

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD. and
SAMSUNG ELECTRONICS AMERICA, INC.

Petitioner

v.

RESONANT SYSTEMS, INC.,

Patent Owner

Case IPR2023-01025

U.S. Patent No. 9,941,830

**DECLARATION OF ANDREW WOLFE, PH.D.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,941,830**

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I, Andrew Wolfe, declare as follows:

I. INTRODUCTION

1. I have been retained by Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. (“Samsung” or “Petitioners”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”).

2. I am being compensated at a rate of \$650/hour for my services in this proceeding, which is my regular and customary rate.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

4. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of U.S. Patent No. 9,941,830 (“the ’830 patent”)(Ex. 1001).¹ My opinions are set forth below.

II. BACKGROUND AND QUALIFICATIONS

5. I am an independent consultant. All my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In

¹ Where appropriate, I refer to exhibits I understand will be attached to the petition for *inter partes* review of the ’830 patent (the “Petition”).

forming my opinions, I have relied on my education, experience, and knowledge regarding electrical engineering, computer science, audio engineering, user interface design, and experience with consumer product design.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. A copy of my current curriculum vitae, which details my education and professional and academic experience, as well as a list of all publications I have authored in the past ten years, is included as Ex. 1004 in this proceeding. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

A. Relevant Academic Experience

7. In 1985, I earned the B.S.E.E. degree in Electrical Engineering and Computer Science from the Johns Hopkins University. In 1987, I received the M.S. degree in Electrical and Computer Engineering from Carnegie Mellon University and in 1992, I received the Ph.D. degree in Computer Engineering from Carnegie Mellon University. My doctoral dissertation proposed a new approach for the architecture of a computer processor.

8. I have taught at some of the world's leading institutions in the fields of processor technology, computer systems, consumer electronics, software, design tools, data security, cryptography and intellectual property issues. These institutions

include Stanford University, Princeton University, Carnegie Mellon University, and Santa Clara University.

9. From 1991 through 1997, I served on the Faculty of Princeton University as an Assistant Professor of Electrical Engineering. At Princeton, I taught undergraduate and graduate-level courses in Computer Architecture, Advanced Computer Architecture, Display Technology, and Microprocessor Systems, and conducted sponsored research in the area of computer systems and related topics. From 1999 through 2002, I taught a Computer Architecture course to both undergraduate and graduate students at Stanford University multiple times as a Consulting Professor. At Princeton, I received several teaching awards, both from students and from the School of Engineering. I have also taught advanced microprocessor architecture to industry professionals in IEEE and ACM sponsored seminars. I am currently a lecturer at Santa Clara University teaching courses on Microprocessor Systems, Advanced Logic Design, Real-Time Computing, and Mechatronics. In my Mechatronics class, I teach electrical engineers, mechanical engineers, and computer engineers about all kinds of electromagnetic actuators, about sensors, and about feedback control.

10. I have published more than fifty peer-reviewed papers in computer architecture and computer systems and IC (integrated circuit) design. My CV,

attached as Exhibit 1004, lists all publications that I have authored in the previous 10 years.

11. I have also chaired IEEE and ACM conferences in microarchitecture and IC design and served as an associate editor for IEEE and ACM journals. I served on the IEEE Computer Society Awards committee. I am an IEEE Fellow, and IEEE Computer Society Distinguished Contributor, and a Member of ACM. I am a named inventor on at least fifty-seven U.S. patents and thirty-seven foreign patents including at least eleven patents related to touch-based input or similar functionality.

12. I have been the invited keynote speaker at the ACM/IEEE International Symposium on Microarchitecture and at the International Conference on Multimedia. I have also been an invited speaker on various aspects of technology or the PC industry at numerous industry events including the Intel Developer's Forum, Microsoft Windows Hardware Engineering Conference, Microprocessor Forum, Embedded Systems Conference, Comdex, and Consumer Electronics Show as well as at the Harvard Business School and the University of Illinois Law School. I have been interviewed on subjects related to technology and the electronics industry by publications such as the Wall Street Journal, New York Times, LA Times, Time, Newsweek, Forbes, and Fortune as well as CNN, NPR, and the BBC. I have also spoken at dozens of universities including MIT, Stanford, University of Texas,

Carnegie Mellon, UCLA, University of Michigan, Rice University, and Duke University.

B. Relevant Professional Experience

13. I am the founder and sole employee of Wolfe Consulting. Through Wolfe Consulting, I provide technical and business analytics to businesses on processor technology, computer systems, consumer electronics, software, design tools, data security, cryptography and intellectual property issues. I have more than thirty years' experience developing products, researching, consulting, and teaching in those fields. In that time, I have worked as a computer architect, computer system designer, and as an executive in the PC and electronics business.

14. I have more than 35 years of experience as a computer architect, computer system designer, personal computer graphics designer, educator, and executive in the electronics industry.

15. In 1983, I began designing touch sensors, microprocessor-based computer systems, and I/O (input/output) cards for personal computers as a senior design engineer for Touch Technology, Inc. During the course of my design projects with Touch Technology, I designed I/O cards for PC-compatible computer systems, including the IBM PC-AT, to interface with interactive touch-based computer terminals that I designed for use in public information systems. I continued designing and developing related technology as a consultant to the Carroll Touch

division of AMP, Inc., where in 1986 I designed one of the first custom touch-screen integrated circuits. I designed the touch/pen input system for the Linus WriteTop, which many believe to be the first commercial tablet computer.

16. From 1986 through 1987, I designed and built a high-performance computer system as a student at Carnegie Mellon University. From 1986 through early 1988, I also developed the curriculum, and supervised the teaching laboratory, for processor design courses.

17. In the latter part of 1989, I worked as a senior design engineer for ESL-TRW Advanced Technology Division. While at ESL-TRW, I designed and built a bus interface and memory controller for a workstation-based computer system, and also worked on the design of a multiprocessor system.

18. At the end of 1989, I (along with some partners) reacquired the rights to the technology I had developed at Touch Technology and at AMP, and founded The Graphics Technology Company. Over the next seven years, as an officer and a consultant for The Graphics Technology Company, I managed the company's engineering development activities and personally developed dozens of touch screen sensors, controllers, and interactive touch-based computer systems.

19. I have consulted, formally and informally, for a number of fabless semiconductor companies. In particular, I have served on the technology advisory boards for two processor design companies: BOPS, Inc., where I chaired the board,

and Siroyan Ltd., where I served in a similar role for three networking chip companies – Intellon, Inc., Comsilica, Inc., and Entridia, Inc. – and one 3D game accelerator company, Ageria, Inc.

20. I have also served as a technology advisor to Motorola and to several venture capital funds in the United States and Europe. Currently, I am a director at Turtle Beach Corporation, providing guidance in its development of premium audio peripheral devices and user input devices for PCs, mobile devices, and gaming consoles.

21. From 1997 through 2002, I held a variety of executive positions at a publicly held fabless semiconductor company originally called S3, Inc. and later called Sonicblue Inc. I held the positions of Chief Technology Officer, Vice President of System Integration Products, Senior Vice President of Business Development, and Director of Technology, among others.

22. My teams developed the Rio MP3 players and a music delivery platform and webstore backend service for selling music. In 1999, this music delivery system was spun out as a separate company called RioPort.com. I served on the RioPort.com board of directors and became involved in its product and technology strategy. I also managed engineering and marketing for the Rio product line for a period of time as an interim general manager. The Rio MP3 players were among the first consumer products to incorporate large quantities of NAND flash

memory. During my time at SonicBlue we launched more than 30 new consumer electronics products.

III. MATERIALS REVIEWED

23. The opinions contained in this declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding electrical engineering, computer science, and haptic and linear actuation sciences.

24. In forming my opinions expressed in this declaration, I reviewed the following materials:

- the '830 patent (Ex. 1001);
- the file history of the '830 patent (U.S. Patent Application 15/181,249) (Ex. 1002);
- U.S. Patent 9,369,081 ("'081Pat.") (Ex. 1023);
- the file history of U.S. Patent 9,369,081 (Application No. 14/469,210) ('210 application" or "'081FH") (Ex. 1024);
- U.S. Patent 8,860,337 ("'337Pat.") (Ex. 1025);
- the file history of U.S. Patent 8,860,337B2 (Application No. 13/345,607) ("'607 application" or "'337FH") (Ex. 1026);
- U.S. Patent 8,093,767 ("'767Pat.") (Ex. 1027);

- the file history of U.S. Patent 8,093,767 (Application No. 12/782,697) (“’697 application” or “’767FH”) (Ex. 1028);
- the file history of U.S. Provisional Patent Application 61/179,109 (“’109 application”) (Ex. 1029);
- U.S. Patent Application Publication 2011/0144426A1 (“Blenk”) (Ex. 1030);
- U.S. Patent Application Publication 2011/0248817A1 (“Houston”) (Ex. 1031);
- U.S. Patent Application Publication 2007/0261185A1 (“Guney”) (Ex. 1032);
- U.S. Patent Application Publication No. US2012/0133308 (“’308Pub.”) (Ex. 1033); and
- any other materials I refer to in this declaration in support of my opinions.

25. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the specification of the ’830 patent at the time of the alleged invention, which I have been asked to initially consider as no earlier than June 13, 2016 (the filing date of U.S. Application No. 15/181,249, later

issued as the '830 Patent). *See* Ex. 1002. My opinions reflect how one of ordinary skill in the art would have understood the '830 patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

26. Based on my experience and expertise, it is my opinion that the '308 publication discloses all the features recited in claims 1–20 (“challenged claims”) of the '830 patent, as I discuss in detail below.

A. Information Considered

27. My opinions are based on my years of education, research and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this declaration and those listed in the Exhibit List at the end of this declaration.

28. I may rely upon these materials and/or additional materials to respond to arguments raised by the Patent Owner. I may also consider additional documents and information in forming any necessary opinions—including documents that may not yet have been provided to me.

29. My analysis of the materials produced in this matter is ongoing and I will continue to review any new materials as it is provided. This declaration represents only those opinions I have formed to date.

IV. LEVEL OF ORDINARY SKILL IN THE ART

30. The '830 Patent identifies the relevant field of art as follows: "The current application is directed to various types of linear vibrational modules, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces." Ex. 1001 at Abstract. Based on that description of the field of art, my experience, and the information I have reviewed for purposes of this proceeding, I believe a person of ordinary skill in the art in the field of the '830 Patent in 2016 ("Skilled Artisan" or "POSITA") would have been someone with a bachelor's degree in electrical engineering, mechanical engineering, computer science, or a similar field and two years of experience related to electronic consumer product design. Additional training can substitute for educational or research experience, and vice versa. Such a hypothetical person would have been familiar with various consumer products involving a vibrational component.

V. RELEVANT LEGAL STANDARDS

31. I am not an attorney and offer no legal opinions, but in the course of my work, I have had experience studying and analyzing patents and patent claims from the perspective of a person skilled in the art.

32. In expressing my opinions and considering the subject matter of the claims of the '830 Patent, I am relying upon certain basic legal principles that have been explained to me.

A. Priority Date

33. I understand that, to gain benefit of the filing date of an earlier patent application, each application in the chain leading back to the earlier application must comply with the statutory written description requirement.

34. I understand that, to satisfy the written description requirement, a patent's specification must reasonably convey to a person of ordinary skill in the art ("POSITA") that the inventor had possession of the claimed subject matter when the patent application was filed. I understand that, to show "possession" of the invention, the disclosure must describe the invention, including all its claimed limitations. It is not enough that a claimed invention is an obvious variant of that which is disclosed in the specification. Although the meaning of terms, phrases, or diagrams in a disclosure is to be explained or interpreted from the vantage point of a POSITA, all the limitations must appear in the specification.

35. I further understand that entitlement to a filing date extends only to subject matter that is disclosed and not to subject matter that is not disclosed but would be obvious over what is expressly disclosed. Thus, a prior application itself

must describe an invention, and do so in sufficient detail that a POSITA can clearly conclude that the inventor invented the claimed invention as of the filing date sought.

36. I also understand that a patent's priority date is a legal determination based on underlying factual issues. Therefore, I am not rendering a legal opinion on the ultimate legal question of priority date. Rather, my testimony addresses the underlying facts and factual analysis that would support a legal determination of the priority date.

37. I understand that the priority date afforded to a United States patent depends upon the earliest date of the disclosed support for that patent's claimed invention such that claims are evaluated on a claim-by-claim basis and are entitled priority to only the date for which that claim can show it was disclosed to the public or the United States Patent and Trademark Office in the form of provisional, non-provisional, continuation, or continuation-in-part United States patent application.

38. I understand that when a claim incorporates claimed subject matter not previously disclosed in prior-claimed patent applications, that subject matter constitutes "new matter" that entitles the entirety of that claim to only the earliest priority date for which the new claimed subject matter was disclosed, commensurate with my understanding in ¶ 37, above.

B. Claim Interpretation

39. I understand from Counsel that during an IPR proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I understand that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

C. Prior Art

40. I understand from Counsel that certain patents and printed publications can be considered prior art in an IPR proceeding. I understand that prior art must predate the effective filing date of the claims of the patent-at-issue.

41. I understand that in this proceeding the Petitioner has the burden of proving that the claims of the '830 Patent are anticipated by or obvious in view of the prior art by a preponderance of the evidence. I understand that "a preponderance of the evidence" is evidence sufficient to show that a fact is more likely true than it is not.

42. I understand the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art” and generally includes patents and printed publications (e.g., books, journal publications, articles on websites, product manuals, etc.). My analysis below compares the claims to patents and printed publications that are prior art to the claims.

1. Anticipation

43. I understand that for an invention claimed in a patent to be found patentable, it must be, among other things, new in view of what was known before the invention was made.

44. I understand there are two ways in which prior art may render a patent claim unpatentable. Prior art can be shown to “anticipate” the claim. My legal understanding of the legal standard for “anticipation” is set forth below.

45. I understand that a claimed invention is not patentable if it would have anticipated the invention at the time the invention was made.

46. I understand that one anticipation standard is defined in statute (35 U.S.C. § 102(b) as follows:

A person shall be entitled to a patent unless - (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

47. I understand that an inventor’s own work may qualify as a prior art reference applied to same inventor’s later patent application when it is patented or

described in a printed publication in at least the United States more than a year before the date that same inventor applies for a patent in the United States with respect to the same claimed invention.

2. Means-Plus Function Issues

48. I understand that a petition must identify, for any terms with means-plus-function limitations, the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function. I also understand a rebuttable presumption exists that without use of the term, “means,” a claim term is not interpreted as means-plus-function, but that other nonce words like “component” have been found to satisfy the rebuttable presumption and invoke a means-plus-function claim construction of such a claim term.

49. I also understand that a petitioner seeking to demonstrate that the prior art discloses a means-plus-function limitation must prove that the corresponding structure—or an equivalent—was present in the prior art and performing the same claimed function.

50. I understand that the standard for determining whether the prior art discloses the corresponding structure or an equivalent is whether there are insubstantial differences, which means that if the assertedly equivalent structure performs the claimed function in substantially the same way to achieve substantially

the same result as the corresponding structure described in the specification, it is equivalent.

51. I understand that proving structural equivalence does not require a component-by-component analysis, but rather that it is sufficient to show structure, materials, or acts that perform the claimed function in substantially the same way to achieve substantially the same result because the claim limitation is the overall structure corresponding to the claimed function and not individual components.

52. I understand that for a claim to be valid, its scope must be definite, and that improperly introducing a term can lead to an unascertainable scope of a term, rendering it indefinite. I understand that any claim element first addressed in the claims by the antecedent basis, “a” may then be identified later in the claims by the antecedent basis, “the.” I understand that failing to follow this convention may lead to ambiguity in the identification of the particular claim element in question, leading to an indefinite scope of the claim’s term. For purposes of this proceeding, I identified and provided my best understanding of any such terms despite such ascertainable scope.

VI. SUMMARY OF OPINIONS

53. For the reasons I discuss below, it is my opinion that claims 1–20 of the ’830 patent are anticipated by the ’308 publication.

VII. BRIEF DESCRIPTION OF TECHNOLOGY

A. Background of the Technology

54. The '830 patent at issue in this matter is related to vibration modules that generate vibrational forces and are incorporated into various appliances, devices, and systems. Vibration-generating consumer products come in many forms, and when incorporating a vibration module, generally, require an electrically-driven magnetic circuit that alternates its current to reverse the magnetic fields created by that circuit, which in turn causes a driving component to force a moveable component to move back and forth. In order to provide context for these patents and the state of the technology at the time they were filed, a high-level review of the technology related to computer input and output, software systems related to these functions, and vibrational devices is likely to be beneficial.

1. Computer Hardware

55. Digital computer systems have commonly used the same basic high-level architecture since they began to be developed in the mid-20th century.

56. Computer systems generally include one or more central processing units ("CPU"). A CPU performs all of the primary calculations in the computer. As such, the CPU controls and coordinates the activities of the other connected devices. The CPU would have memory connected to it. This memory holds programs and data that are used to perform the computing and communications functions of the computer. The programs run on the CPU. These programs are generally referred to

as “software.” This software includes instructions to the CPU that direct it to perform calculations and to control communications within the computer and to devices connected to the computer.

57. The term input/output (“I/O”) device is used to identify hardware devices that can input or output data to the CPU and/or memory of the computer. One category of I/O devices are “input devices” that are used to communicate information from the user to the computer. These are the devices that give the computer its interactive capability. In general, these devices sense or measure some physical phenomenon such as motion, light, or sound. We use these physical inputs to communicate with the computer. Each of the other input devices operates in a generally similar way. For example, a mouse can use motion sensors to determine the distance and direction that the mouse is moved and then communicate that information as computer data to the software running on the computer. These types of data are called “input data” and can be processed by software running on the CPU. By 1997, a large number of different input devices were common in computers. These included keyboards for text input; a mouse, trackball, joystick, touchpad, graphics tablet, and touchscreen for cursor positioning; a microphone for sound; and a camera for images.

58. Other I/O devices include output devices. These are the devices that a computer would use to provide information to the user. In general, all of these

devices translate computer data to some physical phenomenon, such as motion, light, or sound. For example, a computer monitor converts the data from the computer into an array of light output that form a visible image. This image can include text, graphics, or video. An ink-jet printer converts the computer data to motion by using motors to move the print head and paper and piezoelectric actuators to spray ink at the right time. A sound card uses computer data to generate electrical signals to move the speaker cone back and forth to produce sounds.

59. The computer system provides interactivity by coordinating these various devices through software. The user provides input using an input device. The software on the CPU responds to that input, performs calculations, and retrieves data from memory in order to generate a response. That response is provided back to the user on an output device. For example, if I move the mouse to the left, the mouse can communicate the direction and amount of motion to the CPU as computer data. The CPU (using software) can then calculate how much the cursor on the screen should move and calculate a new screen image reflecting the new cursor position. This new image is sent to the computer monitor where it is displayed to the user. These type of input/compute/response cycles are at the core of interactive computing.

60. By the mid-1980s, devices called “microcontrollers” or “microcomputers” integrated a CPU, memory, and input/output devices onto a single

component. These components were often used to create devices that included computer-controlled input and/or output based on user input. For example there were toys available in the 80s where a child could press a button corresponding to a letter and the CPU would (via execution of software) cause a speaker to vibrate back and forth to make the corresponding sound.

2. Haptics

61. The use of haptics to provide tactile information is a very old technology. I first became familiar with haptic technology when I worked in the signal processing lab at Johns Hopkins. My own research involved touch detection but the professor supervising my work was developing haptic actuators in the lab to assist in communicating with hearing impaired individuals.

62. The use of haptics for force feedback to an input device also has a long history. For example, U.S. Patent No. 3,919,616 (Ex. 1033), filed in 1971, describes a force-feedback joystick input device. The device provides X, Y, and Z positional data to a computer which can then use that positional input to control a display. The computer also generates force-feedback signals to create haptic feedback to the joystick.

63. Nearly 25 years later, the core concepts behind haptic force-feedback devices remained very much the same, but generally-available computer systems had evolved to include multitasking operating systems, graphical user interfaces,

icons, windows, and many other common features we see in computers and handheld devices today. As these features appeared, haptic feedback was used along with other input devices such as mice and touchscreens and with the new software applications and operating systems.

64. Generally, haptic feedback is provided by means of an actuator. An actuator is a type of motor or other motion transducer device that moves or controls some mechanism. A motion transducer is any device that moves in response to an electrical signal. These include motors, solenoids, voice coils (i.e. speakers), and piezoelectric devices. With respect to haptic feedback, a variety of different types of actuators can be used to generate haptic feedback. The most basic example of an actuator for haptic feedback is simply using a motor, solenoid, or other motion transducer to push the user with a rod or stick. For example, a pin might press against a user's finger to notify him that a certain event is occurring. A more complicated example might use a solenoid or pneumatics to impart vibration to the housing of a device, which a user holding the device could feel. Such actuators would provide controllable forces or vibrations which a user would sense upon their activation. In modern electronic devices, another common example of an actuator is an eccentric rotating mass (ERM) motor, which has an offset (non-symmetric) mass attached to the shaft of the motor. As the ERM motor rotates, the offset mass generates a force which generally can be felt as a movement (e.g., a vibration) of the motor and

whatever the motor is attached to. ERM motors are commonly called pager motors since, in the 1980s and 1990s, causing a pager to vibrate was a common high-volume application for these devices. Another example of an actuator is a piezoelectric actuator. Piezoelectric actuators include a piezoelectric material that deforms or flexes when a voltage is applied, and the movement of the material creates haptic feedback for anyone touching that material. Traditional speakers can be used to create vibrations as well when they generate audio signals in the low-frequency ranges that people can feel. Speakers were used to create the “Sensurround” haptic effects in movie theaters for the 1974 film “Earthquake.”² Linear Haptic Resonators use very similar technology to a traditional speaker with a few common modifications. Additional mass may be provided so that vibrations are stronger and the spring action may be provided by a traditional spring or balancing magnets rather than the diaphragm itself. Linear Haptic Resonators are sometimes called voice coil actuators due to the similarity to a speaker’s voice coil.

