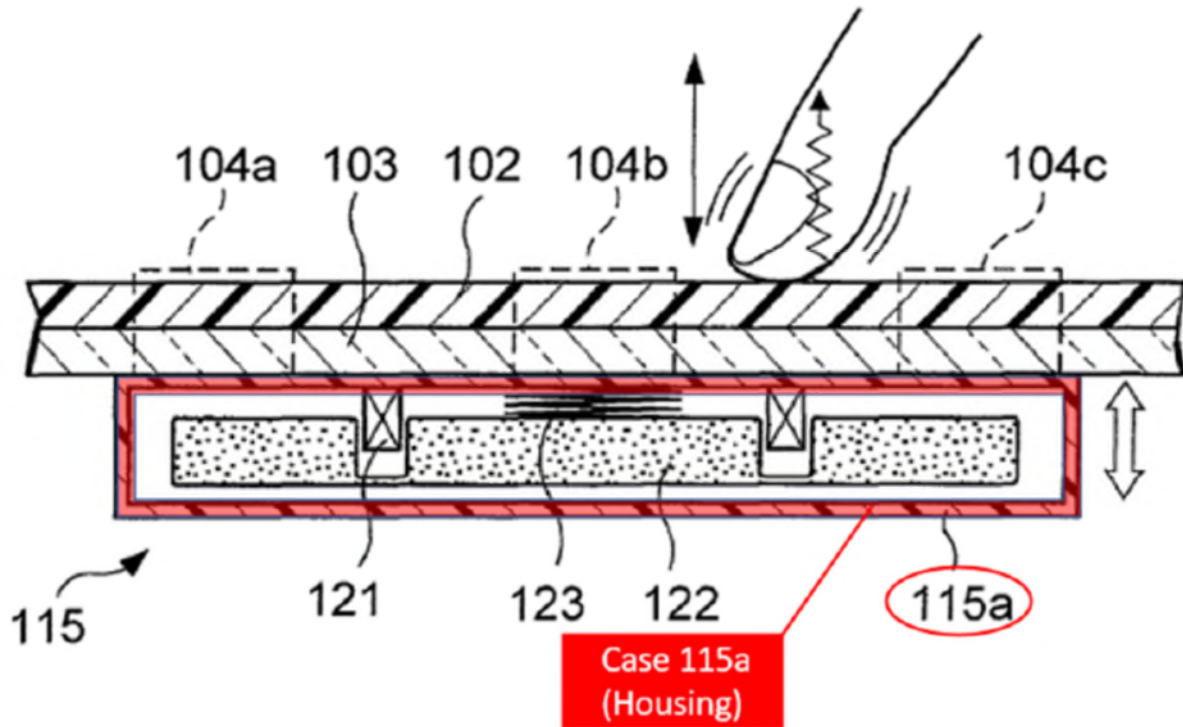
C. Analysis

1. [2pre]: A linear vibration module comprising:

As the Board already found, to the extent it is limiting, Fukumoto discloses a *linear vibration module*. NINTENDO-1003, ¶163; *see also* NINTENDO-1058, 18-24. Fukumoto discloses "[a]n electronic device drives an oscillatory actuator to cause generation of vibration ... in a direction perpendicular to their respective front surfaces." Fukumoto, Abstract. Fukumoto's oscillatory actuator oscillates in the same way as the '337 patent. *Id.*, 14:20–24 ("linear oscillatory actuator"), Fig. 3; NINTENDO-1001, 3:6–20.

2. [2a]: a housing;

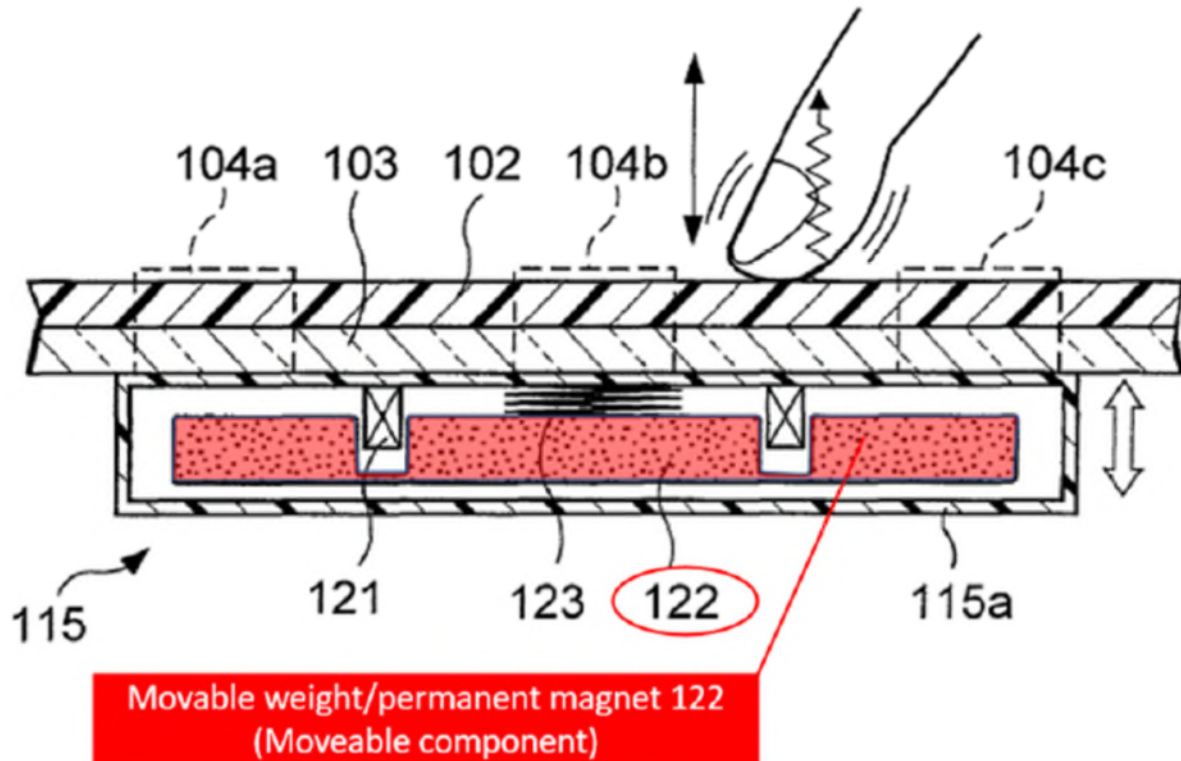
As the Board already found, Fukumoto discloses this limitation because the components of its oscillatory actuator are “housed inside the case 115a.” Fukumoto, 15:56–59; NINTENDO-1003, ¶164; *see also* NINTENDO-1058, 18-24.



Fukumoto, Fig. 3. Fukumoto’s case 115a discloses a *housing*. Alternatively, Figure 1 shows Fukumoto’s PDA has main case 101 which also discloses or suggests a *housing* under an interpretation of *housing* as being the body of the larger device with the “linear vibration module.” *Id.*, Fig. 1.

3. [2b]: a moveable component;

As the Board already found, Fukumoto discloses this limitation. NINTENDO-1003, ¶165; *see also* NINTENDO-1058, 18-24. Fukumoto discloses a “columnar movable weight 122 made of permanent magnet.” Fukumoto, 14:32–37.



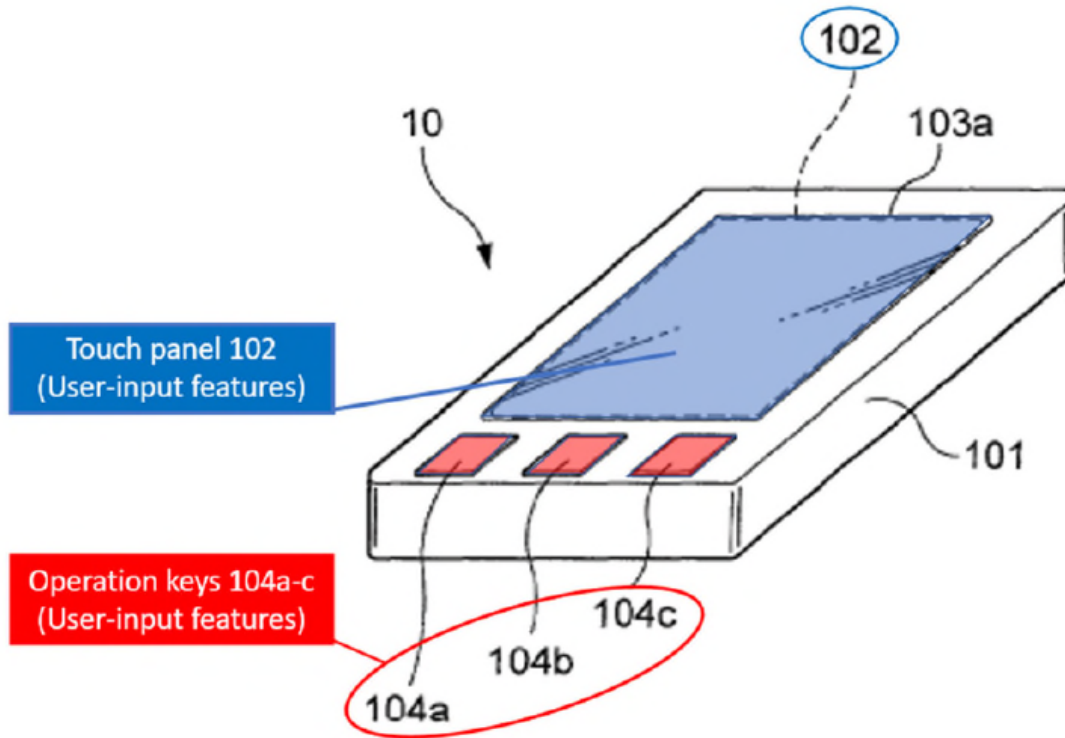
Id., Fig. 3. Fukumoto discloses “[t]he movable weight 122 linearly reciprocates in the vertical direction in the figure.” *Id.*, 14:57–60. Fukumoto’s movable weight 122 discloses a *moveable component* (i.e., a moving weight that performs the recited function (“moves”)).

4. [2c]: a power supply;

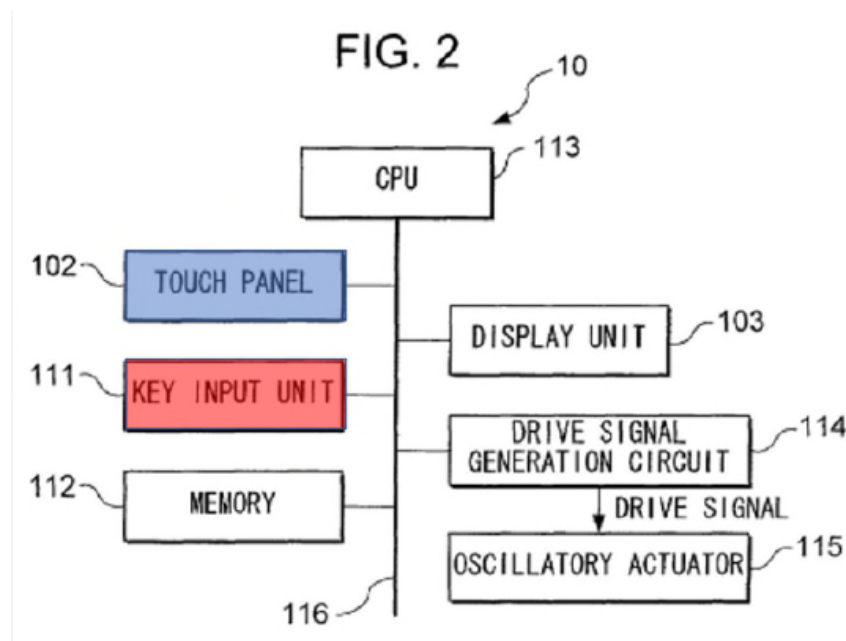
As the Board already found, Fukumoto discloses or renders obvious this limitation. NINTENDO-1003, ¶166; *see also* NINTENDO-1058, 18-24. Fukumoto discloses “movable weight 122 linearly reciprocates in the vertical direction in the figure by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal) is applied to the coil 121.” Fukumoto, 14:57-60. For oscillatory actuator 115 to vibrate at a resonant frequency, it requires “small drive power,” which “reduce[s] the power consumption.” *Id.*, 16:44–50. A POSITA would have understood and found it obvious that the “drive power” is supplied to the coil using *a power supply*. NINTENDO-1003, ¶166.