²See, e.g., <https://daily.redbullmusicacademy.com/2019/07/earthquake-sensurround-cerwin-vega>;

https://web.archive.org/web/20150207231458/http://ww2.odu.edu/~kwinters/Courses/Film%20Sound/history%2070s_files/thirties.htm

65. Different actuators are capable of providing different forms of haptic feedback. For example, an ERM motor might only be able to rotate in one direction and at a single speed, while a piezoelectric actuator might be able to output more complex haptic feedback such as simulating textures. Moreover, the same actuator might be able to output different haptic feedback, such as to indicate different information for different events. For example, a solenoid might push a rod against an object once to indicate one event while pushing the rod against the object repeatedly to indicate a different event. Various parameters also can be varied to provide further information, such as pressing the rod harder or more frequently to indicate a more urgent event. Various types of actuators relevant to vibration (such as piezoelectric actuators, solenoids, ERM motors, and linear resonators) were all well-known in the art before the patents-in-suit, and were all known to be used for haptic feedback.

66. While much of the academic research on haptics has focused on very sophisticated forms of feedback, haptic feedback also can occur at a basic level. For example, one common form of haptic feedback in the 1980s was the pager, which would vibrate to alert the user of a message. In the 1990s, the popularity of pagers declined while the popularity of mobile phones increased. Many such mobile phones, including the Motorola StarTAC, which I used at the time, would vibrate upon receiving a phone call.

3. Haptics in Graphical User Interfaces

67. As graphical user interfaces became common in the 1980s and the 1990s, various companies and researchers incorporated haptic feedback into graphical user interfaces. One common technique involved adding actuators to a mouse to provide haptic feedback to a user as they encountered various graphical objects such as buttons, menus, and scroll bars. The haptic feedback is provided, for example, as a cursor is moved over each graphical object. These techniques migrated to touch sensors as touch sensors became more popular.

VIII. OVERVIEW OF THE '830 PATENT

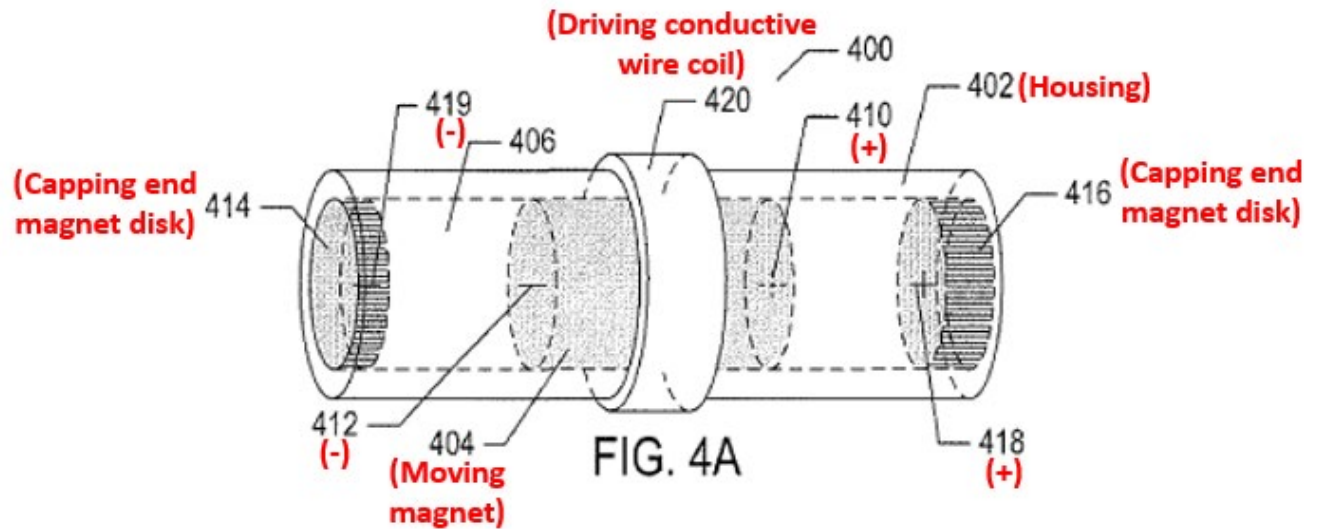
A. Specification: Overview

68. The '830 Patent (Ex. 1001) relates to “linear vibration modules . . . that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces,” such as “consumer appliances” and “pagers” that “are produced by linear oscillation of a weight or member” further resulting from “rapidly alternating the polarity of one or more driving electromagnets.” *'830Pat.*, Abstract, 1:25–33, 3:1–7, 3:62–64, 4:17–21. The '830 Patent further describes a “linear-resonant vibration module,” which includes “feedback control” to ensure the linear vibration module operates “at or near the resonant frequency.” *Id.* The '830 patent acknowledges that “vibration-inducing motors” were not new at the relevant time. *Id.*, 1:25–33. According to the '830 patent, “[t]he most common electromechanical system used for generating vibrations is an intentionally unbalanced electric motor,”

and the '830 patent identifies four problems with using such motors for generating vibration. *Id.*, 1:31–33, 2:15–67 (problems with unbalanced electric motors include “destructive, unbalanced forces within the motor,” “inefficien[cy] in producing vibrational motion,” “elliptical vibrational modes,” and “only a very limited portion of the total vibrational-force/frequency space is accessible”). The '830 patent thus identifies a need “to seek more efficient and capable vibration-generating units for incorporation into many consumer appliances, devices, and systems.” *Id.*, 3:1–7.

69. The '830 patent thus describes linear vibration modules (“LVMs”) and linear-resonant vibration modules (“LRVMs”) that can use used in a variety of applications. *Id.*, 4:17–21. Such LVMs and LRVMs “are linear in the sense that the vibrational forces are produced by a linear oscillation of a weight or component within the LVM or LRVM, rather than as a by-product of an unbalanced rotation,” and according to the '830 patent, this “linear nature” addresses the problems associated with prior art unbalanced vibration-inducing motors. *Id.*, 4:21–36.

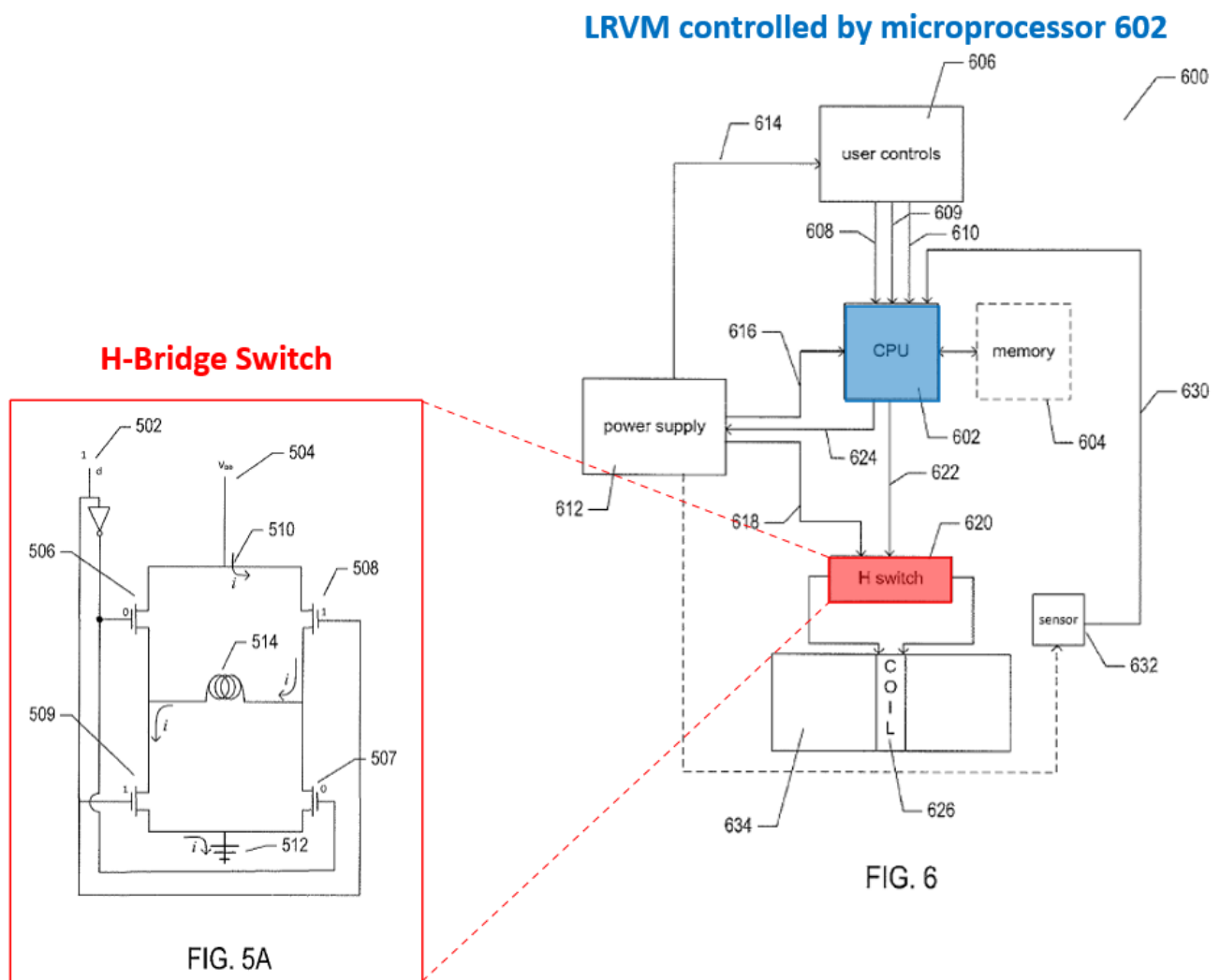
70. Figure 4A depicts one example of the '830 patent’s LVRM including a tubular housing (402), solid, cylindrical moving magnet (404) with opposing polarities on opposing sides (410, 412), capping end magnet disks of the tubular housing (414, 416), and a coil of conductive wire (420):



Id. at Fig. 4A (annotated to show associated components); 4:49–5:10.

71. During operation of the LRVM of Fig. 4A, current is applied in a first direction to coil 420, creating a magnetic force that accelerates weight 404 in a direction parallel to the axis of the housing. *Id.*, 5:11–16. Current is then applied in the opposite direction to coil 420, resulting in weight 404 accelerating in the opposite direction (i.e., “linearly oscillates back and forth”). *Id.*, 5:11–41. “Thus, by 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.* at 5:34–41.

72. The '830 patent explains that “[t]he 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.*, 5:50–6:5. Specifically, microprocessors and H-bridge circuitry can be used to control the application of current and changes in direction of current to the coil:

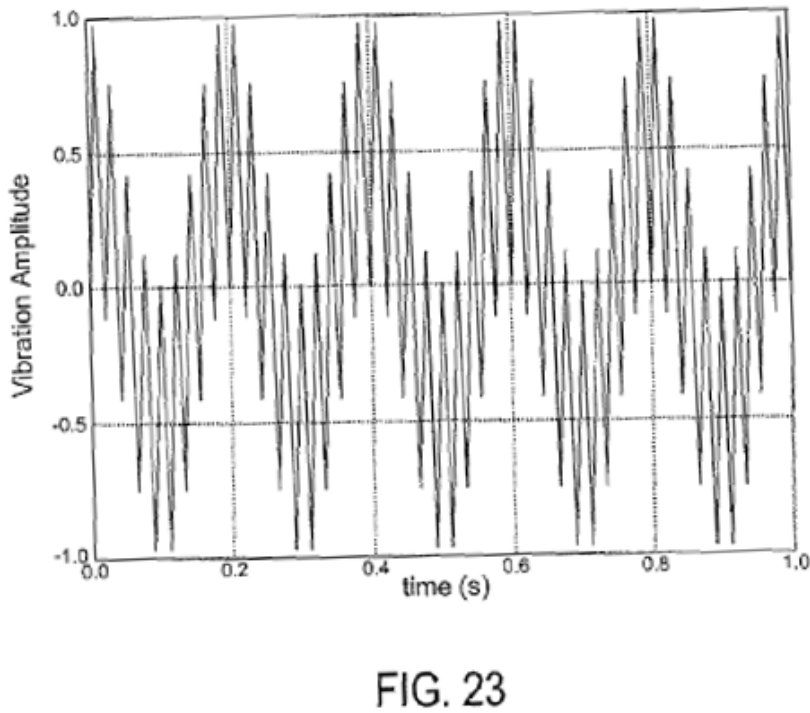
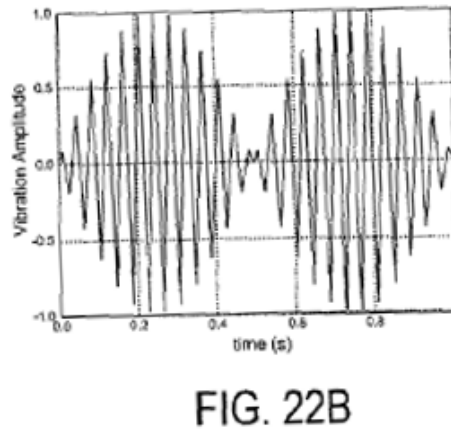
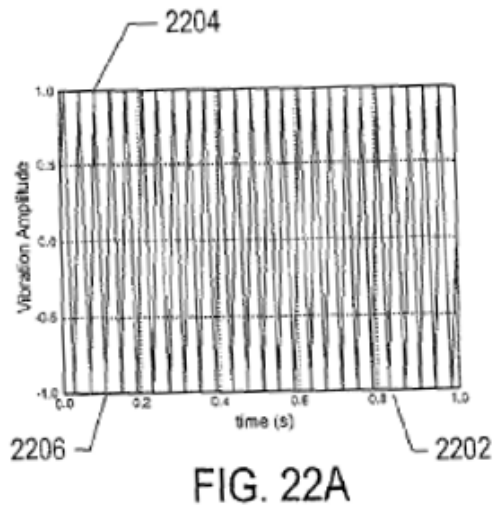


Id. at Figs. 5A, 6 (annotated and combined to show relationship between components); 5:50–6:5 (disclosing application of control signals 502 and 504 to the

H-bridge switch to reverse current); 6:6–51 (disclosing CPU microprocessor control of the LRVM using H-bridge switch 618).

73. The '830 Patent discloses that a user may independently control the “vibration amplitude and vibration frequency” of the LRVM. *Id.* at 4:36–40 (describing user-input features as physical controls including “buttons, sliders, and other types”), 6:27–29 (“controls may include any of various dials, pushbuttons, switches, or other electromechanical-control devices”). According to the '830 patent, microprocessor control “allows for an essentially limitless number of different vibrational behaviors and modes to be configured by software or firmware design, by user input, or by a combination of software or firmware design and user input.” *Id.*, 13:20–31. Figures 22A-23 “illustrate interesting vibrational modes produced by driving a linear-resonant vibration module simultaneously at two different frequencies”:

Complex vibrational patterns and modes



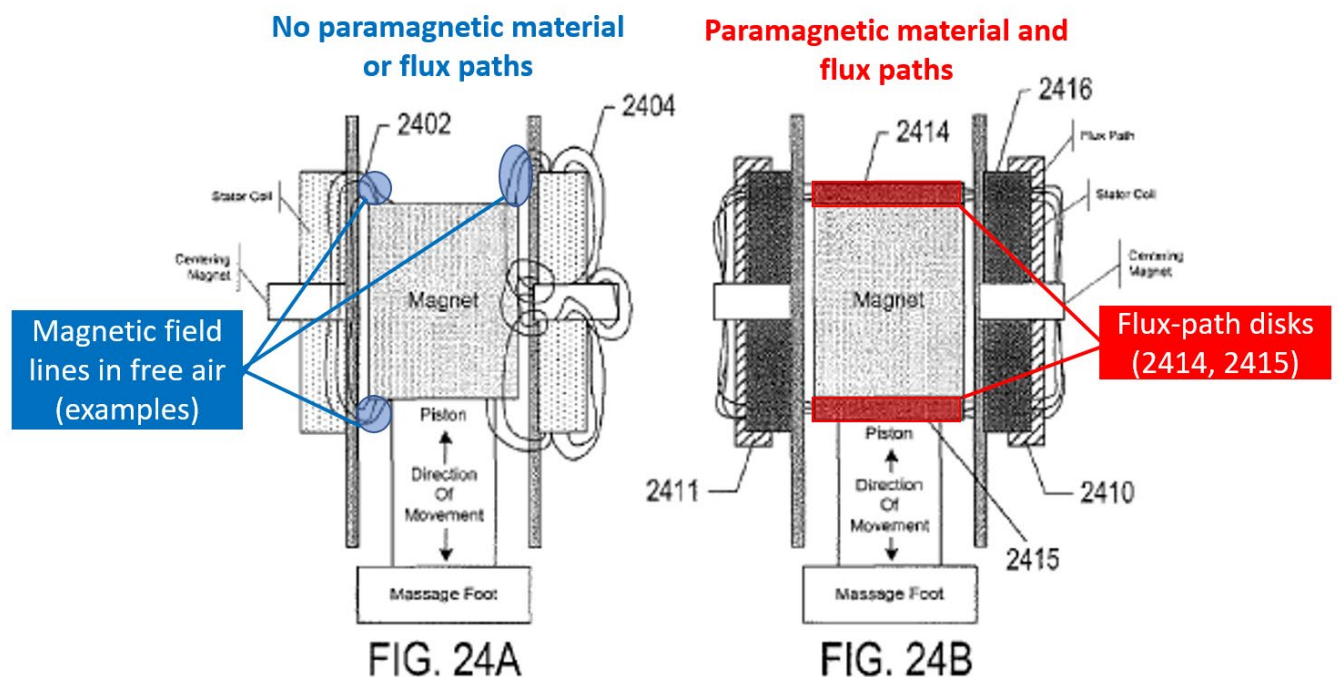
Id. at Figs. 22A–B, 23; 13:31–59.

74. The '830 Patent further describes “different alternative implementations of LRVMs.” *Id.* at 3:62–64. Known applications for vibration-

inducing motors at the relevant time included “consumer appliances, toys . . . pagers . . . hair-trimming appliances, electric toothbrushes, electric toy football games” among others. *Id.* at 1:25–31.

75. The '830 patent also discusses incorporating “paramagnetic flux paths” into its LVM. *Id.*, 14:3–14:35. Specifically, the '830 patent explains: “Free air can be considered to be analogous to a resistor in an electric circuit and increases the resistance, or magnetic reluctance, of a magnetic circuit and reduces and [sic] the flux of the magnetic field.” *Id.*, 14:7–10. Thus, the '830 patent explains that “paramagnetic materials” can be introduced to “provide a lower-resistance path for magnetic flux.” *Id.*, 14:13–19.

76. The '830 Patent distinguishes between an LVM embodiment with (Fig. 24A) and without (Fig. 24B) paramagnetic flux paths:



Id. Figs. 24A–B (annotated), 14:3–19. According to the ’830 Patent, paramagnetic flux paths are introduced to the LVM by including paramagnetic materials (“flux path disks”) that “decrease the portion of magnetic field lines passing through free air” and therefore providing “a more efficient linear vibration module.” *Id.* at 14:20–35.

B. Specification: The ’830 Patent Discloses That the Invention is Directed to Linear Vibration Modules

77. Importantly, I observed that the ’830 patent specification does *not* disclose an embodiment of the invention directed to the “vibration module” genus that encompasses both linear and non-linear oscillation. Rather, as noted above, both the abstract and summary disclose that the invention is directed to linear vibration modules that produce linear oscillation. ’830*Pat.*, Abstract (“The current application is directed to various types of **linear vibrational modules**, including linear-resonant vibration modules that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”)³; *id.*, 3:11–19 (disclosing the same in “Summary” section). The detailed description also begins with a paragraph disclosing that the application is directed to linear vibration modules.

³ I have added all emphases unless I noted otherwise.

Detailed Description ... The current application is directed to various **linear vibration modules** (“LRMs”), including various types of **linear-resonant vibration modules** (“LRVMs”), that can be used within a wide variety of different types of appliances, devices, and systems, to generate vibrational forces. The LVMs and LRVMs that represent embodiments of the current application **are linear** in the sense that the vibrational forces are produced by a **linear oscillation** of a weight or component within the LVM or LRVM, rather than as a by-product of an unbalanced rotation, as in the case of currently employed unbalanced electric motors.

Id., 4:17–27.