5. [2d]: user-input features;

As the Board already found, Fukumoto discloses this limitation. NINTENDO-1003, ¶¶167-168; *see also* NINTENDO-1058, 18-24. Fukumoto discloses a PDA with a “touch panel” and “push-button type operation keys” for a user to “input[] operation instructions to the PDA 101.” Fukumoto, 13:40–14:13.



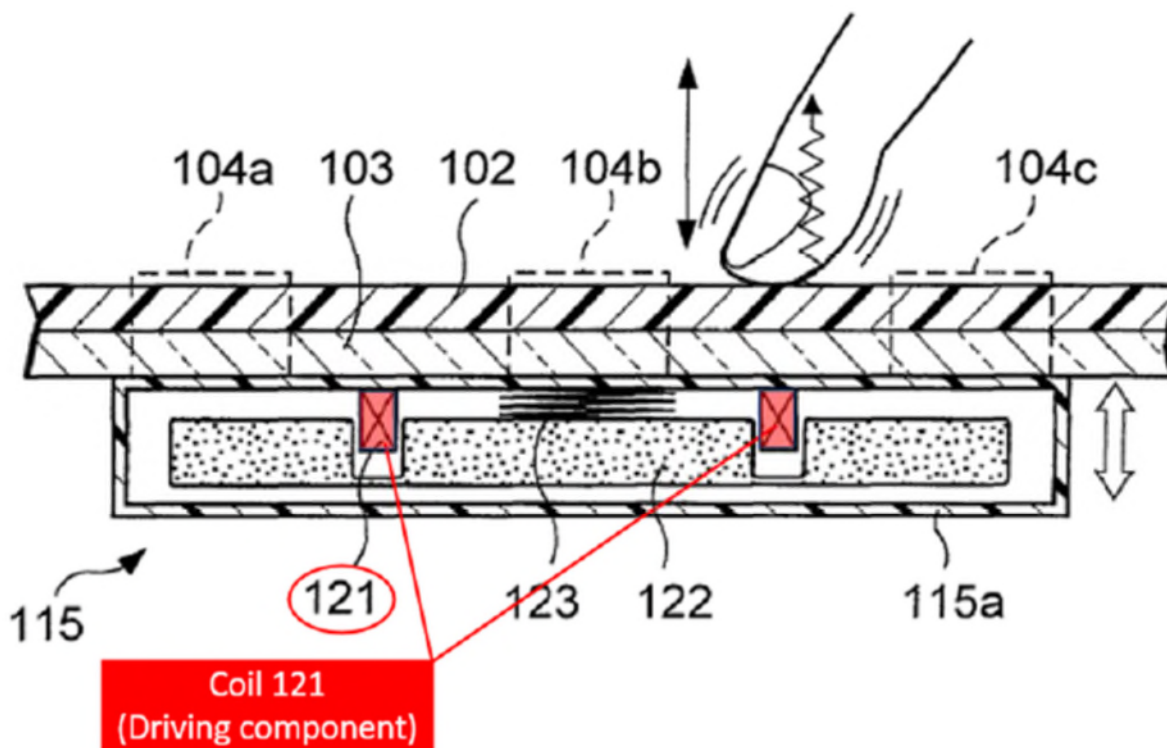
Id., Fig. 1.



Id., Fig. 2, 14:8–13, 30:48–53, 31:27–29, Fig. 41. Fukumoto’s touch panel, push button keys, and slider disclose the *user-input features*. NINTENDO-1003, ¶167.

6. [2e]: a driving component that drives the moveable component in each of two opposite directions within the housing; and

As the Board already found, Fukumoto discloses this limitation. NINTENDO-1003, ¶¶169-170; *see also* NINTENDO-1058, 18-24. Fukumoto discloses “movable weight 122 linearly reciprocates in the vertical direction in the figure by the magnetic force generated from the coil 121 when an AC (alternating) current (drive signal) is applied to the coil 121.” Fukumoto, 14:57–60; NINTENDO-1003, ¶169.



Id., Fig. 3. Like the '337 patent which discloses “driving coils 1412 and 1414” used to “control the plunger to linearly oscillate” (NINTENDO-1001, 10:7-13), Fukumoto discloses a coil 121 (“*driving component*”) that causes movable weight

122 to reciprocate in the vertical direction within housing 115a when alternating current is applied to coil 121 (“*drives the moveable component in each of two opposite directions within the housing*”) (*i.e.*, a coil of conductive wire that performs the recited function). NINTENDO-1003, ¶170.

7. **[2f]: a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features,**

Fukumoto-Aldrich renders obvious this limitation if the Full Construction is adopted. As the Board already found, if only the Abridged Construction is required, Fukumoto itself renders obvious this limitation. *See* §V.A.2; NINTENDO-1003, ¶171; *see also* NINTENDO-1058, 18-24, 33-34.

First, Fukumoto discloses using a *processor* and memory (“CPU 113” and “memory 112,” Fukumoto, Fig. 2, 13:54-59) but does not expressly disclose an H-bridge switch. Instead, Fukumoto discloses applying an AC drive signal to coil 121 (Fukumoto, Fig. 2, 14:57–60) and does not provide details about the circuitry used in Fukumoto to convert power supplied from, *e.g.*, the battery in the electronic device, to the AC drive signal. NINTENDO-1003, ¶172.

Dr. Ben-Tzvi explains that components to do this conversion were well-known, including H-bridge switches, oscillator circuits, and inverters. NINTENDO-1003, ¶¶173-180; NINTENDO-1052, 6; Rossi, Fig. 1, 1:50-53 (H-bridge switch is a

“known technique”). A POSITA would have viewed any of these well-known options as equivalent and obvious, including the use of an H-bridge switch, because each would convert input power into the desired waveform needed in Fukumoto’s device. NINTENDO-1003, ¶¶173-180. An H-bridge switch was well-known and advantageously efficiently convert a signal to alternating current. *Id.*

Furthermore, if the *control component* must be situated *within the linear vibration module* (see §V.A.2), a POSITA would have found this to be an obvious implementation of Fukumoto. Fukumoto does not explain where its CPU and memory is or should be located, and instead just shows a relationship between the components in a block diagram. NINTENDO-1003, ¶181; see, e.g., Fukumoto, Fig. 2, 13:54-14:26. A POSITA would have found it obvious to place Fukumoto’s CPU and memory, or a secondary CPU and memory, *within the vibration module* as a well-known method of implementation in similar systems. See NINTENDO-1004, 2:18-35; NINTENDO-1008, Figs. 1-2, [0045]-[0048]. A POSITA would have understood this common practice would simplify integration of the *linear vibration module* into devices such as the “PDA 10” or “personal computers, ATMs ..., and other various types of electronic devices” and “portable electronic devices” of Fukumoto. Fukumoto, 1:13-25, 13:41-43. This arrangement would enable the linear vibration module to take care of its own basic functionality rather than burdening the device’s main processor with basic tasks related to the operation of the *linear*

vibration module. NINTENDO-1003, ¶181. It would also enable the vibration module to be sold as a standalone unit for integration into other devices, reduce electromagnetic interference, and provided improved performance. *Id.*

Fukumoto-Aldrich renders obvious that the processor is programmed with the algorithm described in the Full Construction (*i.e.*, Steps 706 through 716 of Figure 7A). *See* §V.A.2; NINTENDO-1001, Figs. 7A-7C; NINTENDO-1003, ¶182.

As an initial matter, a POSITA would have understood that Fukumoto would have needed multiple variables to track operation of its device (*e.g.*, PDA 10) and the haptic feedback. NINTENDO-1003, ¶183. Fukumoto explains that when “at least one of the touch signal or key operation signal has been input,” the CPU “reads from the memory 112 the waveform data of the drive signal to be applied to the oscillatory actuator 115.” Fukumoto, 17:7–11. Fukumoto also explains that its memory “stores a plurality of types of waveform data” in order to “give a greater variation to the mode of vibration used.” *Id.*, 47:43-51. “For example, the vibration time, the magnitude of vibration, and the period of the strength of the vibration may be freely changed.” *Id.* A POSITA would have understood that Fukumoto would need to track several variables to allow the vibrations to be so “freely changed” including those for the **mode** (*e.g.*, whether to simply operate the oscillator actuator at a “frequency for causing resonance in the housing” (*id.*, 48:42-47) or pursuant to the “plurality of types of waveform data” stored in memory (*id.*, 47:43-51)) and

strength (“magnitude of vibration”) (*id.*). Fukumoto also describes that as a part the processor’s operation it “instruct[s] generation of drive signal” and a POSITA would have found it obvious that this would have operated off a variable regarding the *control output* to the connected drive signal generation circuit. Fukumoto, Figs. 2, 5-6, 11, 13-15, 17-18; NINTENDO-1003, ¶183. Furthermore, as the desired operation and strength of vibration are adjusted pursuant to user input and action on Fukumoto’s device, these *mode* and *strength* variables would necessarily need to be set to values represented by selections per user input to the user input features. NINTENDO-1003, ¶183. The Fukumoto-Aldrich combination would have included other variables (*e.g.*, *lvl0*, *lvl1*, *freq*, *d*, *inc*) to perform Aldrich’s feedback control method for reasons expressed in Ground 1. *Id.*, ¶183; §VII.F.7. Fukumoto discloses that by default “the frequency F_0 [(*i.e.*, *freq*)] of the drive signal ... is made to match with the natural frequency f_1 of the main case 101” but that it could be set to other frequencies because it “is not limited to the frequency for causing resonance.” Fukumoto, 16:38-59, 48:42-47. Further, the directional signal (*i.e.*, *d*), 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. NINTENDO-1003, ¶¶183, 135.

In the '337 patent's step 704⁶, the control program “waits for [the] next event.” NINTENDO-1001, 6:61-65. Similarly, Fukumoto discloses that it does not perform its method of reading waveform data and driving the oscillating actuator until it “detect[s] operation input.” Fukumoto, 22:21-32, Figs. 5, 11, 14-15. A POSITA would have understood that this means that Fukumoto waits until some event such as a user input event or an event timer. NINTENDO-1003, ¶184.

In the '337 patent's steps 706-708, the expiration of a timer triggers the control program algorithm to output a flipped signal *d* to cause the oscillator circuit (*e.g.*, H-bridge switch) to reverse its output and apply a reverse force on the movable weight, to achieve the desired frequency. NINTENDO-1001, Fig. 7A, 7:10-17. This is taught or rendered obvious by Fukumoto. NINTENDO-1003, ¶185. Fukumoto discloses using a “count value” to control when the CPU outputs to “the drive signal generation circuit.” Fukumoto, 17:20-40. Furthermore, Fukumoto's figures showing a “waveform of the drive signal” demonstrate that to drive Fukumoto's linear oscillatory actuator of Figure 3, Fukumoto must provide a signal which alternates between a high and low value at a frequency f_0 to cause the oscillatory actuator to resonate. *Id.*, Fig. 4, 16:54-56. A POSITA would have recognized a well-known and effective way to do this is to flip the signal input to the drive signal

⁶ See footnote 5 on page 50.

generation circuitry (*e.g.*, H-bridge switch) pursuant to a *timer* which expires at the desired frequency because, as discussed above, Fukumoto already discloses using a “count value” to control Fukumoto’s drive signal output to Fukumoto’s oscillatory actuator. NINTENDO-1003, ¶185; NINTENDO-1026, 8-9, 31-32.