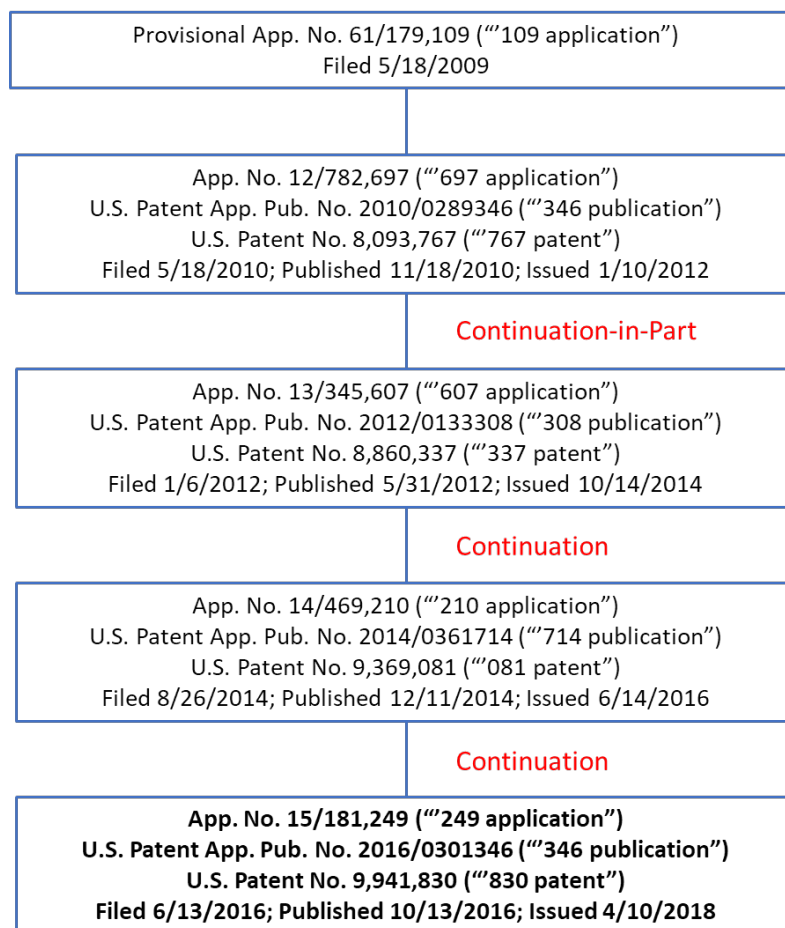
78. Further, the detailed description discloses with respect to *every* figure that describes the invention (i.e., Figures 4-25) that the invention is directed to linear vibration modules. As to certain figures, the ’830 patent specification also specifically emphasizes the benefits of linear modules over non-linear vibration modules. *Id.*, 4:49–52 (“FIGS. 4A-G illustrate **one particular LRVM**, and operation of the particular LRVM ...”), 5:11–12 (“FIGS. 4B-G illustrate operation of the **LRVM** shown in FIG. 4A.”), 5:52–56 (“FIGS. 5A-B illustrate an H-bridge switch that can be used ... to change the direction of current applied to the coil that drives **linear oscillation within an LRVM**.”), 6:6–9 (“FIG. 6 provides a block diagram of the **LRVM**, illustrated in FIGS. 4A-G ...”), 6:52–56 (“FIGS. 7A-C provide control-flow diagrams that illustrate the control program, executed by the CPU, that controls operation of an **LRVM** ...”), 8:41–44 (“FIG. 8 represents the range of frequencies and vibrational forces that can be achieved by different implementations of **LRVM and LRVM control programs**”), 8:62–66 (“FIG. 9

shows a plot of the amplitude/frequency space and regions in that space that can be operationally achieved by unbalanced electrical motors and by **LRVMs** that represent embodiments of the current application.”), 9:20–22 (“FIGS. 10–17 show a variety of different alternative implementations of **LRVMs** that represent different embodiments of the current application.”), 10:55–57 (“FIG. 18 illustrates an enhancement of an implementation of the **linear-resonant vibration module** . . .”), 11:25–34 (describing Fig. 19 as illustrating “plots of amplitude versus frequency for a high-Q and a low-Q vibration device” and stating “**linear-resonant vibration module**, when controlled to vibrate at a resonant frequency . . . generally operates as a high-Q device”), 12:20–46 (describing Figure 20 as illustrating “portions of amplitude/frequency space accessible to various types of vibration modules” and stating that “a **linear vibration module** with user-controlled variable amplitude and variable frequency can provide a much broader range of amplitude/frequency combinations than currently available vibration modules”), 12:54–13:19 (describing Figure 21 as illustrating “the dependence between frequency and amplitude in a low-Q **linear vibration module** as well as a modified dependence that can be obtained by control circuitry”), 13:31–33 (“FIGS. 22A-23 illustrate interesting vibrational modes produced by driving a **linear-resonant vibration module** simultaneously at two different frequencies.”), 14:3–4 (“FIGS. 24A–25 illustrate incorporation of paramagnetic flux paths into a **linear vibration module**.”).

C. '830 Patent Priority

79. The '830 patent purports to claim priority through a series of applications to Provisional Application No. 61/179,109 ("the '109 application"), filed May 18, 2009. To demonstrate why the '830 patent's priority date is no earlier than the filing of its original claims on June 13, 2016, it is necessary to discuss the disclosures of the earlier applications.

80. I have depicted the '830 patent's priority chain below.



D. Originally-Filed Applications in the Priority Chain

81. As with the '830 patent specification itself, each application in the priority chain discloses that the invention is directed to linear vibration modules. Thus, based on my review of these documents, the only support for the challenged claims—which are each directed to a generic “vibration module”—is the originally-filed '830 patent claims themselves.

1. '109 Application

82. I observe that the '109 application is titled “**linear** vibrating motor for sex toy.” Ex. 1029, 1.⁴ In the overview of the invention, the '109 provisional application discloses that applicants’ purported invention was directed to “several variations of a **linear** resonating vibration motor primarily for use in adult sex toys.” *Id.*, 7. The overview further discloses that “[w]hile most vibrating motors used for adult sex toys use rotary motors that push an off-center weight around to create vibrations, **this invention moves a weight back and forth (linearly) to create vibrations.**” *Id.*

83. The '109 application further discloses two examples of a “**linear** vibrator”—(1) a “Thumper”; and (2) a “Pattycake.” *Id.*, 8–12. The Thumper “creates

⁴ My pin cites to the applications discussed in Sections VIII.D–VIII.E refer to internal pagination of the PDFs.

vibrations by forcing [a] moving magnet to move back and forth.” *Id.*, 8. The Pattycake “creates vibrations by forcing the plunger to move up and down.” *Id.*, 10.

84. The ’109 application includes two claims, which are both directed to an adult sex toy that includes “electromagnets that **linearly** move a mass within the sex toy to create vibrations.” *Id.*, 12 (claim 1).

2. ’697 Application

85. I understand that the ’697 application (Ex. 1028) is the first non-provisional application in the priority chain and was filed on May 18, 2010. ’767Pat., Fields 22, 60. The ’697 application led to the issuance of the ’767 patent on January 10, 2012. ’767Pat., Fields 21, 45.

86. The ’697 application is titled “**linear**-resonant vibration module.” Ex. 1028, 19. The abstract discloses the embodiments of the “present invention” are directed to “**linear-resonant vibration modules** that can be incorporated into a wide variety of appliances, devices, and systems to provide vibrational forces.” *Id.*, 36⁵; see also *id.* (“The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”).

⁵ See *supra* fn. 4.

87. The summary and detailed description disclose that the invention is directed to linear vibration modules. *Id.*, 22 (“**Summary ... Various embodiments of the present invention comprise linear-resonant vibration modules** that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”), 23 (“**Detailed Description ... Embodiments of the present invention include various types of linear-resonant vibration modules (“LVRMs”)** that can be used within a wide variety of different types of appliances, devices, and systems, to generate vibrational forces. The LVRMs that represent embodiments of the present invention are linear in the sense that the vibrational forces are produced by a **linear oscillation** of a weight or component within the LRVM, rather than as a by-product of an unbalanced rotation, as in the case of currently employed unbalanced electric motors.”).

88. Further, the ’697 application discloses figures illustrating the invention (i.e., Figs. 4–18), which show that the invention is directed to linear vibration modules. *Id.*, 24–33.

89. The ’697 application includes one originally-filed claim, which is likewise directed to a linear vibration module. *Id.*, 35 (“[Claim] 1. A **linear resonant vibration module** comprising: ... a magnetic weight that **moves linearly** within the

chamber ... control components that apply current that periodically alternates, in direction, to the coil to **linearly oscillate** the magnetic weight within the chamber in order to produce vibrational forces.”).

3. '607 Application

90. I understand that the '607 application (Ex. 1026) was filed on January 6, 2012 as a continuation-in-part of the '697 application. '308Pub., Fields 22, 63. The '607 application led to the issuance of the '337 patent on October 14, 2014. *Id.*, Fields 21, 45.

91. The '607 application is titled “linear vibration modules and linear-resonant vibration modules.” EX1026, 24.⁶ Like its parent '697 application, the '607 application abstract discloses that the application is directed to linear vibration modules. *Id.*, 52 (“**Abstract ... The current application is directed to various types of linear vibrational modules**, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”).

⁶ See *supra* fn. 4.

92. Also like the '697 application, the summary and detailed description disclose that the invention is directed to linear vibration modules. *Id.*, 27 (“**Summary ... The current application is directed to various types of linear vibrational modules**, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”), 29 (“**Detailed Description ... The current application is directed to various linear vibration modules (‘LRMs’)**, including various types of linear-resonant vibration modules (‘LRVMs’), that can be used within a wide variety of different types of appliances, devices, and systems, to generate vibrational forces. The LVMs and LRVMs that represent embodiments of the current application are linear in the sense that the vibrational forces are produced by a **linear oscillation** of a weight or component within the LVM or LRVM, rather than as a by-product of an unbalanced rotation, as in the case of currently employed unbalanced electric motors.”).

93. Again like the '697 application, the '607 application discloses with respect to Figs. 4–18 that the invention is directed to linear vibration modules. *Id.*, 30–39. In addition, the '607 application includes new Figs. 19–25. The '607

application discloses for these new figures that the invention is directed to linear vibration modules. *Id.*, 40–45.

94. The '607 application includes 18 originally-filed claims, each directed to a **linear vibration module**. *Id.*, 48 (“[Claim] 1. A **linear vibration module** comprising: ... a driving component that **drives the moveable component in each of two opposite directions within the housing ...**”), 48–51 (claims 2-18 depending directly or indirectly from claim 1).

4. '210 Application

95. I understand that the '210 application (Ex. 1024) was filed on August 26, 2014 as a continuation of the '607 application. '081Pat., Fields 22, 63. The '210 application led to the issuance of the '081 patent on June 14, 2016. *Id.*, Field 45.

96. I observe that the '210 application is titled “linear vibration modules and linear-resonant vibration modules.” EX1024, 11.⁷ Relative to the '607 application, the '210 application includes a substantively identical abstract, summary, and introductory paragraph to the detailed description. *See id.*, 39 (“**Abstract ... The current application is directed to various types of linear vibrational modules**, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide

⁷ *See supra* fn. 4.

vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”), 14 (“**Summary ... The current application is directed to various types of linear vibrational modules**, including linear-resonant vibration modules, that can be incorporated in a wide variety of appliances, devices, and systems to provide vibrational forces. The vibrational forces are produced by **linear oscillation** of a weight or member, in turn produced by rapidly alternating the polarity of one or more driving electromagnets.”), 16 (“**Detailed Description ... The current application is directed to various linear vibration modules (‘LRMs’)**, including various types of linear-resonant vibration modules (‘LRVMs’), that can be used within a wide variety of different types of appliances, devices, and systems, to generate vibrational forces. The LVMs and LRVMs that represent embodiments of the current application are linear in the sense that the vibrational forces are produced by a **linear oscillation** of a weight or component within the LVM or LRVM, rather than as a by-product of an unbalanced rotation, as in the case of currently employed unbalanced electric motors.”).

97. The ’210 application also includes a substantively identical description of the invention (i.e., Figures 4-25) as the ’607 application. *See id.*, 17-33.

98. In addition, the 18 originally-filed claims of the ’210 application are directed to a linear vibration module, and are identical to the originally-filed claims

of the '607 application. *Id.*, 35 (“[Claim] 1. **A linear vibration module** comprising: ... a driving component that **drives the moveable component in each of two opposite directions within the housing ...**”), 35–38 (claims 2–18 depending directly or indirectly from claim 1).

5. '249 Application

99. I understand that the '249 application (Ex. 1002) was filed on June 13, 2016 as a continuation of the '210 application. '830Pat., Fields 22, 63. The '249 application led to the issuance of the challenged '830 patent on April 10, 2018. *Id.*, Field 45. The '249 application is titled “linear vibration modules and linear-resonant vibration modules.” EX1002, 40.⁸ The '249 application has a substantively identical specification to its parent '607 and '210 applications, and its specific disclosures were described above with respect to the '830 patent specification, the '607 application, and the '210 application. *See id.*, 40-63 (specification), 69 (Abstract).

100. Unlike the earlier applications, however, I note that the applicants **deleted all references to “linear”** in the 20 originally-filed claims of the '249 application, such that the claims are directed to the “vibration module” genus and not the species of a linear vibration module. *See id.*, 64-68.

⁸ *See supra* fn. 4.

101. This is readily apparent when comparing the original-filed claims in the '249 application in redline format against the originally-filed claims of the parent '607 and '210 applications. Claim 1–18 are reproduced below in redline format.

1. A ~~linear~~ vibration module comprising:

...

a driving component that drives the moveable component ~~in each of two opposite directions~~ to oscillate within the housing; and
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~~ one or more stored values.

Id., 64.

2. The ~~linear~~ vibration module of claim 1 wherein the control component is one of ...

Id.

3. The ~~linear~~ vibration module of claim 1 wherein the control component receives output signals from sensors within the ~~linear~~ vibration module during operation of the ~~linear~~ vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.

Id.

4. The ~~linear~~ vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the ~~linear~~ vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.

Id., 64-65.

5. The ~~linear~~ vibration module of claim 4 wherein the one or more operational control parameters is a strength of vibration produced by the ~~linear~~ oscillation of the moveable component; and wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to ~~linearly~~ oscillate, the control component dynamically adjusting the power supplied to the driving component to produce ~~linear~~ oscillation of the movable component at a resonant frequency for the ~~linear~~ vibration module.

Id., 65.

6. The ~~linear~~ vibration module of claim 4 wherein the one or more operational control parameters include both a strength of vibration produced by the ~~linear~~ oscillation of the moveable component and a current operational mode; and wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to ~~linearly~~ oscillate.

Id.

7. The ~~linear~~ vibration module of claim 1 wherein the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component.

Id.

8. The ~~linear~~ vibration module of claim 1 wherein the housing is a ~~linear~~ tube, capped at both ends by movable-component-repelling-components selected from one of mechanical springs and magnets; wherein the movable component is a magnet shaped to slide within the ~~linear~~ tube; and wherein the driving component is an electromagnetic coil.

Id.

9. The ~~linear~~ vibration module of claim 1 wherein the housing is a ~~linear~~ tube, capped at both ends by movable-component-repelling components; and

wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.

Id., 65-66.

10. The ~~linear~~ vibration module of claim 1 further including rotational driving components that induce rotational motion of the movable component in addition to translational motion induced by the driving component.

Id., 66.

11. The ~~linear~~ vibration module of claim 1 wherein the ~~linear~~ vibration module further includes two or more driving components, each, when activated, driving the moveable component to ~~linearly~~ oscillate with an amplitude particular to the activated driving component.

Id.

12. The ~~linear~~ vibration module of claim 1 wherein housing includes a power supply, the microprocessor, and a moveable-component track orthogonal to a long axis of the housing; wherein the moveable component is a plunger that moves a first direction and a second direction opposite from the first direction within the moveable-component-track; and wherein the driving component comprising two electromagnetic driving coils and a centering magnet.

Id.

13. The ~~linear~~ vibration module of claim 1 wherein the moveable component is a clamped mechanical arm to which two magnets are attached; and wherein the driving component comprising an electromagnetic coil that, when opposite currents are applied at a particular frequency to the electromagnetic coil, causes the mechanical arm to vibrate.

Id.

14. The ~~linear~~ vibration module of claim 1 further including flux paths comprising a paramagnetic material that is shaped and positioned to

reduce the reluctance of one or more magnetic circuits within the ~~linear~~ vibration module.

Id.

15. The ~~linear~~ vibration module of claim 1 wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.

Id., 67.

16. The ~~linear~~ vibration module of claim 15 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency; a beat frequency; and an aperiodic oscillation waveform.

Id.

17. The ~~linear~~ vibration module of claim 1 wherein the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features.

Id.

18. The ~~linear~~ vibration module of claim 1 further including elastomeric bristles used to transfer vibration from the ~~linear~~ vibration module to a surface.

Id.

102. Further, originally-filed independent claims 19–20 in the '249 application are new claims that delete all references to “linear” and are identical to claim 1 reproduced above with respect to the preamble, “housing,” “power supply,” “user-input features,” “driving component,” and “control component” limitations.

Id., 64, 67-68. The substantive difference between claim 1 and claims 19 and 20 is that claims 19 and 20 incorporate the limitations from dependent claims 14 and 15, respectively, into claim 1. *Id.*, 66–68. Thus, claims 19 and 20 are identical in scope to claims 14 and 15 reproduced above.

103. As explained below, the originally-filed claims in the '249 application issued in the '830 patent without amendment.

E. Relevant Prosecution History of the '249 Application ('830FH)

1. Applicants Requested Examination Under the AIA

104. During prosecution, I understand that the applicants requested that the '249 application be examined as an AIA first inventor to file application.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☒ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Ex. 1002, 8.

105. Subsequently, the examiner examined the application under the AIA.

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Id., 104.

106. Notably, applicants also filed the '210 application after March 16, 2013 but did not request examination under AIA law.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Ex. 1024, 8.

107. As reflected in the summaries of the '210 and '249 applications above, I have observed that the only substantive differences between the claims in the '210 application and the claims in the '249 application are as follows:

- (1) in the '249 application, applicants deleted all references to a “linear” vibration module, such that the claims are directed to the “vibration module” genus; and
- (2) in the '249 application, applicants amended the claims to require that the control component controls supply of power from the power supply based on *stored values* rather than user input.

108. Because these are the only changes that could be considered new matter, I understand that they are the only reasons that could have prompted applicants to request examination of the '249 application under the AIA. Further, as to (2), the '607 application (which published as the '308 publication and issued as the '337 patent) was filed before March 16, 2013. As I explain below, the '308 disclosed controlling supply of power based on stored values.

109. Thus, in my opinion, the only new matter in the '249 application was (1)—i.e., broadening the claims to cover the “vibration module” genus.

2. The Examiner Allowed the Original Claims Without Amendment

110. I understand that the Examiner rejected claims 1–18 based on non-statutory double patenting over claim 1 of the '081 patent in view of Guney (US2007/0261185). Ex. 1002, 105. In making this rejection, the Examiner stated that claim 1 of the '081 patent discloses a housing, a movable component, a power supply, user-input features, and a control component. *Id.* The Examiner stated that claim 1 of the '081 patent “lacks disclosing stored values,” which Guney disclosed. *Id.* Importantly, the examiner did not reject the claims of the '249 application over the disclosures in the '081 patent specification—as I understand that the '081 patent was not available generally as §§102/103 prior art.

111. The Examiner also rejected claims 19–20 of the '249 application based on non-statutory double patenting over claim 1 of the '337 patent in view of Guney. *Id.*, 105–106. As with the '081 patent, the Examiner stated that claim 1 of the '337 patent did not disclose stored values, but that Guney disclosed stored values. *Id.* Once again, I understand that the Examiner did not reject the claims of the '249 application over the disclosures in the '337 patent specification.

112. The Examiner also rejected claims 1–12 as being obvious over Blenk (US2011/0144426) in view of Houston (US2011/0248817). *Id.*

113. In response, applicants traversed the double patenting rejections on the grounds that they were legally improper. *Id.*, 119–120. As to the rejection based on

Blenk and Houston, applicants relied on the preamble reciting a “vibration module” to distinguish the prior art. *See id.*, 120-121.

114. The Examiner subsequently allowed the claims without amendment.

IX. CLAIM CONSTRUCTION

115. I have given all the claim terms of the challenged claims their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art, at the time of the alleged invention. In the following paragraphs I describe my particular constructions of specific claim limitations and claims warranted by the respective claim language I discuss in my opinions below.

A. The Preamble’s Recitation of a “Vibration Module” is Limiting

116. The preamble of each challenged claim recites a “vibration module.” In my opinion, the preamble is a limitation for several reasons.

117. In my opinion, the preambles provide life, meaning, and vitality to the claims. Further, I also observe that the preambles provide antecedent basis for subsequent terms in the body of certain claims. *See, e.g.*, Ex. 1001, Claim 3 (“wherein the control component receives output signals from sensors within *the vibration module*”), Claim 4 (“wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of *the vibration module*”), Claim 5 (“the control component dynamically adjusting the power

supplied to the driving component to produce oscillation of the movable component at a resonant frequency for *the vibration module*”), Claim 11 (“wherein *the vibration module* further includes two or more driving components”), Claim 14 (“further including flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within *the vibration module*”), Claim 18 (“further including elastomeric bristles used to transfer vibration from *the vibration module* to a surface”), Claim 19 (“A vibration module comprising: ... flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within *the vibration module*.”).