The Fukumoto-Aldrich combination discloses the ’337 patent’s “monitor” routine including using a timer’s expiration to trigger the monitor routine (steps 710-712 of the ’337 patent). NINTENDO-1001, Figs. 7A, 7B. As discussed in Ground 1 at §VII.F.7, a POSITA would have known that the ’337 patent’s “monitor” routine is a simple and known routine for implementing a feedback loop and would have found it obvious, based on Aldrich’s feedback control to operate at a resonant frequency, execute a monitor routine with a specific sampling rate (*i.e.*, each time a timer expires, requiring a reset of the timer each time the monitor routine executes (step 754)) to compare vibration parameters while incrementing or decrementing the drive frequency to adjust toward the desired frequency. NINTENDO-1003, ¶186; Aldrich, 2-3; §VII.F.7.

A POSITA would have understood that the Fukumoto-Aldrich combination uses one or more sensors to sensor values which are then stored (step 730). Specifically, Fukumoto’s processor routine may include a monitoring routine that **senses** the circuit and oscillatory actuator conditions per Aldrich’s control algorithm. NINTENDO-1003, ¶187; Fukumoto, Fig.1; Aldrich, 2-3. A POSITA would have

understood that Aldrich's control algorithm would be implemented as a part of Fukumoto's processor to control the oscillatory actuator via the drive signal generation circuit, particularly because Fukumoto's block diagrams of the PDA 10 do not depict an element for performing device control other than the CPU / processor. NINTENDO-1003, ¶187; Fukumoto, Fig. 2. Fukumoto additionally describes in a separate embodiment that a sensor may be used to "detect [] position" to "cause the same vibration to be generated by the vibrator [] every time." Fukumoto, 19:56-60. Although Fukumoto describes using this for an embodiment where a "DC motor" is used to generate vibration (*id.*, 19:5-10), a POSITA would have understood that Fukumoto could also apply such sensors in a combination of Fukumoto-Aldrich in the embodiment where the oscillatory actuator is a linear oscillatory actuator to sense values required by Aldrich's control algorithm. NINTENDO-1003, ¶187; Fukumoto, Figs. 2-5, 13:41-19:3. Fukumoto discloses the actuator may be operated in different *modes* (*i.e.*, at a "frequency for causing resonance in the housing" (Fukumoto, 48:42-45) or pursuant to the "plurality of types of waveform data" (Fukumoto, 47:43-44) stored in memory) (steps 732-734). NINTENDO-1003, ¶187.

Thus, the software executed by the microprocessor in the combined system receives signals from the sensors which are indicative of vibrational strength, compares a current sensed value with a previously sensed value to tune the input

frequency about a resonant frequency, consistent with steps 730-754 of Figure 7B of the '337 patent. NINTENDO-1003, ¶188; Aldrich, 1-3; §VII.F.7.

In accordance with Aldrich, a current sensed vibration strength value at an incrementally increased control signal frequency is compared with a previous sensed vibration strength value. NINTENDO-1003, ¶189. 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.” Aldrich, 2. This discloses steps 736-740 of the '337 patent. NINTENDO-1003, ¶189.

When the vibration strength has not increased with increased frequency input, the control program determines that the resonant frequency has been exceeded. NINTENDO-1003, ¶190; Aldrich, 2. The “direction of change of frequency during the following sampling period is reversed,” such that the frequency is decremented, and the process continues. Aldrich, 2. This discloses steps 742-744 of the '337 patent. NINTENDO-1003, ¶190. The combined system proceeds in a similar manner when decrementing the input frequency, following steps 746-752 of the '337 patent. *Id.*

In the combination, 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. NINTENDO-1003, ¶191; *see also* §§VII.E.3, VII.F.7, VIII.B.1.

Additionally, Fukumoto’s CPU executes a control routine triggered by user input (*i.e.*, the ’337 patent’s steps 714-716 as illustrated in Figure 7C) which provides a corresponding output to the H-bridge switch when it “instructs the drive signal generation circuit 114 to generate a drive signal,” and in response, “the drive signal generation circuit 114 generates a drive signal using the waveform data supplied from the CPU 113.” Fukumoto, 17:20–26. As explained above, Fukumoto explains that its memory “stores a plurality of types of waveform data” to “give a greater variation to the mode of vibration used.” *Id.*, 47:43-51. Fukumoto discloses that the actuator may be operated in different *modes* (*i.e.*, at a “frequency for causing resonance in the housing” (*id.*, 48:42-47) or pursuant to the “plurality of types of waveform data” stored in memory (*id.*, 47:43-51)) and that the “magnitude of vibration” (*i.e.*, the “*strength*” in the ’337 patent’s control routine) can be adjusted (step 760). *Id.* Fukumoto describes a routine to control the actuator based on the type of waveform data and strength of vibration: Fukumoto’s processor generates the drive signal, starts the application of the drive signal, and maintains the drive signal for a prescribed time. *Id.*, Fig. 5. Further a POSITA would have understood or found it obvious that as a part of providing a “drive signal,” Fukumoto’s processor would also direct the supply of power, *e.g.*, from Fukumoto’s battery, to the circuitry

(*e.g.*, H-bridge switch) to provide the desired output according to the desired waveform such as by adjusting the “supply voltage” to the H-bridge switch according to the needed amplitude (step 762), where the user input is received during a monitoring period so that the input is processed and implemented, requiring a reset of the monitor timer’s interval (step 764). NINTENDO-1003, ¶192; §§VII.F.7, VIII.C.7; Rossi, 2:4-12, 3:6-18, Fig. 5. This is equivalent to the ’337 patent’s algorithm step of providing an output to the power supply in accordance with the user input, consistent with the POSITA’s understanding of the operation of such circuitry including H-bridge circuits. §§VII.F.7, VIII.C.7; Rossi, 2:4-12, 3:6-18, Figs. 5-6; NINTENDO-1003, ¶192.