118. In addition, during prosecution, applicants relied on the preamble to distinguish prior art (EX1002, 120–121), which confirms the preamble’s recitation of a “vibration module” is a claim limitation.

119. I understand that applicants’ reliance on the preamble to distinguish prior art also indicates that the preambles’ recitation of a “vibration module” is a claim limitation.

B. Constructions Under ¶ 112, § 6 (MPF)

120. I understand that although no claim terms in the Challenged Claims use the term “means,” there is a rebuttable presumption that the claim terms are not MPF.

Below, I have identified such claimed terms and the specific portions of the specification that describe the corresponding structure for each such limitation.

121. I note that none of the MPF constructions require linear oscillation, and therefore do not limit the claims to a “linear” vibration module.

1. “moveable component”

Limitation (Function Underlined)	Corresponding Structure
Claims 1, 19, 20: “ <u>moveable component</u> ” (i.e., a component that <u>moves</u>)	A moving weight. <i>E.g.</i> , Ex. 1001, Figs. 4A–4G (weight 404), Fig. 6 (oscillating mass 634).

2. “driving component”

Limitation (Function Underlined)	Corresponding Structure
Claims 1, 19, 20: “a driving component that <u>drives the moveable component to oscillate within the housing</u> ”	One or more electromagnetic coils. <i>E.g.</i> , Ex. 1001, Figs. 4A–4G (coil 420); Fig. 6 (coil 626); Fig. 13 (first coil 1302 and second coil 1304).

3. “control component”

Limitation (Function (or Additional Function for Dependent Claims) Underlined)	Corresponding Structure
Claims 1, 19, 20: “a control component that <u>controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values</u> ”	Processor and H Bridge Switch, where processor is programmed with an algorithm to perform the following steps: (1) set the mode and strength to default values or values represented by selections made by user input to the user input features, (2) provide a corresponding output to the power supply, and (3) provide a

	corresponding output to the H-bridge switch. Ex. 1001, 7:20–34, 8:20–30, Fig. 7A, Fig. 7C.
Claim 3: “wherein the control component <u>receives output signals from sensors within the vibration module during operation of the vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors</u> ”	Claim 1 structure with the processor further programmed with an algorithm to perform the following steps: (1) convert the received output signal into an integer, (2) compare that integer to a specific value, (3) adjust one or more operational control outputs based on that comparison. Ex. 1001, 7:24–29, 7:42–8:19, Figs. 7A, 7B.
Claim 4: “wherein the control component <u>adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters</u> ” ⁹	Claim 1 structure with the processor further programmed with the same claim 3 algorithm.

B. Claims 4-6

122. I understand that in claims 4 (and therefore its dependent claims 5–6), “[t]he one or more operational control outputs of the control component,” “the sensors,” and “the one or more sensors” do not have proper antecedent basis. I

⁹ I note that Claims 5 and 6 depend from claim 4 and recite additional limitations related to “the one or more operational control parameters” and “the one of more operational control outputs.” I address those limitations below.

address multiple possible interpretations in my opinions: (1) the first two terms should be “~~the~~ one or more operational control outputs of the control component” and “~~the~~ sensors,” and (2) claim 4 should depend from claim 3 rather than claim 1.

X. Detailed Explanation of the Ground

A. The '109, '697, '607, and '210 Applications Disclosing a “Linear Vibration Module” Do Not Provide Written Description Support for the '830 Patent Claims Directed to the “Vibration Module” Genus

123. I understand that the Board can consider the challenged claims’ priority date, and that a priority claim to an earlier application is valid only if the earlier application, *inter alia*, provides adequate written description for the claims pursuant to § 112. 35 U.S.C. § 120.

124. Here, each challenged claim is directed to the “vibration module” genus in its preamble, and the preamble is limiting. *See* Section IX.A. In addition to the preamble being limiting, I observe that the applicants deleted the language from the body of independent claims 1, 19, and 20 of the '830 patent requiring oscillation in each of two opposite directions (i.e., linear oscillation), which results in a broader claim to the vibration module genus that does not require linear oscillation. *See* Ex. 1001, Claim 1 (“a driving component that drives the moveable component ~~in each of two opposite directions~~ to oscillate within the housing”) (redline showing changes from earlier claims in '337/'081 patents); *id.* (claims 19 and 20 including a similar limitation).

125. I note that the '830 patent specification itself discloses that “oscillation” is not necessarily linear, which confirms that the claims are not limited to linear oscillation. Ex. 1002, 1:44–48 (“As shown in FIGS. 2A-B, the asymmetrically-mounted weight creates an **elliptical oscillation** of the end of the shaft, normal to the shaft axis, when the shaft is rotated at relatively high speed by the electric motor.”).

126. Thus, each challenged claim recites a generic “vibration module” as a limitation and further deletes all references to linear oscillation. As summarized above, however, none of the earlier-filed applications provide written description support for a generic “vibration module.” Rather, applicants repeatedly and consistently described their invention as being directed to linear vibration modules in each of the '109, '697, '607, and '210 applications (and even in the specification of '249 application, which issued as the '830 patent). The originally-filed claims of each earlier application are likewise directed to a linear vibration module. Therefore, it is my opinion that the applicants were not in possession of the claimed “vibration module” genus. Indeed, applicants’ decision to prosecute the '249 application under the AIA confirms that the earlier applications do not provide written description support for the “vibration module” genus.

127. Thus, because the earlier applications do not provide written description support for a generic “vibration module,” I understand the ’830 patent claims are not entitled to an earlier priority date.

B. The ’830 Patent Is Only Entitled to a June 13, 2016 Priority Date Based on Its Originally-Filed Claims Directed to the “Vibration Module” Genus

128. I understand that when a continuation application is filed with a claim having limitations not supported by earlier-filed applications to which the continuation claims priority, the continuation does not receive the benefit of the earlier application’s filing date.

129. Therefore, it is my opinion that the ’830 patent claims are only entitled to a June 13, 2016 priority date based on the filing of the original claims in the ’249 application directed to the “vibration module” genus.

C. The ’308 Publication Is AIA § 102(a)(1) Prior Art and Discloses a “Linear Vibration Module” That Anticipates All Claims of the ’830 Patent

130. Because the ’830 patent claims are only entitled to a priority date as of June 13, 2016, I understand that the ’308 publication—which published on May 31, 2012—qualifies as AIA § 102(a)(1) prior art. Further, I note that the ’308 publication contains a substantively identical specification to the ’830 patent and discloses a species (i.e., a linear vibration module) that anticipates each claim of the ’830 patent directed to the “vibration module” genus. It is my understanding that, although

disclosure of a species may not be sufficient to support a generic claim (as is the case here), the disclosed species can nevertheless anticipate such a generic claim. *See, e.g.*, MPEP §2131.02 (“A Species Will Anticipate a Claim to a Genus”).

XI. SPECIFIC GROUND FOR CHALLENGE

A. Ground Challenging Claims 1–20 of the ’830 Patent

131. The ’308 Publication Anticipates Claims 1–20 under pre-AIA 35 U.S.C. § 102(b).

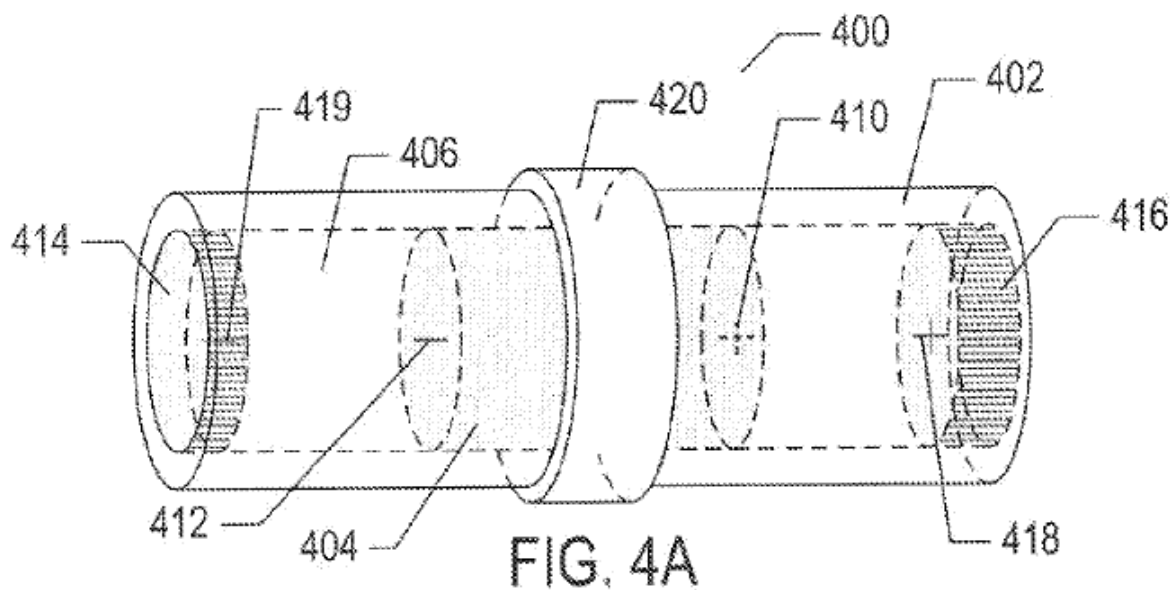
B. The ’308 Publication Anticipates Claims 1-20

132. As I noted above, the ’308 publication includes a substantively identical specification to the ’830 patent and discloses a species (i.e., a linear vibration module) that anticipates the genus “vibration module” to which every challenged claim is directed. Below, I provide examples demonstrating how the ’308 publication anticipates each challenged claim.

1. Claim 1

a. 1[pre]: “A vibration module comprising”

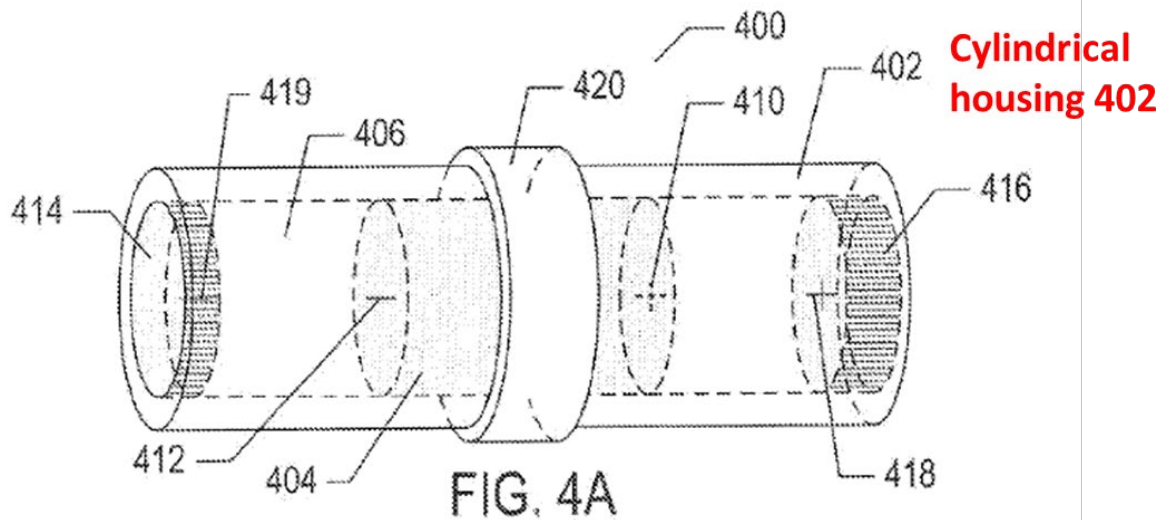
133. 1[pre] is a limitation. *See* Section IX.A. In my opinion, the ’308 publication discloses 1[pre]. Specifically, the ’308 publication discloses a species linear vibration module of the genus “vibration module.” The species linear vibration module is shown, for example, in Figures 4A–4G and, as described with respect to 1[e], produces linear oscillation. ’308Pub., [0028] (“FIGS. 4A–G illustrate **one particular [linear-resonant vibration module] LRVM ...**”).



Id., Fig. 4A, Abstract (“The current application is directed to various types of **linear vibrational modules** ... The vibrational forces are produced by **linear oscillation** of a weight or member ...”); [0010] (describing the linear vibration module in the “Summary” section); [0027] (describing the linear vibration module in the introductory paragraph to the “Detailed Description”); Claim 1.

b. 1[a]: “a housing”

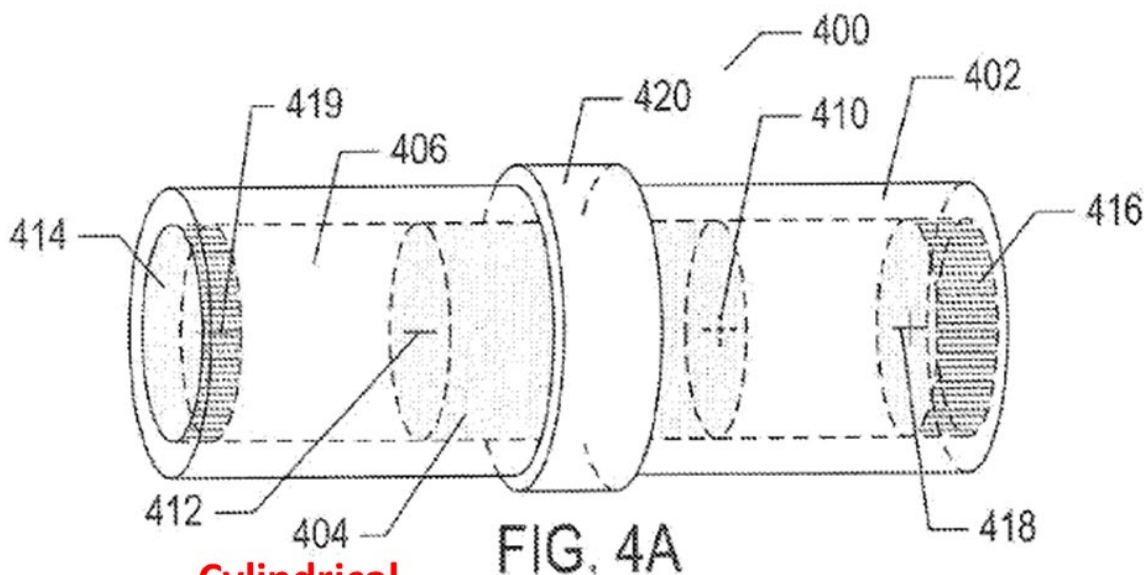
134. In my opinion, the ’308 publication discloses 1[a]. The housing is shown, for example, as cylindrical housing 402 in Figure 4A. ’308Pub., [0028] (“The LRVM includes a **cylindrical housing 402** within which a solid, cylindrical mass 404, or weight, can move linearly along the inner, hollow, cylindrically shaped chamber 406 within the cylindrical housing or tube 402.”).



Id., Fig. 4A, [0028] (“[A] coil of conductive wire 420 girdles the cylindrical housing, or tube 402 at approximately the mid-point of the cylindrical housing.”), [0029], [0032], [0041]–[0042], Figs. 4B–4G, 6, 12, 13, Claim 1 (“1. A linear vibration module comprising: ... a housing.”).

c. 1[b]: “a moveable component”

135. In my opinion, the ’308 publication discloses 1[b] under non-MPF or MPF. For either, the ’308 publication discloses, for example, “a solid, cylindrical mass 404, or weight, [that] can move linearly.” ’308Pub., [0028]. In the embodiment shown in Fig. 4A, the weight is a magnet. *Id.* (“The ***weight is a magnet*** ...”).



**Cylindrical
mass 404**

Id., Fig. 4A, Claim 1 (“1. A linear vibration module comprising: ... a moveable component.”).

d. 1[c]: “a power supply”

136. In my opinion, the ’308 publication discloses 1[c]. The power supply is shown, for example, as element 612 in Figure 6. ’308Pub., [0032]–[0033] (describing Figure 6 as representing a block diagram of the LRVM shown in Figs. 4A-G and including “power supply 612”).

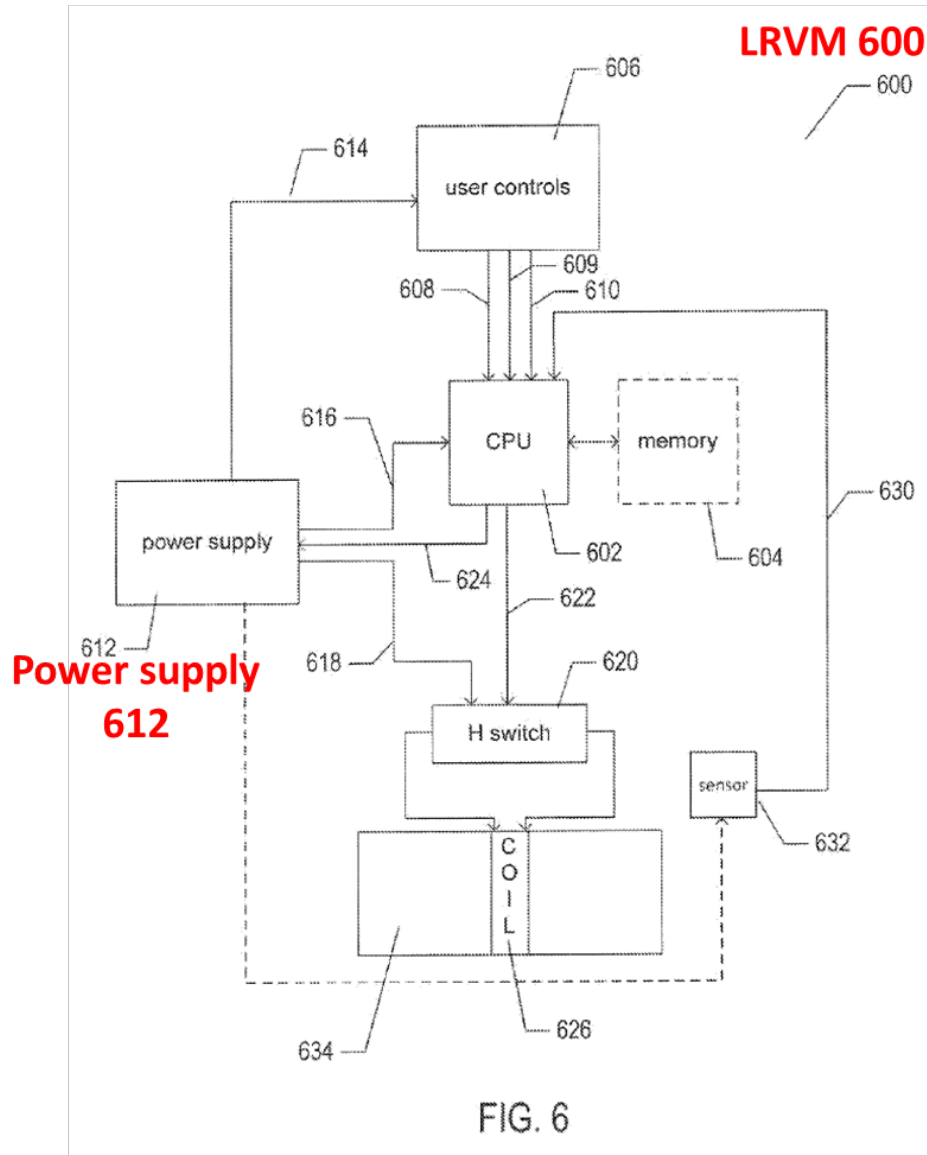


FIG. 6

Id., Fig. 6, Claim 1 (“1. A linear vibration module comprising: ... a power supply.”).

e. 1[d]: “user-input features”

137. In my opinion, the ’308 publication discloses 1[d]. The user-input features are shown, for example, as user controls 606 in Figure 6.

The CPU receives inputs from the *user controls 606* that together comprise a user interface. These controls may include any of *various dials, pushbuttons, switches, or other electromechanical-control devices*. As one example, the *user controls may include[] a dial to select a strength of vibration*, which corresponds to the current applied

'308Pub., [0033].