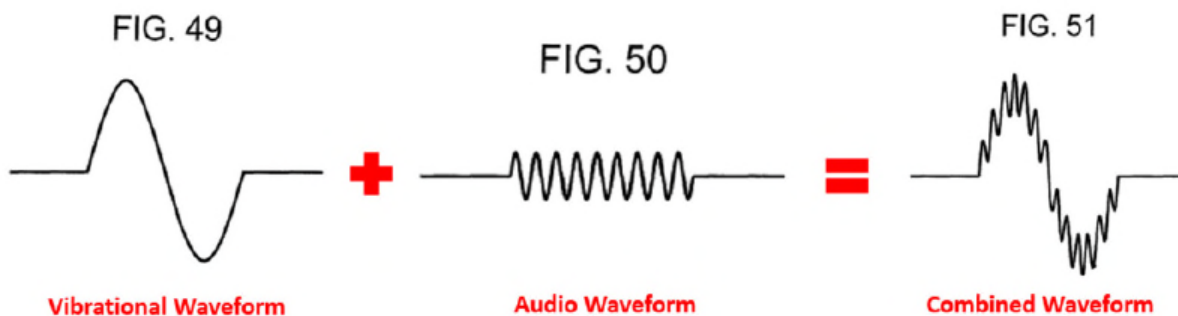
Fukumoto thus discloses or suggests a processor, circuitry to convert power supplied from, for example, the battery in the electronic device to the AC drive signal (equivalent to the ’337 patent’s disclosed H-bridge switch), and an equivalent algorithm to perform the claimed function with at least equivalent steps to those disclosed in the ’337 patent’s specification. NINTENDO-1003, ¶193.

Should the Abridged Construction’s two-step algorithm be adopted (§V.A.2), Aldrich is unnecessary and Fukumoto itself renders obvious this limitation. NINTENDO-1003, ¶194. As explained above, Fukumoto’s control component (“control means”) is implemented in Fukumoto’s CPU and memory. §VIII.C.7;

NINTENDO-1003, ¶194. Further, a POSITA would have recognized that Fukumoto includes a switch (*e.g.*, H-bridge switch). §§VIII.C.7; NINTENDO-1003, ¶194.

8. [2g]: wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.

As the Board already found, Fukumoto discloses or renders obvious this limitation. NINTENDO-1003, ¶195; *see also* NINTENDO-1058, 18-24, 33. Fukumoto discloses that both a vibration-causing waveform (Figure 49) and a sound-causing waveform (Figure 50) can be combined into one waveform and can then be used as a drive signal for the oscillatory actuator (Figure 51):



Fukumoto, Figs. 49–51 (combined), 18:15–17, 34:38–35:9.

A POSITA would have recognized the different frequency and amplitude characteristics of the vibrational and audio waveforms (Figures 49, 50, respectively) and combination of these two waveforms into one would create a complex vibration mode driving Fukumoto’s moveable component at the plurality of different frequencies simultaneously (Figure 51). NINTENDO-1003, ¶196.

**IX. GROUND 3: FUKUMOTO-ALDRICH-SAIKI-MASAHIKO
RENDERS OBVIOUS CLAIM 3**

The PTAB found unpatentable the same limitations in the related '830 patent based on Fukumoto-Saiki-Masahiko. NINTENDO-1058, 18-34, 57, 67-69.

A. Saiki

Saiki relates to a driving circuit in a portable telephone or pager that outputs two signals of two different frequencies. Saiki, 1:9–13, 2:10–36. Saiki discloses an electric signal generator that generates a synthesized vibration output waveform by combining eight point frequencies (P1-P8) such that those frequencies are either in phase or in reverse phase with each other. *Id.*, 14:47–15:5, 15:24–37. Notably, the resulting vibration output waveform in Saiki's Figure 17B is substantially like the complex vibration mode in the '337 patent's Figure 22B. NINTENDO-1003, ¶211.

FIG. 17B

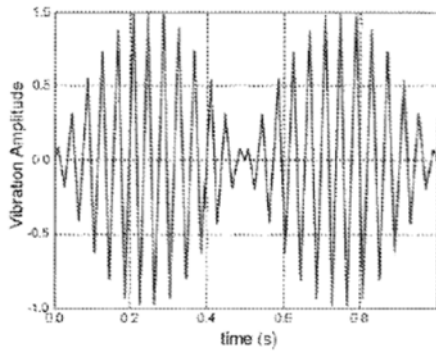
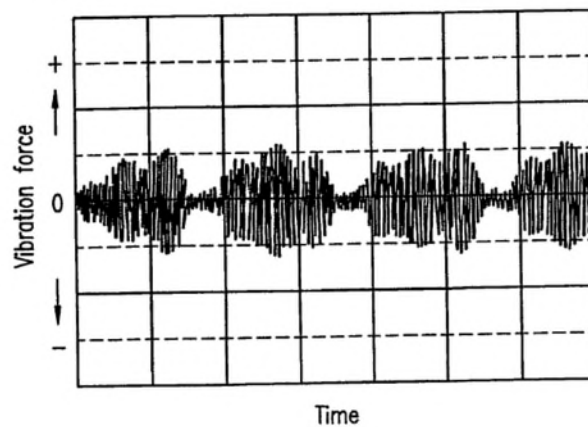


FIG. 22B

NINTENDO-1001, Fig. 22B



Saiki, Fig. 17B

B. Masahiko

Masahiko relates to a vibration generating apparatus in a mobile phone, touch panel, or other device, which exhibits vibration tactile haptic effects. Masahiko, 1:16-21. Masahiko discloses generating a beat vibration as well as changing “period[] spikes” in the total energy of a system driven by a pure sine wave that eventually reaches steady state, but other bipolar, square-based waves used as drive signals continue to change the excitation and dampening phases to change in a non-repetitive, gradual manner. *Id.*, 12:55-56, 14:26-53, 22:55-23:59, Figs. 5, 6, 15, 16; NINTENDO-1003, ¶215.