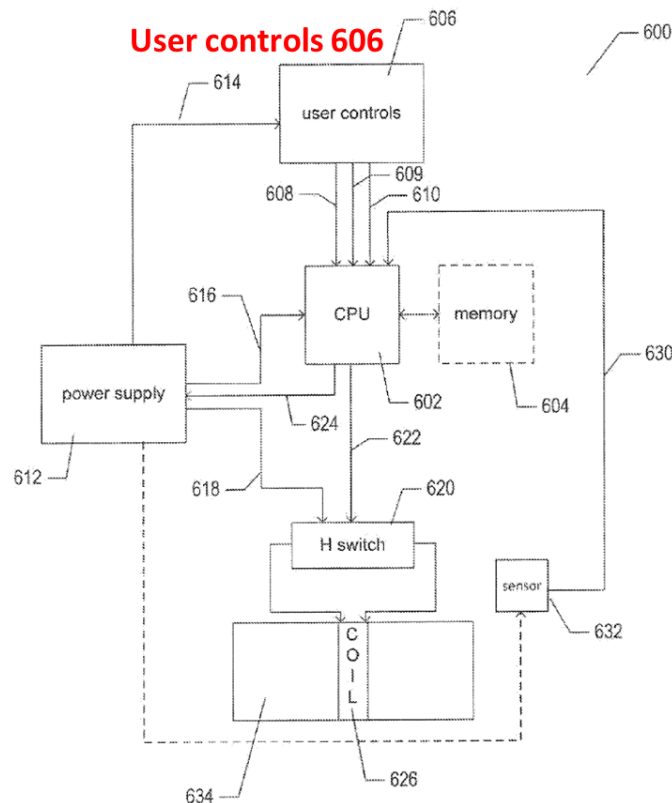


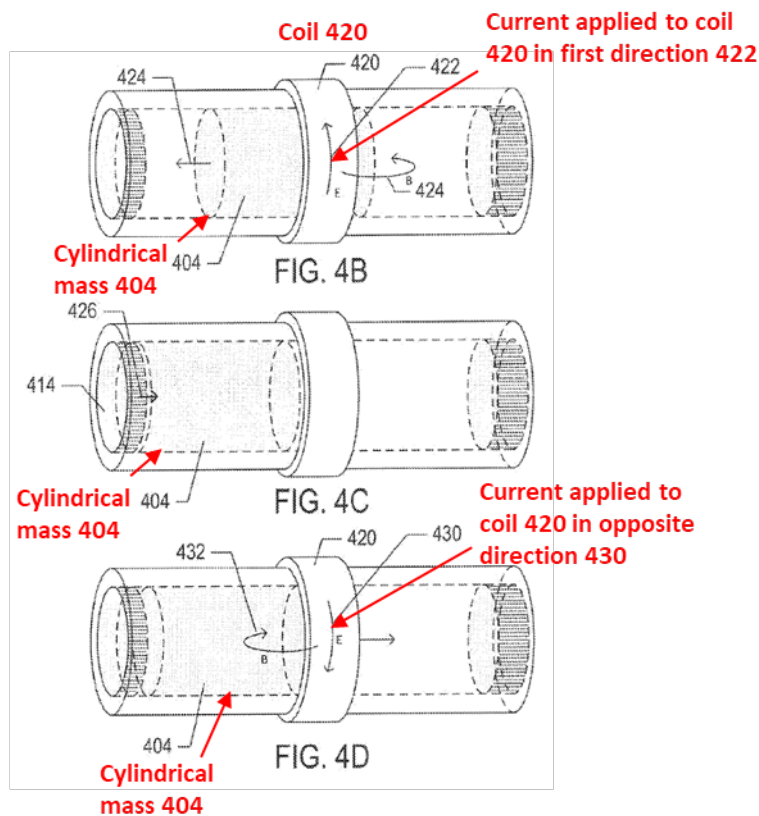
FIG. 6

Id., Fig. 6, [0027], [0032], Claim 1 (“1. A linear vibration module comprising: ... user-input features.”).

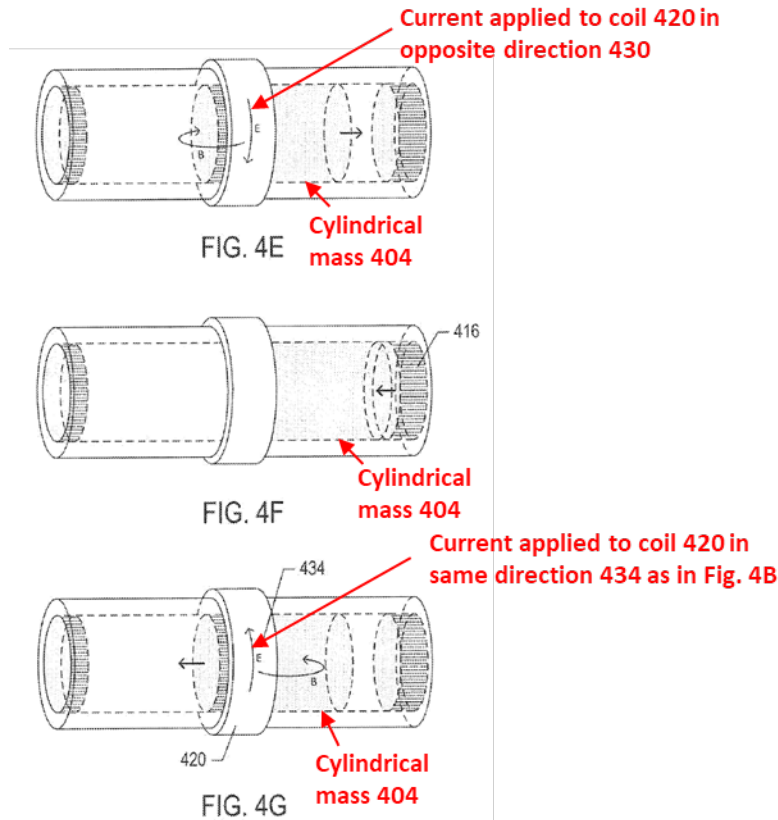
f. 1[e]: “a driving component that drives the moveable component to oscillate within the housing; and”

138. In my opinion, the '308 publication discloses 1[e] under non-MPF or MPF. Under either, the '308 publication discloses a coil that causes the movable component to oscillate within the housing. The coil is shown, for example, as

element 420 in Figs. 4A–G and its operation is described with respect to Figs. 4B–G. Changing the direction of current through the coil causes the moveable component (weight 404) to oscillate linearly (i.e., back and forth) within the housing. '308Pub., [0028].



Id., Figs. 4B–D.



Id., Figs. 4E-G, [0031].

139. Further, under non-MPF, the '308 publication includes the following claim that discloses 1[e]: “1. A linear vibration module comprising: ... a driving component that drives the moveable component in each of two opposite directions within the housing.” *Id.*, Claim 1.

- g. 1[f]: “a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values”

140. In my opinion, the '308 publication discloses 1[f] under MPF or non-MPF.

(i) MPF

141. Under MPF, the '308 publication discloses this limitation both with respect to its default operation mode and with respect to a change in user input.

142. Specifically, with respect to Figs. 6, 7A, and 7C, the '308 publication discloses an H-Bridge switch and a processor programmed with an algorithm to set mode and strength variables to default values and/or values represented by selections made by user input to the user input features, (2) provide a corresponding output to the power supply, and (3) provide a corresponding output to the H-bridge switch. *See* '308Pub., [0031] (describing operation of H-bridge switch), [0032]–[0033] (describing block diagram of LRVM, including a H-bridge switch 620 and CPU 602, i.e., a processor), [0034] (describing algorithm depicted in Fig. 7A), [0036] (describing algorithm depicted in Fig. 7C).

(a) Default Operation

143. With respect to Fig. 7A, the '308 publication discloses steps 702, 706, 708, 714, and 716. These steps are shown below.

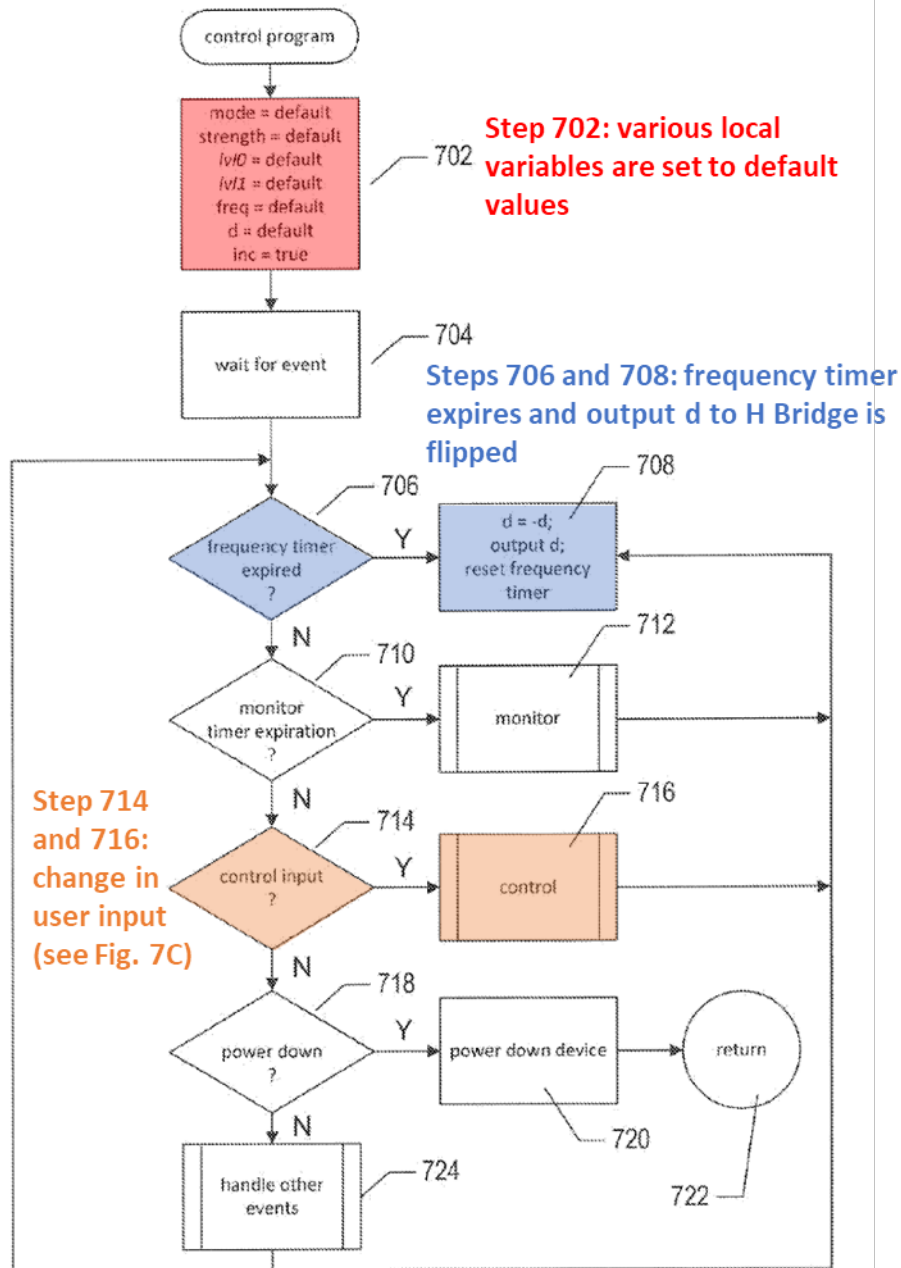


FIG. 7A

Id., Fig. 7A (annotated).

144. The '308 publication discloses that the “[t]he program begins execution, in step 702, upon a power-on event ...” *Id.*, [0034]. Next, “various local variables are set to default values,” including values corresponding to mode and

strength. *Id.* A POSITA would have understood that both the variables mode and strength are “stored values” because they are stored in the processor memory or other memory in the linear vibration module.¹⁰ Notably, the ’308 publication explicitly discloses with respect to certain of the variables that they are “stored.” *See, e.g., id.*, [0035] (disclosing with respect to the “monitor” routine relevant to feedback control that the routine “*stores* the integer value in variable lvl1” and disclosing that the “monitor” routine “decreases the value *stored* in the variable freq” under certain conditions). A POSITA would have further recognized the mode and strength values are stored local variables because these values can be “set” to “default” values, so a memory of values must be maintained for comparative reference and “setting” for the program to operate properly.

145. The control program uses both the default operation mode (with its associated default for the freq variable) and a stored value corresponding to the strength variable to cause the moveable component to oscillate at a frequency and amplitude specified by these stored values.

¹⁰ The ’308 publication discloses that the control program and “other values needed during execution of the control program” may be stored in on-board memory of the microprocessor. *Id.*, [0033]. Alternatively, the control program may be stored in a low-powered memory chip or flash memory. *Id.*

146. As to frequency, in step 706, the control program executed by the processor flips the value of output d to the H Bridge switch when the frequency timer expires based on the default mode and the associated stored freq variable. *Id.*, [0034] (“When an event occurs, the control program begins a series of tasks, the first of which is represented by the conditional step 706, to determine what event has occurred and appropriately handle that event. When the frequency timer has expired, as determined in step 706, the value of the output signal d is flipped, in step 708, and output to the H-bridge switch, with the frequency timer being reset to trigger a next frequency-related event. The frequency-timer interval is determined by the current value of the variable freq.”).

147. As to amplitude, a POSITA reading Fig. 6 and Fig. 7A together would have understood that the control program causes the processor to output a control input 624 to the power supply 612 based on the stored strength variable. See '308Pub., [0033] (“The power supply 612 receives a **control input 624 from the CPU to control the current supplied to the H-bridge switch 618** for transfer to the coil 626.”). Further, the '308 publication discloses that the magnitude of the supplied current corresponds to amplitude of vibration. '308Pub., [0053] (“The user is additionally provided with an input feature to allow the user to **control the current or duty cycle used to drive the linear vibration module and to thus**

increase and decrease the amplitude of vibration produced by the linear vibration module.”).

(b) User Input

148. The '308 publication discloses that when there is a change in user input (e.g., steps 714 and 716), the control routine shown in Fig. 7C is invoked. *Id.*, [0034] (“[W]hen the event corresponds to a change in the user input through the user interface, as determined in step 714, **the routine “control” is called in step 716.**”).

149. Fig. 7C “provides a control-flow diagram for the routine ‘control,’ called in step 716 in FIG. 7A.” *Id.*, [0036]. The '308 publication discloses that in step 760 of Fig. 7C, “the **variables mode and strength** are set to the **currently selected mode and vibrational strength**, represented by the current states of control features in the user interface.” *Id.* Then, “in step 762, the routine ‘control’ computes an output value *p* corresponding to the currently selected strength, **stored** in the variable strength, and outputs the value *p* to the power supply so that the power supply outputs an appropriate current to the coil.” *Id.*.

150. Fig. 7C is reproduced below.

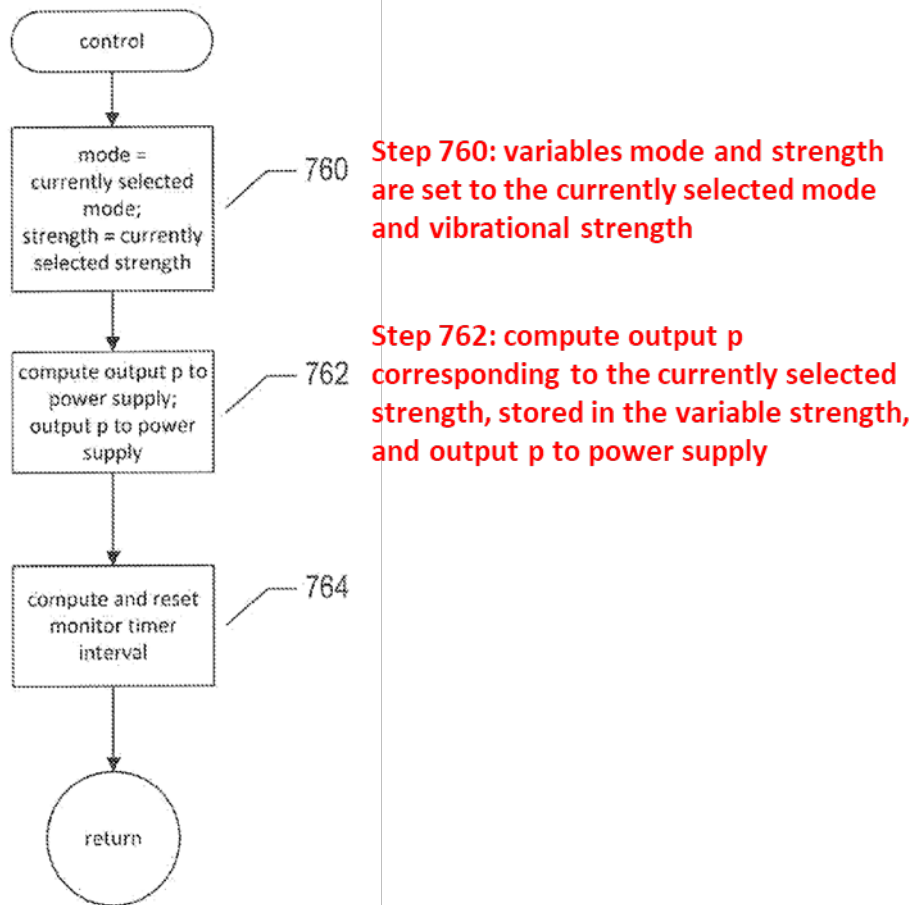


FIG. 7C

Id., Fig. 7C (annotated).

151. A POSITA would have understood that at the completion of the routine in Fig. 7C, the program returns to Fig 7A, where the linear vibration module would now operate according to the value stored in the freq variable associated with the user-selected mode. Specifically, as described above with respect to the default operation in steps 706 and 708, the control program executed by the processor flips the value of output d to the H Bridge switch when the frequency timer expires based on the user-selected mode and the associated freq variable. '308Pub., [0034].

(ii) Non-MPF

152. The same disclosures described above for MPF meet this limitation under non-MPF. Additionally, like the '830 patent, the '308 publication discloses a variable oscillator circuit for allowing the user to control frequency and a user input feature for allowing the user to control current (i.e., amplitude of vibration). *See* '308Pub., [0052]–[0053]. *See also* my analysis of 2[a] in ¶¶155–156. Although not corresponding structures under MPF because the '830 patent does not disclose sufficient detail regarding them, this disclosure teaches 1[f] under non-MPF.

153. Further, the '308 publication discloses the following claim limitation: “1. A linear vibration module comprising: ... 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.” *Id.*, Claim 1. As described above with respect to MPF, this disclosure of controlling supply of power based on user-input also discloses controlling supply of power based on stored values.

2. Claim 2

a. 2[pre]: “The vibration module of claim 1 wherein the control component is one of:”

154. In my opinion, the '308 publication discloses 2[pre]. *See* 1[pre], 1[f]; *see also* '308Pub., Claim 2 (“The linear vibration module of claim 1 wherein the control component is one of.”).

b. 2[a]: “an [sic] variable oscillator circuit with additional control circuitry; and”

155. In my opinion, the '308 publication discloses 2[a]. A POSITA would have understood the claimed variable oscillator circuit with additional control circuitry is structure and is therefore not MPF. To the extent 2[a] is not invalid under § 112, the '308 publication discloses it. *See* '308Pub., [0052]–[0053]. Specifically, the '308 publication discloses a “variable-frequency oscillator circuit [that] can be controlled by user input to drive the H switch or other H-switch-like circuit to operate the linear vibration module at different frequencies.” *Id.*, [0053]. Further, for controlling amplitude, the '308 publication discloses that “[t]he user is additionally provided with an input feature to allow the user to control the current or duty cycle to drive the linear vibration module and to thus increase and decrease the amplitude of vibration...” *Id.*

156. Further, the '308 publication discloses the following claim limitation that discloses 2[a]: “2. The linear vibration module of claim 1 wherein the control component is one of: ... an [sic] variable oscillator circuit with additional control circuitry.” *Id.*, Claim 2.

c. 2[b.i] “a control component that includes a microprocessor;”

157. In my opinion, the '308 publication discloses 2[b.i]. *See* 1[f]. Further, the '308 publication discloses the following claim limitation that discloses 2[b.i]: “2.

The linear vibration module of claim 1 wherein the control component is one of: ... a control component that includes a microprocessor.” *Id.*, Claim 2.

- d. **2[b.ii]“a control program, stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by the one or more stored values”**

158. In my opinion, the '308 publication discloses 2[b.ii]. *See* 1[f]. Because this limitation discloses a microprocessor (i.e., structure), it is not subject to MPF. Moreover, the '308 publication discloses the following claim limitation that discloses 2[b.ii]: “2. The linear vibration module of claim 1 wherein the control component is one of: ... a control program, Stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by user input received from the user-input features.” *Id.*, Claim 2. As described above with respect to 1[f], this disclosure of controlling supply of power based on user-input also discloses controlling supply of power based on stored values.

- 3. **Claim 3: “The vibration module of claim 1 wherein the control component receives output signals from sensors within the vibration module during operation of the vibration module and adjusts one or more operational**

control outputs of the control component according to the received output signals from the sensors”

159. The '308 publication discloses claim 3 under non-MPF or MPF. As an initial matter, under non-MPF, the '308 publication discloses the following claim that discloses claim 3: “3. The linear vibration module of claim 1 wherein the control component receives output signals from sensors within the linear vibration module during operation of the linear vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.” '308Pub., Claim 3.

160. Further, under either non-MPF or MPF, the '308 publication discloses that the processor described with respect to 1[f] is further programmed with an algorithm to perform the following steps: (1) convert the received output signal into an integer, (2) compare that integer to a specific value, (3) adjust one or more operational control outputs based on that comparison.

- a. The control component receives output signals from the sensors and adjusts the “operational control output” d to the H bridge switch based on the sensor output signals corresponding to strength of vibration**

161. To summarize, with respect to Fig. 7A, the '308 publication discloses step 712 that calls routine “monitor,” which is illustrated in Fig. 7B. '308Pub., [0034]–[0035]. The monitor routine is described in paragraph [0035]. In the monitor routine, the output signals are received from sensors in step 730 and the control

component adjusts the variable freq and resets the frequency timer as described in detail below. The '308 publication discloses with respect to Fig. 7A that changing the variable “freq” also adjusts the interval of the frequency timer, which in turn changes how often the output d to the H Bridge Switch is flipped (i.e., adjusts operational control output “d”). '308Pub., [0034] (“When the frequency timer has expired, as determined in step 706, the value of the output signal d is flipped, in step 708, and output to the H-bridge switch, with the frequency timer being reset to trigger a next frequency-related event. **The frequency-timer interval is determined by the current value of the variable freq.**”).

162. Thus, the monitor routine results in the control component adjusting the “operational control output” d to the H bridge switch based on the sensor output signals corresponding to strength of vibration.

b. Discussion of Fig. 7B

Fig. 7B is reproduced below.

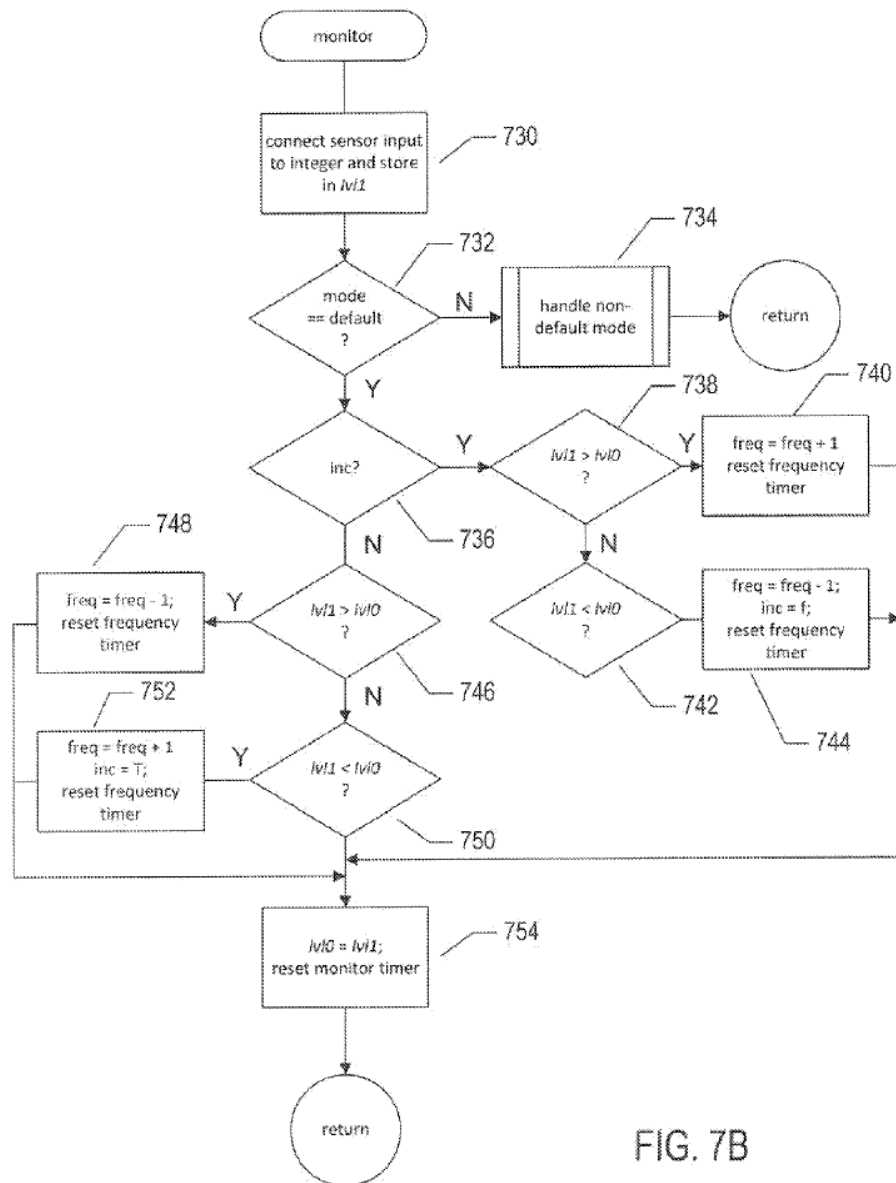


FIG. 7B

Id., Fig. 7B.

163. With respect to Fig. 7B, the '308 publication discloses that, in step 730, the sensor input is converted to an integer representing the current vibrational force and stored in variable lv1. *Id.*, [0035]. Subsequently, the routine determines whether the module is operating in “default mode” in step 732 and, if yes, the routine uses

continuous feedback control in order operate the module “as close as possible to the resonant frequency.” *Id.*

164. In the “default mode,” in order to optimize vibrational force, the routine determines whether a boolean variable (“inc”) is set to TRUE or FALSE in step 736. *Id.* If inc is set to TRUE, this means that the frequency is currently being increased in order to obtain a resonant frequency. *Id.*, [0035].

165. If variable inc is set to TRUE (the routine is currently increasing the frequency) and the routine determines in step 738 that the currently-sensed vibrational strength (lv11) is greater than the previously-sensed vibrational strength (lv10), the routine determines that the vibrational force has been recently increased by increasing the frequency, increases the “freq” variable again in step 740, and resets the frequency timer (presumably to a shorter interval, such that the output d is flipped more often). *Id.* The routine then proceeds to step 754 where the value in lv11 is stored in lv10 and exits the monitor routine. *Id.*

166. Otherwise, if it is determined in step 742 that the currently-sensed vibrational strength (lv11) is less than the previously sensed vibrational strength (lv10), then the routine determines that it has increased frequency past the resonance frequency. As a result, in step 744, the routine decreases the variable “freq,” sets the variable inc to FALSE, and resets the frequency timer (e.g., to a longer interval, such that the output d is flipped less often and produces a lower frequency). *Id.* The

routine then proceeds to step 754 where the value in lvl1 is stored in lvl0 and exits the monitor routine. *Id.*

167. If the routine determines in step 736 that inc is set to FALSE (frequency is currently being decreased) and determines in step 746 that the currently-sensed vibrational strength (lvl1) is greater than the previously-sensed vibrational strength (lvl0), the routine in step 748 decreases the value stored in variable “freq” (as this means that decreasing the frequency previously resulted in increasing the vibrational strength). The routine also resets the frequency timer (e.g., to a longer interval, such that the output d is flipped less often and produces a lower frequency). *Id.* The routine then proceeds to step 754 where the value in lvl1 is stored in lvl0 and exits the monitor routine. *Id.*

168. Otherwise, if it is determined in step 750 that the currently-sensed vibrational strength (lvl1) is less than the previously sensed vibrational strength (lvl0), then in step 752 the routine increases the value stored in the variable “freq,” sets the variable inc to TRUE, and resets the frequency timer (presumably to a shorter interval, such that the output d is flipped more often and produces an increased frequency). *Id.* (“Otherwise, when lvl1 is less than lvl0, as determined in step 750, then the routine “monitor” increases the value stored in the variable freq, sets the variable inc to TRUE, and resets the frequency timer in step 752.”). The

routine then proceeds to step 754 where the value in lv11 is stored in lv10 and exits the monitor routine. *Id.*

4. **Claim 4: “The vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.”**

169. “The one or more operational control outputs of the control component,” “the sensors,” and “the one or more sensors” in claim 4 do not have proper antecedent basis, and I address multiple possible interpretations: (1) the first two terms should be “~~the~~ one or more operational control outputs of the control component” and “~~the~~ sensors,” and (2) this claim should depend from claim 3 rather than claim 1.

170. Further, under either non-MPF or MPF, it is my opinion that the ’308 publication discloses claim 4.

171. As described with respect to claim 3, the ’308 publication discloses that the control component receives output signals from the sensors and adjusts the “operational control output” d to the H bridge switch based on the sensor output signals corresponding to strength of vibration. The control component seeks to produce desired outputs from the sensors corresponding to a strength of vibration

(i.e., the operational control parameter) at a frequency that is as close as possible to the resonant frequency. *See* my analysis of claim 3 at ¶¶159–168.

172. Further, under non-MPF, the '308 publication discloses the following claim that discloses claim 4: “4. The linear vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the linear vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.” '308Pub., Claim 4.

5. Claim 5

- a. 5[a]: “The vibration module of claim 4 wherein the one or more operational control parameters is a strength of vibration produced by the oscillation of the moveable component; and”**

173. In my opinion, the '308 publication discloses 5[a] and 5[b] under non-MPF or MPF. *See* analysis of Claim 3, 4. Further, under non-MPF, the '308 publication discloses the following claim limitation that discloses 5[a] and 5[b]: “5. The linear vibration module of claim 4 wherein the one or more operational control parameters is a strength of vibration produced by the linear oscillation of the moveable component, wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to linearly oscillate, the control component dynamically adjusting the power supplied

to the driving component to produce linear oscillation of the movable component at a resonant frequency for the linear vibration module.” ’308Pub., Claim 5.

- b. 5[b]: “wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to oscillate, the control component dynamically adjusting the power supplied to the driving component to produce oscillation of the movable component at a resonant frequency for the vibration module.”**

174. In my opinion, the ’308 publication discloses 5[b] under non-MPF or MPF. *See* analysis of Claim 3, 4. Further, under non-MPF, the ’308 publication discloses the following claim limitation that discloses 5[b]: “5. The linear vibration module of claim 4 ... wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to linearly oscillate, the control component dynamically adjusting the power supplied to the driving component to produce linear oscillation of the movable component at a resonant frequency for the linear vibration module.” ’308Pub., Claim 5.

6. Claim 6

- a. 6[a]: “The vibration module of claim 4 wherein the one or more operational control parameters include both a strength of vibration produced by the oscillation of the moveable component and a current operational mode; and”**

175. In my opinion, the ’308 publication discloses 6[a] and 6[b] under non-MPF or MPF. The only feedback control disclosed in the ’830 patent is the same feedback control disclosed in the ’308 publication described above with respect to

claims 3 and 4. Thus, to the extent claim 6 is not invalid under § 112, the '308 publication discloses 6[a]. *See* my analysis of Claims 3 and 4.

176. Further, under non-MPF, the '308 publication discloses the following claim limitation that discloses 6[a] and 6[b]: “6. The linear vibration module of claim 4 wherein the one or more operational control parameters include both a strength of vibration produced by the linear oscillation of the moveable component and a current operational mode, wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to linearly oscillate.” '308Pub., Claim 6.

b. 6[b]: “wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to oscillate.”

177. In my opinion, the '308 publication discloses 6[b] under non-MPF or MPF. The only feedback control disclosed in the '830 patent is the same feedback control disclosed in the '308 publication described above with respect to claims 3 and 4. Thus, to the extent claim 6 is not invalid under § 112, the '308 publication discloses 6[b]. *See* Claim 3, 4.

178. Further, under non-MPF, the '308 publication discloses the following claim limitation that discloses 6[b]: “6. The linear vibration module of claim 4 ...

wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to linearly oscillate.” ’308Pub., Claim 6.

7. Claim 7: “The vibration module of claim 1 wherein the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component.”

179. In my opinion, the ’308 publication discloses claim 7. The ’308 publication discloses that a magnetic field is generated that includes a component that is parallel to the direction of movement of the moveable component—and consequently that component of the magnetic field generates a magnetic force parallel to the direction of movement of the moveable component. ’308Pub., [0029], Figs. 4D, 4G.

180. Further, the ’308 publication discloses the following claim that discloses claim 7: “7. The linear vibration module of claim 1 wherein the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component.” ’308 publication, Claim 7.

8. Claim 8

a. 8[a]: “The vibration module of claim 1 wherein the housing is a tube, capped at both ends by movable-

**component-repelling components selected from one of
mechanical springs and magnets;”**

181. As explained below, it is my opinion the '308 publication discloses 8[a].

(i) “wherein the housing is a tube”

182. In my opinion, the '308 publication discloses the aspect of 8[a] requiring that the housing is a tube. '308Pub., [0028] (“The LRVM 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.**”), [0032], [0039] (“**Note that the weight and chamber may be cylindrical**, in cross section, as discussed above with reference to FIG. 4A, or may have other shapes, including rectangular or hexagonal cross-sections.”).

183. Further, the '308 publication discloses the following claim limitation that discloses this aspect of 8[a]: “8. The linear vibration module of claim 1 wherein the housing is a linear tube.” '308 publication, Claim 8.

**(ii) “capped at both ends by movable-component-
repelling components selected from one of
mechanical springs and magnets”**

184. In my opinion, the '308 publication discloses the aspect of 8[a] requiring that the housing is capped at both ends by mov[e]able-component-repelling components selected from one of mechanical springs and

magnets. '308Pub., [0028] (explaining that “[t]he cylindrical chamber 406 is **capped by two magnetic disks 414 and 416**” and that the “weight is repelled” by the disks, such that they “act much like springs”), Figs. 4A-4G; id., [0061] (explaining that alterations to the LRVM can include “altering the strength of the **end-cap magnets or mechanical springs** used to facilitate reversal of direction of the moving mass ...”), [0039] (explaining with respect to the embodiment in Fig. 10 that “in place of the end magnets 1002 and 1004, **mechanical springs may alternatively be used**”), Figs 4A-G, 10, *see also* Fig. 11 (disclosing embodiment with moving mass 1102 and end cap magnets depicted at opposite ends of the housing).

185. Further, the '308 publication discloses the following claim limitation that discloses this aspect of 8[a]: “8. The linear vibration module of claim 1 wherein the housing is a linear tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets.” '308 Pub., Claim 8.

b. 8[b]: “wherein the mov[e]able component is a magnet shaped to slide within the tube; and”

186. In my opinion, the '308 publication discloses 8[b]. *See* 1[b]. Further, the '308 publication discloses the following claim limitation that discloses 8[b]: “8. The linear vibration module of claim 1 ... wherein the movable component is a magnet shaped to slide within the linear tube.” '308Pub., Claim 8.

c. 8[c]: “wherein the driving component is an electromagnetic coil.”

187. In my opinion, the '308 publication discloses 8[c]. *See* 1[e]. Further, the '308 publication discloses the following claim limitation that discloses 8[c]: “8. The linear vibration module of claim 1 ... wherein the driving component is an electromagnetic coil.” '308 Pub., Claim 8.

9. Claim 9

a. 9[a]: “The vibration module of claim 1 wherein the housing is a tube, capped at both ends by movable-component-repelling components; and”

188. In my opinion, the '308 publication discloses 9[a]. *See* 8[a]. Further, the '308 publication discloses the following claim limitation that discloses 9[a]: “9. The linear vibration module of claim 1 wherein the housing is a linear tube, capped at both ends by movable-component-repelling components.” '308 Pub., Claim 9.

b. 9[b]: “wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.”

189. In my opinion, the '308 publication discloses 9[b]. The same disclosures discussed above with respect to claim 1 apply to this limitation, except that the moveable component is instead moving mass/weight 1102. Figure 11 depicts the control unit (i.e., microprocessor) and driving coil (i.e., electromagnetic-coil driving component) incorporated into the moving mass. To note, although the text does not describe the driving coil as being incorporated into the moving mass, this

is clearly shown in Figure 11. '308Pub., [0040] (“FIG. 11 shows a similar implementation in which the **control unit and power supply are incorporated into the moving mass 1102.**”).

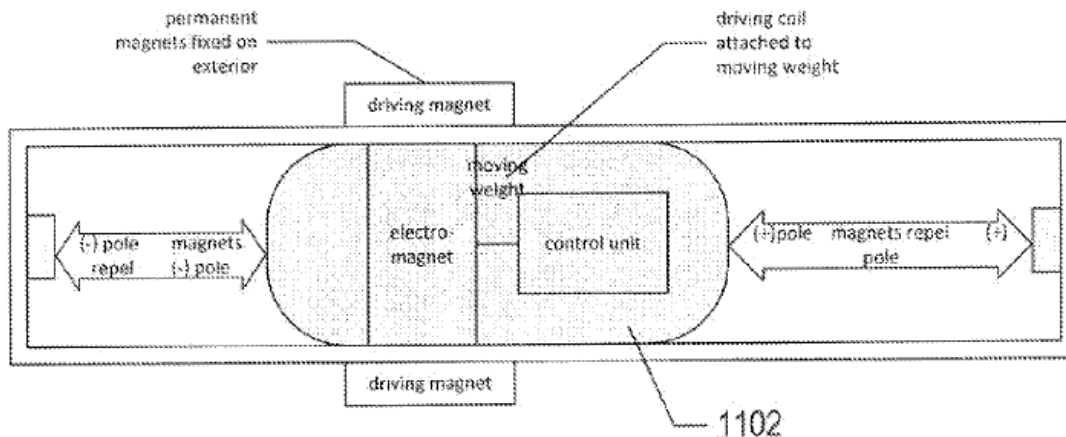


FIG. 11

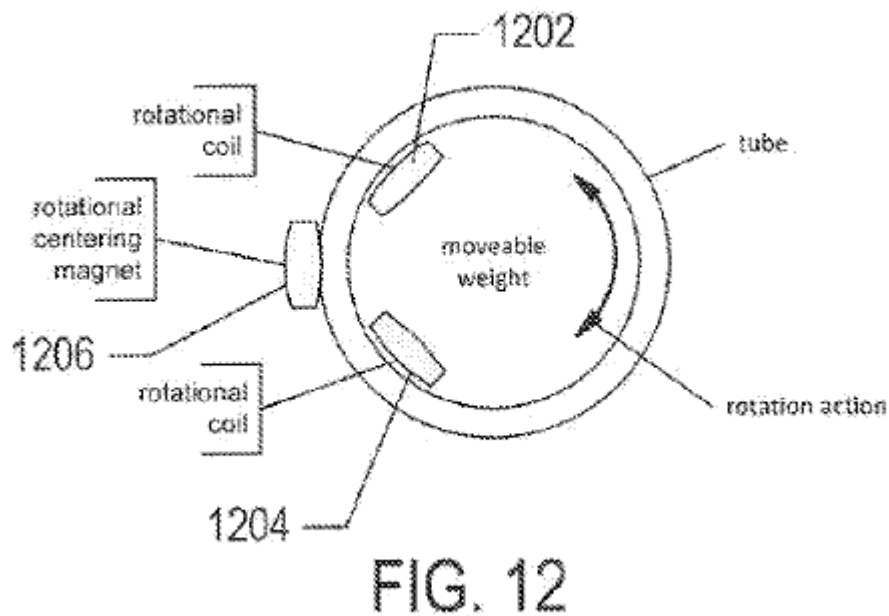
Id., Fig. 11.

190. Further, the '308 publication discloses the following claim limitation that discloses 9[b]: “The linear vibration module of claim 1 ... wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.” '308Pub., Claim 9.

10. Claim 10: “The vibration module of claim 1 further including rotational driving components that induce rotational motion of the movable component in addition to translational motion induced by the driving component.”

191. In my opinion, the '308 publication discloses claim 10. The same disclosures discussed above with respect to claim 1 apply to this claim, except that

the module further includes the rotational driving components 1202 and 1204 shown in Fig. 12 that induce rotational motion of the movable component in addition to translational motion induced by the driving component. '308Pub., [0041].



Id., Fig. 12.

192. Further, the '308 publication discloses the following claim that discloses claim 10: “10. The linear vibration module of claim 1 further including rotational driving components that induce rotational motion of the movable component in addition to translational motion induced by the driving component.” '308Pub., Claim 10.

11. Claim 11: “The vibration module of claim 1 wherein the vibration module further includes two or more driving components, each, when activated, driving the moveable

component to oscillate with an amplitude particular to the activated driving component.”

193. In my opinion, the '308 publication discloses claim 11. The same disclosures discussed above with respect to claim 1 apply to this claim, except that the module further includes the two driving components 1302 and 1304 shown in Fig. 13. '308Pub., [0042] (“FIG. 13 illustrates an embodiment in which **multiple electromagnetic coils are employed**. In FIG. 13, **two coils 1302 and 1304** are placed in two different positions on the housing. The **first coil 1302** may be used to drive linear oscillation of the moving mass 1306, while the **second coil may be activated in order to shorten the length of the chamber within which the moving mass linearly oscillates**, essentially serving as a second repelling magnet. In this implementation of the LRVM, the moving mass may linearly oscillate with at least **two different amplitudes**, depending on whether or not the second coil 1304 is activated to repel the moving mass. Additionally more complex patterns of current reversal in the two coils can be employed to produce complex multi-component vibrational modes of the moving mass.”).

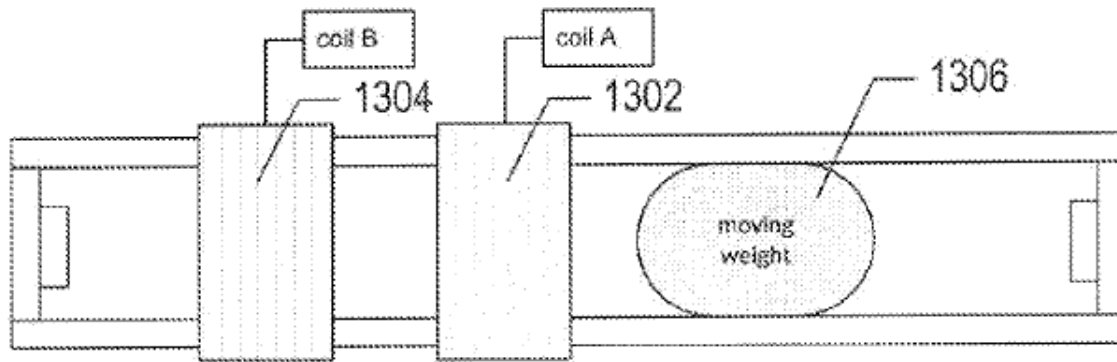


FIG. 13

Id., Fig. 13.