C. Motivations to Combine⁷

1. Saiki with Fukumoto-Aldrich

A POSITA would have found it obvious to implement Saiki's complex vibration modes in Fukumoto-Aldrich's mobile device. NINTENDO-1003, ¶¶198-202. A POSITA would have recognized that Fukumoto-Aldrich and Saiki are combinable because they are both directed to electromagnetic vibration generation in mobile devices. Fukumoto, Figs. 3, 16, 14:38-15:4, 16:17-37, 50:48-59; Saiki, Abstract, Figs. 2, 3B, 1:9-13, 8:58-9:28; NINTENDO-1003, ¶198. A POSITA would have been motivated to make this combination. First, the combination would allow for greater flexibility and variety of available vibration waveforms. Saiki, 15:20-23, 15:46-60; NINTENDO-1003, ¶199. Second, a POSITA would have known that the more complex waveforms taught by Saiki would allow for applying various "preferred vibration[s] ... with which a large vibration force is maintained over time." Saiki, 15:20-23. This would further Fukumoto's goal of providing a device with a "vibration generation mechanism" that can provide clear haptic feedback or provide notifications "in a noisy environment" where audio reports are "ineffective." Fukumoto, 1:5-41; NINTENDO-1003, ¶200.

⁷ The motivations equally apply to combining Saiki and Masahiko with only Fukumoto. Recall Aldrich is only necessary for the Full Construction.

Further, a POSITA would have recognized that the proposed combination would have amounted to no more than applying a known technique (Saiki's frequency signal synthesis) to a known device ready for improvement (Fukumoto-Aldrich's mobile device including its linear oscillatory actuator and drive signal generation circuit) to yield predictable results (creating additional vibration output options). NINTENDO-1003, ¶201; KSR, 550 U.S. at 417.

A POSITA would have had a reasonable expectation of success in making the proposed modification. NINTENDO-1003, ¶202. A POSITA would have only needed to make minor software modifications allowing for different complex vibration waveforms in the Fukumoto-Aldrich combination, which would have been within the POSITA's skill level. *Id.*

2. Masahiko with Fukumoto-Aldrich-Saiki

A POSITA would have found it obvious to implement Masahiko's beat vibration and aperiodic complex vibration modes in Fukumoto-Aldrich-Saiki's mobile device. NINTENDO-1003, ¶¶203-208. A POSITA would have recognized that the Fukumoto-Aldrich-Saiki combination and Masahiko are combinable because all are directed to electromagnetic vibration generation in mobile devices and Aldrich discloses a control algorithm that could be implemented in the software used in such devices. Fukumoto, 14:38–15:4, 16:29–33, 50:48–59; Saiki, Abstract, 1:9-13, 8:58–9:28; Masahiko, 1:17–21, 8:50–10:61; Aldrich, 2; NINTENDO-1003,

¶204. A POSITA would have been motivated to make this combination. First, a POSITA would have known that use of Masahiko’s particular beat and aperiodic waveforms with the Fukumoto-Aldrich-Saiki combination’s drive circuit would allow for more abrupt start and stop to the vibrations as a predictable improvement in the “tactile haptic effects” experienced by a user of a mobile device. Masahiko, 2:13–47, 4:40–46, 10:7–10, 12:55–61; NINTENDO-1003, ¶205. Second, Masahiko discloses that its invention advantageously provides “a vibration generating apparatus which is high in yield [and] low in cost.” Masahiko, 4:40-46; NINTENDO-1003, ¶206.

A POSITA would have recognized the proposed combination would have amounted to no more than applying a known technique (Masahiko’s beat frequency and aperiodic oscillation) to a known device ready for improvement (the Fukumoto-Aldrich-Saiki combination’s mobile device including a linear oscillatory actuator) to yield predictable results (a linear oscillatory actuator that generates a beat wave frequency to stop voltage application—and thereby vibration generation—abruptly, as well as an aperiodic waveform). NINTENDO-1003, ¶207; *KSR*, 550 U.S. at 417.

A POSITA would have had a reasonable expectation of success in making the proposed modification. NINTENDO-1003, ¶208. A POSITA would have only needed to make minor software modifications allowing for different complex

vibration waveforms in Fukumoto-Aldrich-Saiki, which would have been within the POSITA's skill level. *Id.*

D. Analysis

1. [2pre]-[2g]

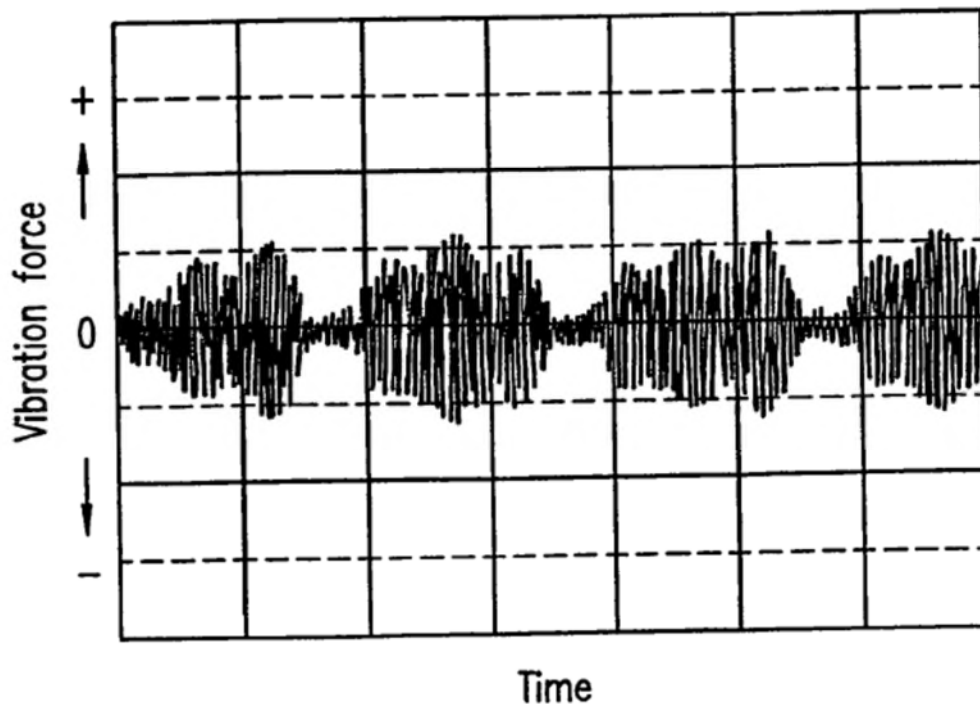
Fukumoto-Aldrich-Saiki-Masahiko discloses or renders obvious Claim 2 for the reasons explained above in Ground 2. *See* §§VIII.C.1-VIII.C.8; NINTENDO-1003, ¶209.