194. Further, the '308 publication discloses the following claim that discloses claim 11: "11. The linear vibration module of claim 1 wherein the linear vibration module further includes two or more driving components, each, when activated, driving the moveable component to linearly oscillate with an amplitude particular to the activated driving component." '308Pub., Claim 11.

12. Claim 12

- a. **12[a]: "The vibration module of claim 1 wherein housing includes a power supply, the microprocessor, and a moveable-component track orthogonal to a long axis of the housing;"**

195. In my opinion, the '308 publication discloses 12[a]. The same disclosures discussed above with respect to claim 1 apply to this claim, except that certain of the module's components are depicted in Fig. 14. '308Pub., [0044] ("FIG. 14 illustrates an alternative LRVM an implementation of the linear-resonant

vibration module to which current application is directed in which a plunger linearly oscillates to produce a vibration. The plunger 1402 is slideably contained within a **moveable-component track orthogonal to a long axis of the main housing 1404** of the LRVM that **includes the power supply, microcontroller**, and other control components.”).

Id., Fig. 14.

b. 12[b]: “wherein the moveable component is a plunger that moves a first direction and a second direction

opposite from the first direction within the moveable-component-track; and”

197. To the extent this limitation is not indefinite due to the fact that the plunger is a component outside of the housing (whereas claim 1 requires that the moveable component “oscillate within the housing”), it is my opinion that the ’308 publication discloses 12[b] in its disclosures regarding Fig. 14. ’308Pub., [0044] (“**The plunger** is girdled by, or includes, a driving magnet 1406 that is attracted to, and seeks to be positioned in alignment with, a centering magnet 1408 mounted within the housing. Applying current to one of two driving coils 1412 and 1414 forces the driving magnet away from the equilibrium position shown in FIG. 14. By rapidly switching the direction of current applied to the driving coils, the microcontroller can control the **plunger to linearly oscillate in an up-and-down fashion, as indicated by arrow 1420.**”).

198. Further, the ’308 publication discloses the following claim that discloses limitation 12[b]: “12. The linear vibration module of claim 1 ... wherein the moveable component is a plunger that moves a first direction and a second direction opposite from the first direction within the moveable-component-track.” ’308Pub., Claim 12.

c. 12[c]: “wherein the driving component comprising two electromagnetic driving coils and a centering magnet.”

199. In my opinion, the '308 publication discloses 12[c] in its disclosures regarding Figure 14 of driving coils 1412 and 1414 and centering magnet 1408. '308Pub., [0044] (“The plunger is girdled by, or includes, a driving magnet 1406 that is attracted to, and seeks to be positioned in alignment with, a **centering magnet 1408** mounted within the housing. Applying current to one of **two driving coils 1412 and 1414** forces the driving magnet away from the equilibrium position shown in FIG. 14.”).

200. Further, the '308 publication discloses the following claim that discloses limitation 12[c]: “12. The linear vibration module of claim 1 ... wherein the driving component comprising two electromagnetic driving coils and a centering magnet.” '308Pub., Claim 12.

13. Claim 13

a. 13[a]: “The vibration module of claim 1 wherein the moveable component is a clamped mechanical arm to which two magnets are attached; and”

201. In my opinion, the '308 publication discloses 13[a] in its disclosures regarding Figure 15 of spring-like member 1502 clamped at one end to the housing and driving magnets 1506 and 1508 attached to spring-like member 1502 '308Pub., [0045] (“FIG. 15 shows yet another LRVm an implementation of the linear-resonant vibration module to which current application is directed. In this an implementation

of the linear-resonant vibration module to which current application is directed, a **spring-like member 1502 is clamped at one end 1504 to the housing**. Driving magnets 1506 and 1508 are fixed to the spring-like member 1502, and when current is rapidly reversed in a coil 1510, the spring-like member 1502 is induced to vibrate at a relatively high frequency.”), [0045] (describing Fig. 16, where “**spring member 1602 is extended to provide an external massage arm 1604 that extends out from the housing**”), [0047] (describing Fig. 17, which adds a “mechanical vibration adjustment feature” to the embodiments of either Figs. 15 or 16).

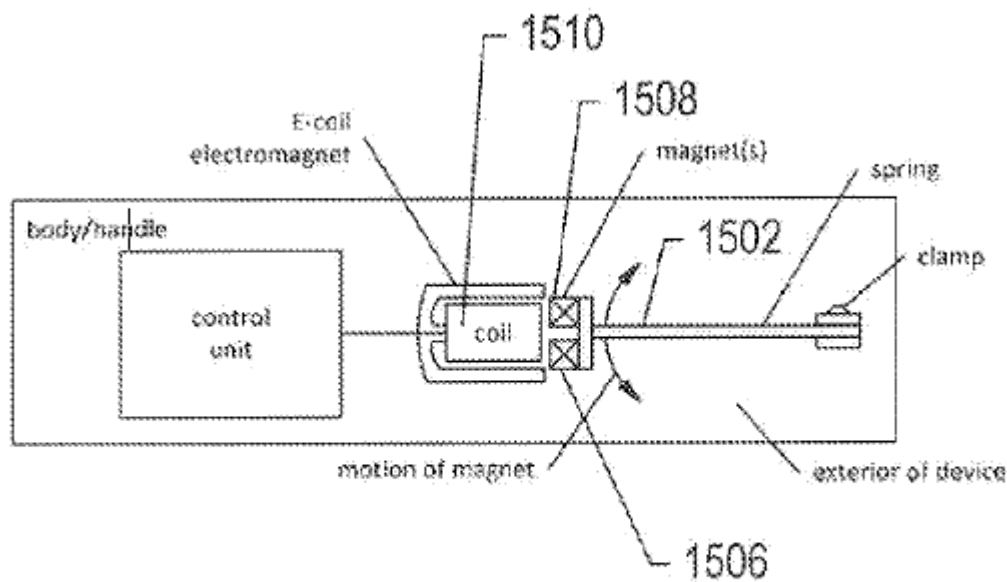


FIG. 15

Id., Fig. 15.

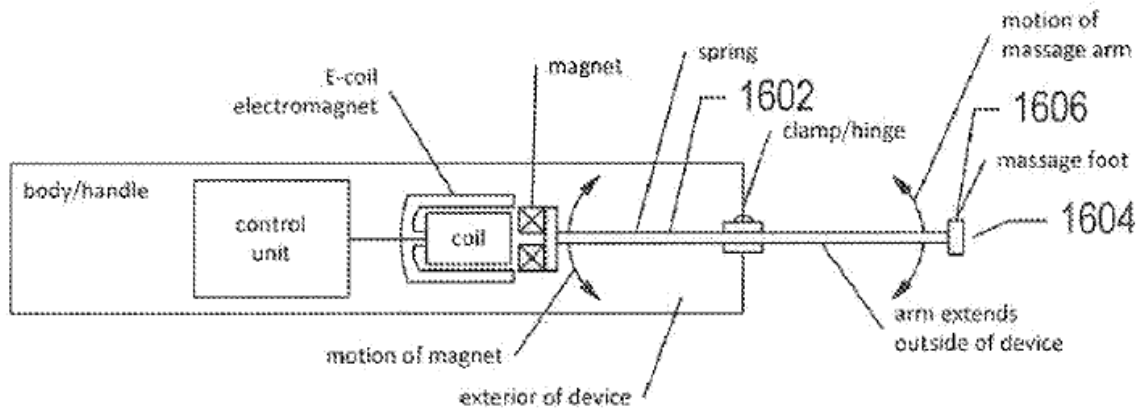


FIG. 16

Id., Fig. 16.

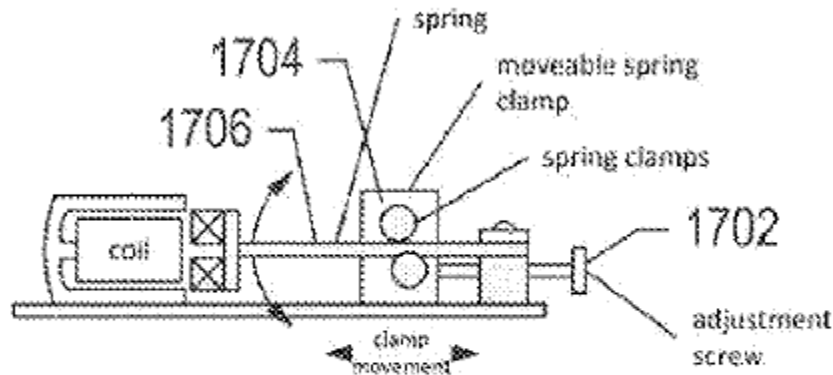


FIG. 17

Id., Fig. 17.

202. Further, the '308 publication discloses the following claim that discloses limitation 13[a]: "13. The linear vibration module of claim 1 wherein the moveable component is a clamped mechanical arm to which two magnets are attached." '308Pub., Claim 13.

- b. 13[b]: “wherein the driving component comprising an electromagnetic coil that, when opposite currents are applied at a particular frequency to the electromagnetic coil, causes the mechanical arm to vibrate.”**

203. In my opinion, the '308 publication discloses 13[b] in its disclosures regarding Figure 15 of coil 1510. '308Pub., [0045] (“Driving magnets 1506 and 1508 are fixed to the spring-like member 1502, and when current is rapidly reversed in a coil 1510, the spring-like member 1502 is induced to vibrate at a relatively high frequency.”).

204. Further, the '308 publication discloses the following claim that discloses limitation 13[b]: “13. The linear vibration module of claim 1 ... wherein the driving component comprising an electromagnetic coil that, when opposite currents are applied at a particular frequency to the electromagnetic coil, causes the mechanical arm to vibrate.” '308Pub., Claim 13.

- 14. Claim 14: “The vibration module of claim 1 further including flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the vibration module.”**

205. In my opinion, the '308 publication discloses claim 14. Specifically, the '308 publication discloses an embodiment in Figs. 24A–25 with paramagnetic flux paths added to the linear vibration module (i.e., elements 2410, 2411, 2414, and/or 2415). '308Pub., [0058]–[0060] (“FIGS. 24A–25 illustrate incorporation of paramagnetic flux paths into a linear vibration module. ... When introduced into a

magnetic field, paramagnetic materials provide a lower-resistance path for magnetic flux ... FIG. 24[B] shows a linear vibration module with added paramagnetic flux paths. These include flux paths around the stator coils 2410-2411 as well as flux-path disks 2414-2415 at the ends of the cylindrical magnet 2416 within the linear vibration module. ... FIG. 25 illustrates flux-path magnetic stops incorporated within a linear vibration module to which the current application is directed.”).

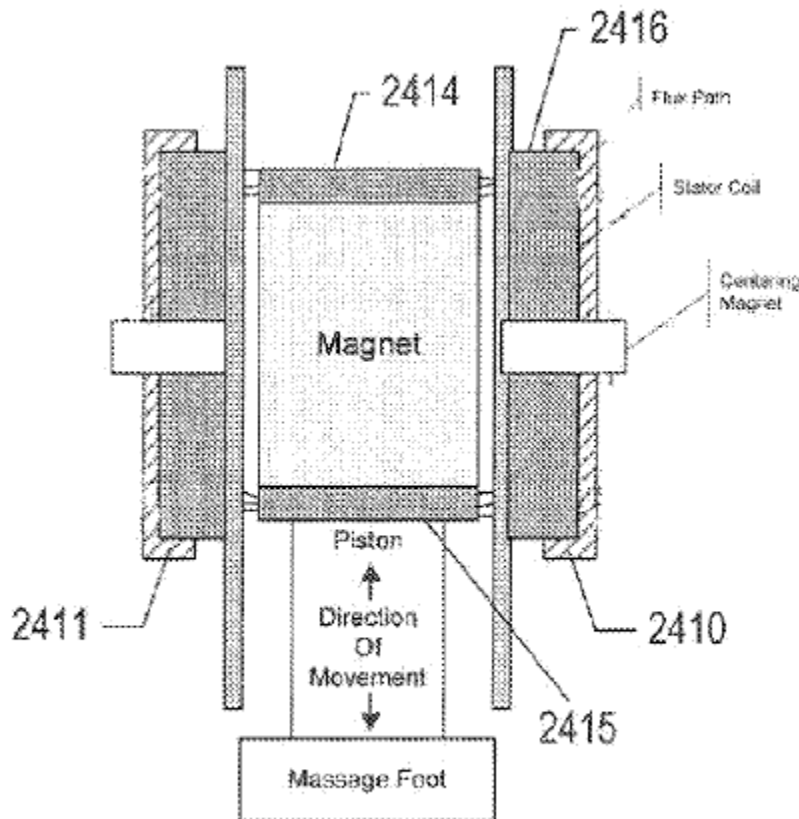


FIG. 24B

Id., Fig. 24B.

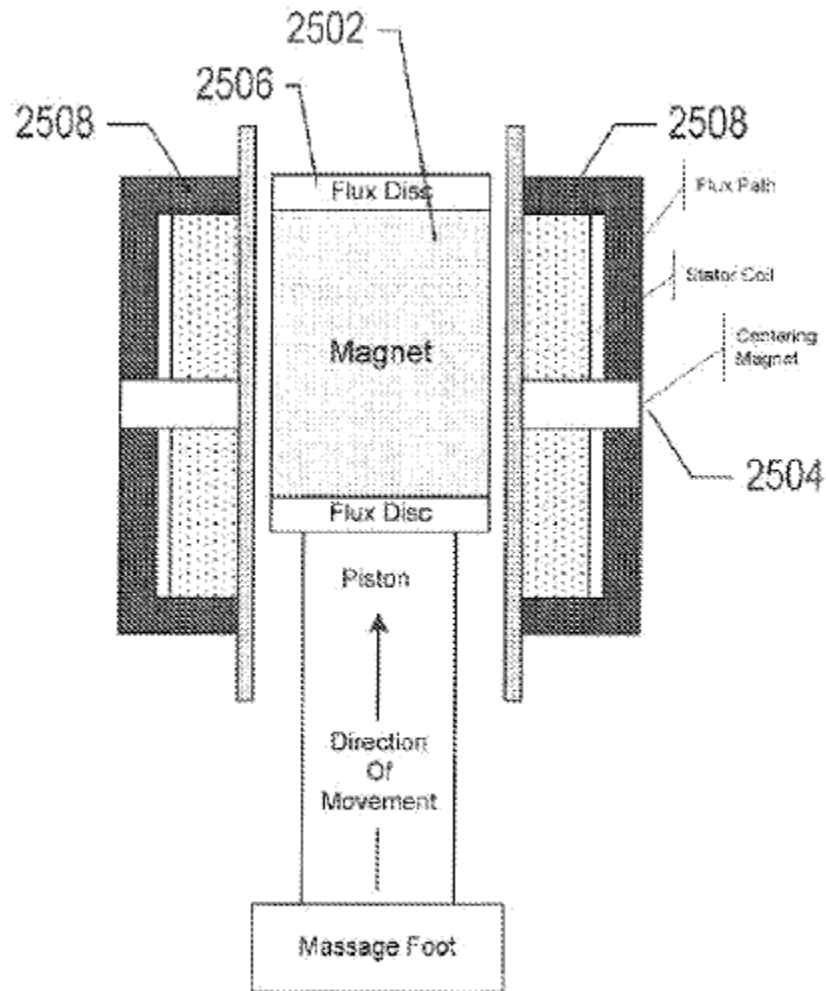


FIG. 25

Id., Fig. 25.

206. Further, the '308 publication discloses the following claim that discloses claim 14: "14. The linear vibration module of claim 1 further including flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the linear vibration module." '308Pub., Claim 14.

15. Claim 15: “The vibration module of claim 1 wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.”

207. In my opinion, the '308 publication discloses claim 15. '308Pub., [0035], [0042], [0056]. Specifically, the '308 publication discloses that Figures 22A–23 “illustrate interesting vibrational modes produced by driving a linear-resonant vibration module simultaneously at two different frequencies.” *Id.*, [0056] (“As one example, a microprocessor-controlled or microcontroller-controlled linear vibration module can be programmed to drive the device simultaneously at two different frequencies. FIGS. 22A–23 illustrate interesting vibrational modes produced by driving a linear-resonant vibration module **simultaneously at two different frequencies.**”).

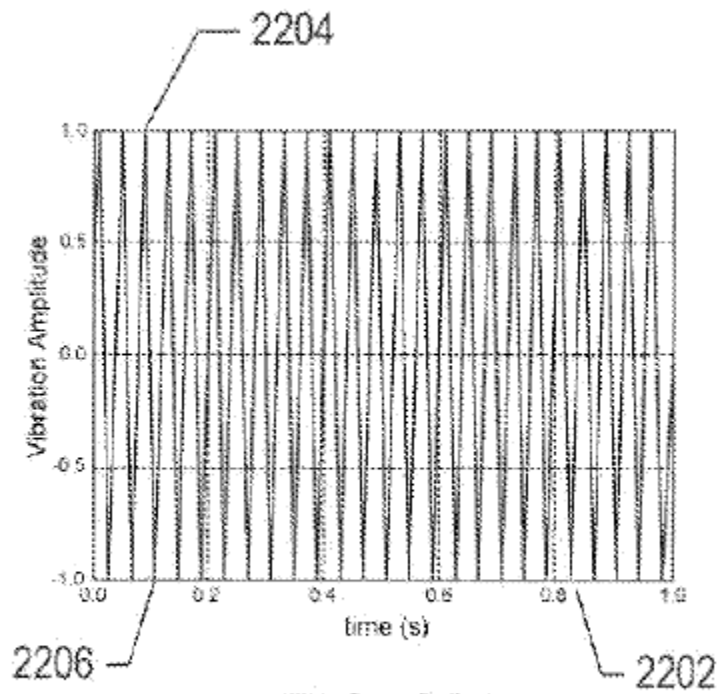


FIG. 22A

Id., Fig. 22A.

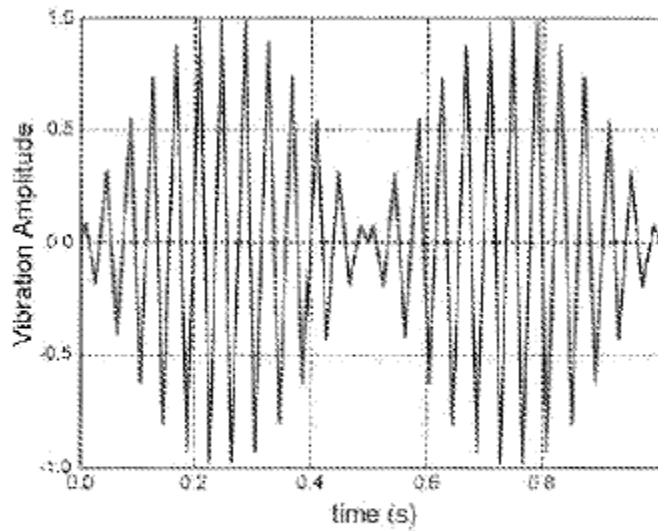


FIG. 22B

Id., Fig. 22B.

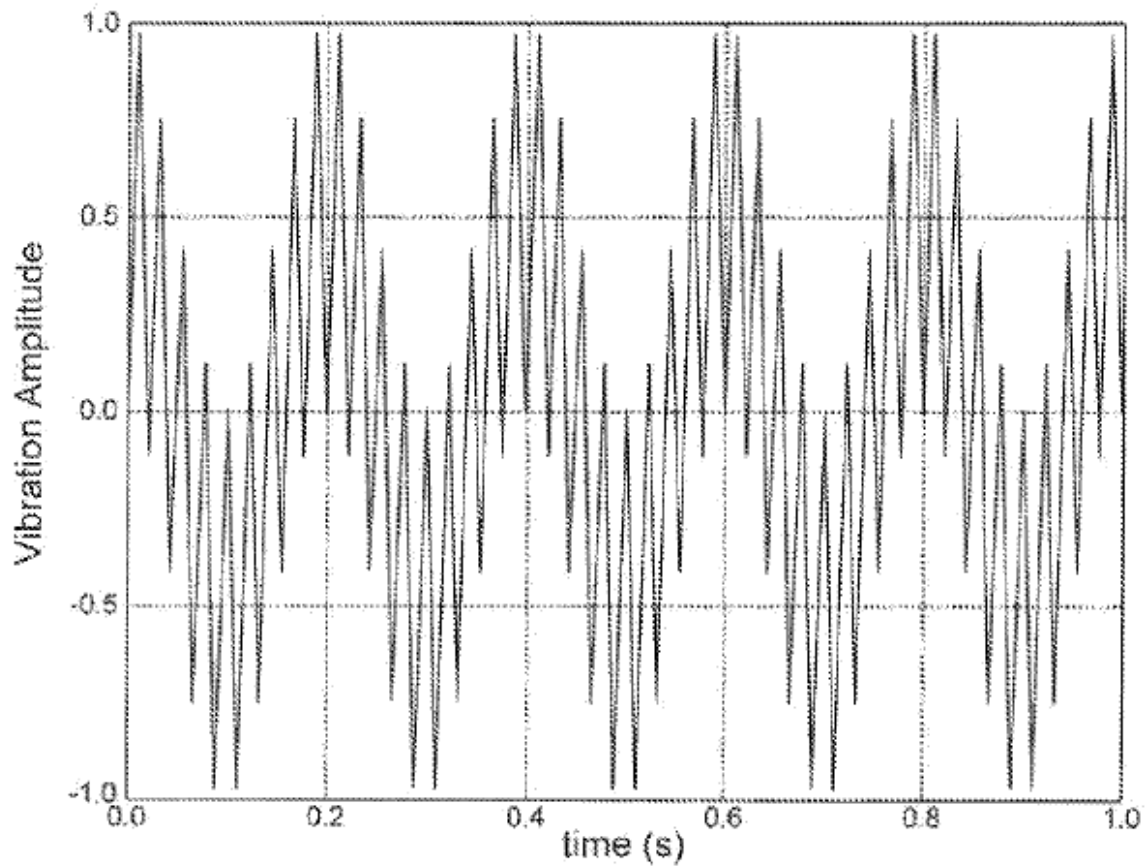


FIG. 23

Id., Fig. 23.

208. Further, the '308 publication discloses the following claim that discloses claim 15: "15. The linear vibration module of claim 1 wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes." '308Pub., Claim 15.

16. Claim 16

- a. 16[pre]: “The vibration module of claim 15 wherein the complex vibration modes include:”**

209. In my opinion, the '308 publication discloses 16[pre]. *See* Claim 15; '308Pub., Claim 16 (“16. The linear vibration module of claim 15 wherein the complex vibration modes include...”).

- b. 16[a]: “a primary oscillation frequency modulated by a modulating oscillation frequency;”**

210. In my opinion, the '308 publication discloses 16[a]. *See* Claim 15; '308Pub., [0056] (“FIG. 22B illustrates a vibration mode of the linear vibration module driven at a primary operational frequency of 25 Hz with an added modulating 1 Hz operational frequency. Driving the linear vibration module by both a primary and a modulating frequency produces low-frequency pulses of high-frequency vibration.”).

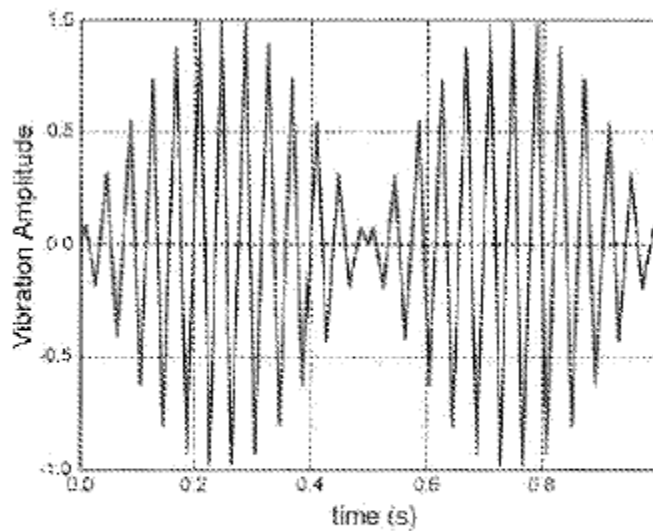


FIG. 22B

Id., Fig. 22B.

211. Further, the '308 publication discloses the following claim that discloses claim limitation 16[a]: “16. The linear vibration module of claim 15 wherein the complex vibration modes include: a primary oscillation frequency modulated by a modulating oscillation frequency.” '308Pub., Claim 16.

c. 16[b]: “a beat frequency; and”

212. In my opinion, the '308 publication discloses 16[b]. *See* Claim 15; '308Pub., [0056] (“FIG. 23 illustrates a different complex vibrational mode in which two driving frequencies combine to produce a lower-frequency **beat-wave form**. The vibrational mode illustrated in FIG. 23 is produced by a primary driving frequency of 25 Hz, as in FIG. 22A, with a second driving frequency of 20 Hz.”).

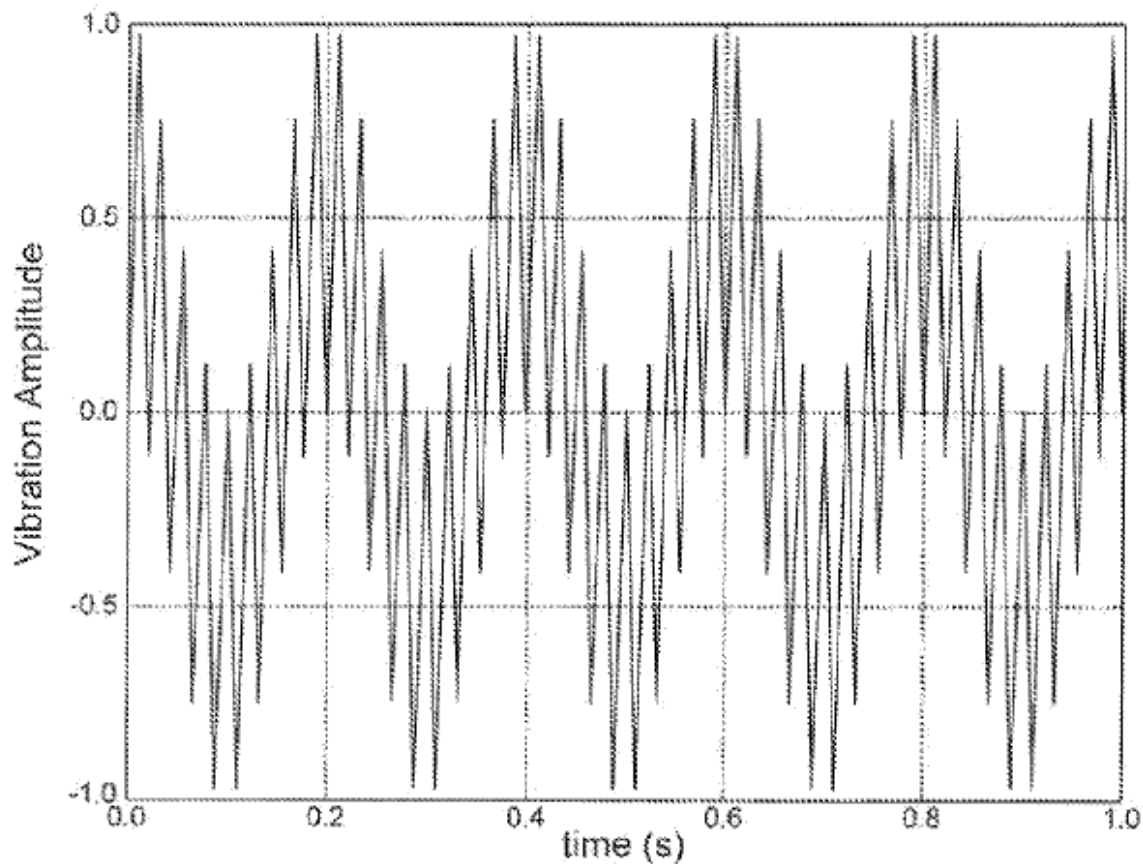


FIG. 23

Id., Fig. 23.

213. Further, the '308 publication discloses the following claim that discloses claim limitation 16[b]: “16. The linear vibration module of claim 15 wherein the complex vibration modes include: ... a beat frequency.” '308Pub., Claim 16.

d. 16[c]: “an aperiodic oscillation waveform.”

214. In my opinion, the '308 publication discloses 16[c]. *See* Claim 15; *see also* '308Pub., [0056] (“By varying the number, relative amplitudes, and frequencies

of two or more driving signals, a microprocessor-controlled or microcontroller-controlled linear-resonance vibration module can be controlled to produce any number of complex vibrational patterns and modes, including periodic modes, modes with multiple different periods, various modulated vibration modes, and even **fully a periodic vibration modes that do not repeat time.”).**

215. Further, the '308 publication discloses the following claim that discloses claim limitation 16[b]: “16. The linear vibration module of claim 15 wherein the complex vibration modes include: ... an aperiodic oscillation waveform.” '308Pub., Claim 16.

17. Claim 17: “The vibration module of claim 1 wherein the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features.”

216. In my opinion, the '308 publication discloses claim 17 under non-MPF or MPF. *See* 1[f] and 2[a]. As discussed with respect to 1[f], the '308 publication discloses a user selecting a strength of vibration and an operational mode, which result in the control component controlling supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features. Further, as described with respect to 1[f] and 2[a], under non-MPF, the '308 publication discloses a variable oscillator circuit and user input

feature that separately control frequency and amplitude of vibration, respectively. *See* '308Pub., [0027], [0036], [0053].

217. Further, the '308 publication discloses the following claim that discloses claim 17: "17. The linear vibration module of claim 1 wherein the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user input features." '308Pub., Claim 17.

18. Claim 18: "The vibration module of claim 1 further including elastomeric bristles used to transfer vibration from the vibration module to a surface."

218. In my opinion, the '308 publication discloses claim 18 in its disclosures with respect to Figure 18 of elastomeric bristles 1802-1805. *See* '308Pub., [0048] ("FIG. 18 illustrates an enhancement of an implementation of the linear-resonant vibration module to which current application is directed shown in FIG. 16. In this embodiment, the massage foot is enhanced to include **elastomer bristles 1802–1805** to transfer the linear oscillation of the massage foot to human skin or another substrate. The **elastomeric bristles**, or pad or brush comprising numerous elastomeric bristles, **allow transmission of vibration to a surface even at low operational powers**, when a rigid or even semi-compliant massage foot would instead simply stop moving for inability to overcome frictional forces.").

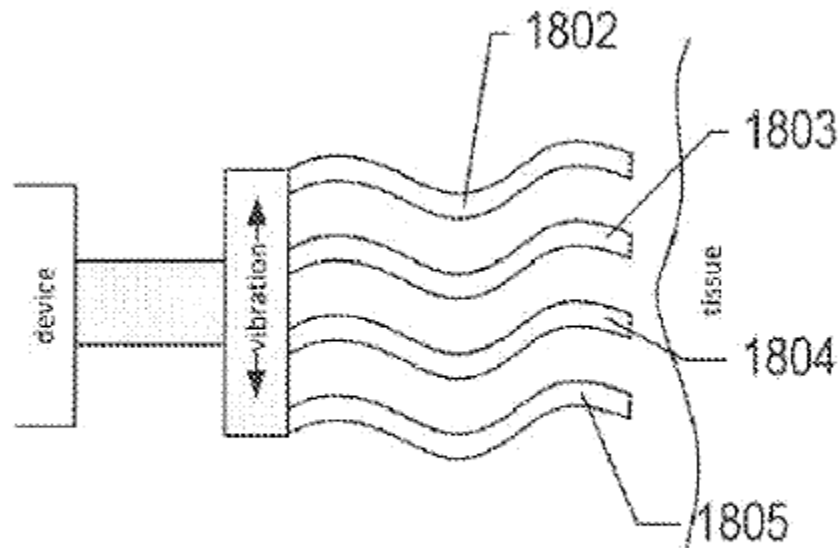


FIG. 18

Id., Fig. 18.

219. Further, the '308 publication discloses the following claim that discloses claim 18: "18. The linear vibration module of claim 1 further including elastomeric bristles used to transfer vibration from the linear vibration module to a surface." '308Pub., Claim 18.

19. Claim 19

a. 19[pre]: "A vibration module comprising:"

220. In my opinion, 19[pre] is a limitation. *See* Section IX.A. The '308 publication discloses 19[pre]. *See* 1[pre]; '308Pub., Claim 1.

b. 19[a]: “a housing;”

221. In my opinion, the '308 publication discloses 19[a]. *See* 1[a]; '308Pub., Claim 1.

c. 19[b]: “a moveable component;”

222. In my opinion, the '308 publication discloses 19[b] under non-MPF or MPF. *See* 1[b]; '308Pub., Claim 1.

d. 19[c]: “a power supply;”

223. In my opinion, the '308 publication discloses 19[c]. *See* 1[c]; '308Pub., Claim 1.

e. 19[d]: “user-input features;”

224. In my opinion, the '308 publication discloses 19[d]. *See* 1[d]; '308Pub., Claim 1.

f. 19[e]: “a driving component that drives the moveable component to oscillate within the housing;”

225. In my opinion, the '308 publication discloses 19[e] under non-MPF or MPF. *See* 1[e]; '308Pub., Claim 1.

g. 19[f]: “a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values; and”

226. In my opinion, the '308 publication discloses 19[f] under non-MPF or MPF. *See* 1[f]; '308Pub., Claim 1.

- h. 19[g]: “flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the vibration module”**

227. In my opinion, the '308 publication discloses 19[g]. *See* Claim 14; '308Pub., Claim 14.

20. Claim 20

- a. 20[pre]: “A vibration module comprising:”**

228. In my opinion, 20[pre] is a limitation. *See* Section IX.A. The '308 publication discloses 20[pre]. *See* 1[pre]; '308Pub., Claim 1.

- b. 20[a]: “a housing;”**

229. In my opinion, the '308 publication discloses 20[a]. *See* 1[a]; '308Pub., Claim 1.

- c. 20[b]: “a moveable component;”**

230. In my opinion, the '308 publication discloses 20[b] under non-MPF or MPF. *See* 1[b]; '308Pub., Claim 1.

- d. 20[c]: “a power supply;”**

231. In my opinion, the '308 publication discloses 20[c]. *See* 1[c]; '308Pub., Claim 1.

- e. 20[d]: “user-input features;”**

232. In my opinion, the '308 publication discloses 20[d]. *See* 1[d]; '308Pub., Claim 1.

- f. 20[e]: “a driving component that drives the moveable component to oscillate within the housing; and”**

233. In my opinion, the '308 publication discloses 20[e] under non-MPF or MPF. *See* 1[e]; '308Pub., Claim 1.

- g. 20[f]: “a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values,”**

234. In my opinion, the '308 publication discloses 20[f] under non-MPF or MPF. *See* 1[f]; '308Pub., Claim 1.

- h. 20[g]: “wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.”**

235. In my opinion, the '308 publication discloses 20[g] under non-MPF or MPF. *See* Claim 15; '308Pub., Claim 15.

XII. Secondary Considerations

236. At this stage of these proceedings, it is my understanding that Petitioner has no burden to identify and rebut secondary considerations. Rather, it is my understanding that Patent Owner must first present a *prima facie* case for such consideration, which Petitioners should then have the chance to rebut. That said, I have considered evidence of secondary considerations that I am aware of at this time, and I am currently unaware of any evidence of secondary considerations that would support a finding of non-obviousness.

I, Andrew Wolfe, declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: June 14, 2023

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'A. Wolfe', is written above a horizontal line.

Andrew Wolfe, Ph.D.

EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent 9,941,830 B2 (“’830Pat.”)
1002	File History of U.S. Patent 9,941,830 (“’830FH”)
1003	Declaration of Andrew Wolfe, Ph.D.
1004	Curriculum Vitae of Andrew Wolfe, Ph.D.
1005	Reserved
1006	Reserved
1007	Reserved
1008	Reserved
1009	Reserved
1010	Reserved
1011	Reserved
1012	Reserved
1013	Reserved
1014	Reserved
1015	Reserved
1016	Reserved
1017	Complaint in <i>Resonant Systems, Inc. v. Samsung Elecs. Co., Ltd.</i> , 2:22-cv-00423 (E.D. Tex. October 26, 2022)
1018	Docket Control Order in <i>Resonant Systems, Inc. v. Samsung Elecs. Co., Ltd.</i> , 2:22-cv-00423 (E.D. Tex.)
1019	Discovery Order in <i>Resonant Systems, Inc. v. Samsung Elecs. Co., Ltd.</i> , 2:22-cv-00423 (E.D. Tex.)
1020	Reserved
1021	Reserved
1022	Reserved
1023	U.S. Patent 9,369,081 B2 (“’081Pat.”)
1024	File History of U.S. Patent 9,369,081 (“’081FH”) (Application No. 14/469,210) (“’210 application” or “’081FH”)

1025	U.S. Patent 8,860,337B2 (“337Pat.”)
1026	File History of U.S. Patent 8,860,337B2 (Application No. 13/345,607) (“607 application” or “337FH”)
1027	U.S. Patent 8,093,767B2 (“767Pat.”)
1028	File History of U.S. Patent 8,093,767B2 (Application No. 12/782,697) (“697 application” or “767FH”)
1029	File History of Provisional Patent Application 61/179,109 (“109 application”)
1030	U.S. Patent Application Publication 2011/0144426A1 (“Blenk”)
1031	U.S. Patent Application Publication 2011/0248817A1 (“Houston”)
1032	U.S. Patent Application Publication 2007/0261185A1 (“Guney”)
1033	U.S. Patent Application Publication No. US2012/0133308 (“308Pub.”)

CLAIM LISTING

Reference	Claim Limitation
Claim 1	
1[pre]	A vibration module comprising:
1[a]	a housing;
1[b]	a moveable component;
1[c]	a power supply;
1[d]	user-input features;
1[e]	a driving component that drives the moveable component to oscillate within the housing; and
1[f]	a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values.
Claim 2	
2[pre]	The vibration module of claim 1 wherein the control component is one of:
2[a]	an variable oscillator circuit with additional control circuitry; and
2[b.i]	a control component that includes a microprocessor,
2[b.ii]	a control program, stored in an electronic memory within, or separate from, the microprocessor, the control program executed by the microprocessor to control supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by the one or more stored values.
Claim 3	
3	The vibration module of claim 1 wherein the control component receives output signals from sensors within the vibration module during operation of the vibration module and adjusts one or more operational control outputs of the control component according to the received output signals from the sensors.
Claim 4	

4	The vibration module of claim 1 wherein the control component adjusts the one or more operational control outputs of the control component according to the received output signals from the sensors in order that subsequent operation of the vibration module produces desired outputs from the one or more sensors corresponding to one or more operational control parameters.
Claim 5	
5[a]	The vibration module of claim 4 wherein the one or more operational control parameters is a strength of vibration produced by the oscillation of the moveable component; and
5[b]	wherein the one or more operational control outputs is a frequency at which the control component drives the moveable component to oscillate, the control component dynamically adjusting the power supplied to the driving component to produce oscillation of the movable component at a resonant frequency for the vibration module.
Claim 6	
6[a]	The vibration module of claim 4 wherein the one or more operational control parameters include both a strength of vibration produced by the oscillation of the moveable component and a current operational mode; and
6[b]	wherein the one or more operational control outputs is a control output that determines a current supplied by the power supply to the driving component and a frequency at which the control component drives the moveable component to oscillate.
Claim 7	
7	The vibration module of claim 1 wherein the driving component comprises one or more electromagnetic coils that generate magnetic fields parallel to the directions in which the moveable component is driven by the driving component.
Claim 8	
8[a]	The vibration module of claim 1 wherein the housing is a tube, capped at both ends by movable-component-repelling components selected from one of mechanical springs and magnets;
8[b]	wherein the movable component is a magnet shaped to slide within the tube; and

8[c]	wherein the driving component is an electromagnetic coil.
Claim 9	
9[a]	The vibration module of claim 1 wherein the housing is a tube, capped at both ends by movable-component-repelling components; and
9[b]	wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.
Claim 10	
10	The vibration module of claim 1 further including rotational driving components that induce rotational motion of the movable component in addition to translational motion induced by the driving component.
Claim 11	
11	The vibration module of claim 1 wherein the vibration module further includes two or more driving components, each, when activated, driving the moveable component to oscillate with an amplitude particular to the activated driving component.
Claim 12	
12[a]	The vibration module of claim 1 wherein housing includes a power supply, the microprocessor, and a moveable-component track orthogonal to a long axis of the housing;
12[b]	wherein the moveable component is a plunger that moves a first direction and a second direction opposite from the first direction within the moveable-component-track; and
12[c]	wherein the driving component comprising two electromagnetic driving coils and a centering magnet.
Claim 13	
13[a]	The vibration module of claim 1 wherein the moveable component is a clamped mechanical arm to which two magnets are attached; and
13[b]	wherein the driving component comprising an electromagnetic coil that, when opposite currents are applied at a particular frequency to the electromagnetic coil, causes the mechanical arm to vibrate.
Claim 14	
14	The vibration module of claim 1 further including flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the vibration module.
Claim 15	

15	The vibration module of claim 1 wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.
Claim 16	
16[pre]	The vibration module of claim 15 wherein the complex vibration modes include:
16[a]	a primary oscillation frequency modulated by a modulating oscillation frequency;
16[b]	a beat frequency; and
16[c]	an aperiodic oscillation waveform.
Claim 17	
17	The vibration module of claim 1 wherein the control component controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude that are independently specified by user input received from the user-input features.
Claim 18	
18	The vibration module of claim 1 further including elastomeric bristles used to transfer vibration from the vibration module to a surface.
Claim 19	
19[pre]	A vibration module comprising:
19[a]	a housing;
19[b]	a moveable component;
19[c]	a power supply;
19[d]	user-input features;
19[e]	a driving component that drives the moveable component to oscillate within the housing;
19[f]	a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values; and
19[g]	flux paths comprising a paramagnetic material that is shaped and positioned to reduce the reluctance of one or more magnetic circuits within the vibration module.
Claim 20	
20[pre]	A vibration module comprising:
20[a]	a housing;
20[b]	a moveable component;

20[c]	a power supply;
20[d]	user-input features;
20[e]	a driving component that drives the moveable component to oscillate within the housing; and
20[f]	a control component that controls supply of power from the power supply to the driving component to cause the moveable component to oscillate at a frequency and an amplitude specified by one or more stored values,
20[g]	wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.