2. [3] (see claim listing)

Fukumoto-Aldrich-Saiki-Masahiko discloses or renders obvious Claim 3. NINTENDO-1003, ¶¶210-216; *see also* NINTENDO-1058, 57-62.⁸ First, Saiki discloses or renders obvious “a primary oscillation frequency modulated by a modulating oscillation frequency.” In Saiki's Figures 17A, 17B (reproduced below), a POSITA would have understood that P1 discloses the “primary oscillation frequency,” and P2 discloses a “modulating oscillation frequency.” NINTENDO-1003, ¶¶210-211.

⁸ The Board already found that Fukumoto-Saiki-Masahiko renders obvious the limitations of claim 3.

FIG. 17B



Saiki, Fig. 17B. The vibration force shown in Figure 17B comprises several frequencies including P1 and P2. *Id.*, 15:24-36.

A POSITA would have understood that P1 is modulated by P2 because P1 is in reverse phase with P2. Saiki, 15:24–36; NINTENDO-1003, ¶212. A POSITA would have been motivated to use Saiki’s complex vibration modes with Fukumoto. §IX.C.1; NINTENDO-1003, ¶212.

Second, Masahiko discloses a “beat frequency.” In Masahiko, the beat vibration or fB is a beat frequency. Masahiko, 12:55–56 (“Conversely, when $f_d < f$, for example, when $f = 196.25$ Hz at $f_o = 157$ Hz, the beat vibration fB is 39.25 Hz.”), Fig. 5; NINTENDO-1003, ¶¶213-214.

Third, Masahiko discloses “an aperiodic oscillation waveform.” Masahiko discloses changing “period[] spikes” in the total energy of a system driven by a pure sine wave that eventually reaches steady state, but other bipolar, square-based waves used as drive signals continue to change the excitation and dampening phases to change in a non-repetitive, gradual manner. Masahiko, Fig. 6, 14:26–53, Figs. 15, 16, 22:56–23:59; NINTENDO-1003, ¶¶215-216.

X. GROUND 4: FUKUMOTO RENDERS OBVIOUS CLAIM 2

Under the Abridged Construction, Fukumoto renders obvious claim 2 for the same reasons explained in Ground 2 because Aldrich is unnecessary. *See* §§V.A.2, VIII; NINTENDO-1003, ¶217. The PTAB found unpatentable the same limitations in the related ’830 patent based on Fukumoto. NINTENDO-1058, 18-34, 67; §II.D. As a result, estoppel applies in two forms (*see infra*) after that judgment becomes final⁹, and the impact of estoppel in IPRs is that PO cannot contest unpatentability. IPR2022-00418, Paper 30, 5, n. 1. Thus, the Board need only reissue the relevant portions of its decision in IPR2023-00993.

First, under CFR 37 § 42.73, that “adverse judgment” precludes PO from “taking action inconsistent with the adverse judgment,” including on claims 2-3

⁹ That decision is currently on appeal, and Petitioner expects affirmance during pendency of this IPR proceeding.

here, which are “not patentably distinct” from the claims subject to the adverse judgment. CFR 37 § 42.73(3). Regulatory estoppel prevents PO from contesting the prior art challenge under Ground 4.

Second, under common law collateral estoppel, a party may not relitigate an issue if: (1) the prior action presents an identical issue; (2) the prior action actually litigated and adjudged that issue; (3) the judgment in that prior action necessarily required determination of the identical issue; and (4) the prior action featured full representation of the estopped party. *VirnetX Inc. v. Apple, Inc.*, 909 F.3d 1375, 1377 (Fed. Cir. 2018) (quoting *Stephen Slesinger, Inc. v. Disney Enters., Inc.*, 702 F.3d 640, 644 (Fed. Cir. 2012)). Each factor is met: In IPR2023-00993, the claim limitations were identical, the art is identical, the judgment squarely addresses each limitation, and Resonant had full representation. NINTENDO-1058, 18-34, 67; §II.D.

XI. GROUND 5: FUKUMOTO-SAIKI-MASAHIKO RENDERS OBVIOUS CLAIM 3

Under the Abridged Construction, Fukumoto-Saiki-Masahiko renders obvious claim 3 for the same reasons explained in Ground 3 because Aldrich is unnecessary. See §§V.A.2, VIII; NINTENDO-1003, ¶218.

The PTAB found unpatentable the same limitations in the related '830 patent based on Fukumoto-Saiki-Masahiko. NINTENDO-1058, 18-34, 57, 67-69.

PO will be estopped from contesting the unpatentability of Claim 3 for the reasons explained at §X.

XII. SECONDARY CONSIDERATIONS

There is no evidence in the prosecution history of this or any related application or patent that any arguments regarding secondary considerations exist. Even if such considerations existed, none would overcome the strong *prima facie* showing of obviousness. See NINTENDO-1003, ¶219.

XIII. CONCLUSION

Petitioners request IPR and cancellation of the Challenged Claims.

Dated: June 23, 2025

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CERTIFICATE OF COMPLIANCE

The undersigned certifies that the foregoing Petition for *Inter Partes* Review complies with the type volume limitation in 37 C.F.R. §42.24(a). According to the utilized word-processing system's word count, the petition—excluding the caption, table of contents, table of exhibits, mandatory notices, certificate of word count, and certificate of service—contains 13,990 words.

Dated: June 23, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing Petition for *Inter Partes* Review and associated documents and exhibits were caused to be served on June 23, 2025 via overnight courier upon the following counsel of record for Patent Owner:

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Copies of this Petition and accompanying documents and exhibits were also served via electronic mail on Patent Owner's counsel of record for related PTAB proceedings and in the related district court litigation – RUSS AUGUST & KABAT:

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