

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

RESONANT SYSTEMS, INC.,
Patent Owner.

Case No. IPR2024-00806
U.S. Patent No. 9,941,830

PATENT OWNER'S RESPONSE

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PATENT OWNER'S EXHIBIT LIST

<i>Exhibit No</i>	<i>Description</i>
2001	Defendant Apple Inc.'s Proposed Claim Constructions, (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.))
2002	Court's Claim Construction Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 91)
2003	Defendant Apple Inc.'s Opening Claim Construction Brief (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 75)
2004	Order Modifying Scheduling Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 57)
2005	Federal Court Management Statistics, Western District of Texas, 2018-2023
2006	Excerpt of Plaintiff's Infringement Contentions (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.))
2007	Excerpt of Defendant's Final Invalidity Contentions (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.))
2008	[Reserved]
2009	Declaration of Keith W. Goossen, Ph.D.
2010	Curriculum Vitae of Keith W. Goossen, Ph.D.
2011	Transcript of Deposition of Blake Hannaford, Ph.D., Jan. 27, 2025
2012	Transcript of Deposition of Blake Hannaford, Ph.D., Jan. 28, 2025
2013	Transcript of Deposition of Blake Hannaford, Ph.D., Jan. 29, 2025
2014	Excerpt of CRC Handbook of Chemistry and Physics (52 nd Ed. 1964)
2015	"Why do ferromagnetic materials channel magnetic field lines?," Physics Stack Exchange, <i>available at</i> https://physics.stackexchange.com/questions/129782/why-do-ferromagnetic-materials-channel-magnetic-field-lines

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

<i>Exhibit No</i>	<i>Description</i>
2016	“Quality Factor (Q)” in Smith, J.O., <i>Introduction to Digital Filters with Audio Applications</i> , available at http://ccrma.stanford.edu/~jos/filters/Partial_Fraction_Expansion.htm
2017	Texas Instruments Precision Designs: Verified Design SLAU508, “Analog Pulse Width Modulation,” by John Caldwell

I. INTRODUCTION

The Board granted institution on several enumerated grounds of obviousness, each based in large part on Gregorio. The arguments presented herein and the additional evidence submitted, such as the testimony of Patent Owner's expert Dr. Keith Goossen (Ex. 2009), demonstrate that Petitioner has failed to establish obviousness of the challenged claims and that Petitioner's grounds should be rejected.

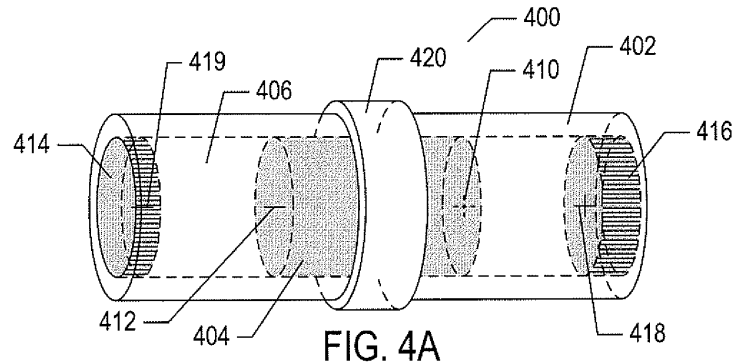
II. SUMMARY OF ARGUMENT

The Petition fails to establish that the art teaches or renders obvious both the power supply as claimed and the control component under the proper means-plus-function construction. The petition also fails to establish that the art teaches or renders obvious the paramagnetic material of claim 14.

III. BACKGROUND

A. Background to the '830 Patent

Many electronic devices such as mobile phones and game controllers make use of components that produce vibrational forces. The '830 patent teaches and claims improved vibration modules with features suitable for such applications:



(Ex. 1001 at 6.) Compared to prior art solutions, the inventions of the '830 patent offer greater durability, greater efficiency, an ability to generate useful vibrations over a range of frequencies, and more desirable patterns of vibration.

B. Related Litigation and PTAB Proceedings

The '830 patent and related patents are asserted in litigation against Apple and in parallel litigation against Samsung and Sony.

The '830 patent is related by continuation to U.S. Patent Nos. 8,093,767 and 8,860,337. The Petitioners have filed IPR2024-00697, IPR2024-00698, and IPR2024-00807 challenging these two patents. The IPR petition concerning the '337 patent (IPR2024-00807) raises invalidity grounds similar to those raised in the present Petition. Patent Owner's response to the petition in IPR2024-00807 makes arguments similar to arguments in the present response.

In an IPR filed by Samsung challenging the '830 patent, IPR2023-00993, the Board found claims 1, 2, 7, 8, 11, 15-17, and 20 to be unpatentable and claims 3-6, 9, 14, and 19 not to be unpatentable.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Patent Owner believes that a POSITA at the time of the invention would have had (1) a bachelor's degree in electrical engineering, mechanical engineering, or a comparable field of study, and (2) at least two years of professional experience with electro-mechanical control systems, or other similarly relevant industry experience. Additional relevant industry experience may compensate for lack of formal education or vice versa.

Petitioners offer a similar level of ordinary skill in the art. Patent Owner does not believe that any of the arguments herein would change if the Board were to adopt Petitioners' definition for the level of ordinary skill rather than Patent Owner's.

V. LEGAL STANDARDS

The petitioner has the burden to clearly set forth the basis for its challenges in the petition. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) as "requiring IPR petitions to identify 'with particularity ... the evidence that supports the grounds for the challenge to each claim'"). A petitioner may not rely on the Board to substitute

its own reasoning to remedy the deficiencies in a petition. *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348, 1355 (2018) (“Congress chose to structure a process in which it’s the petitioner, not the Director, who gets to define the contours of the proceeding.”); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016) (rejecting the Board’s reliance on obviousness arguments that “could have been included” in the petition but were not, and holding that the Board may not “raise, address, and decide unpatentability theories never presented by the petitioner and not supported by the record evidence”); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015) (holding that “a challenge can fail even if different evidence and arguments might have led to success”); *Wasica Finance GMBH v. Continental Auto. Systems*, 853 F.3d 1272, 1286 (Fed. Cir. 2017) (holding that new arguments in a reply brief are “foreclosed by statute, our precedent, and Board guidelines”).

The Board “may reject even uncontroverted expert testimony when it is intrinsically unpersuasive.” *Granite Constr. Co. v. United States*, 962 F.2d 998, 1006 (Fed. Cir. 1992). The petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *Magnum*, 829 F.3d at 1380.

An obviousness determination requires finding that a POSITA would have been motivated to modify or combine teachings in the prior art. *In re*

Stepan Co., 868 F.3d 1342, 1345–46 (Fed. Cir. 2017). Obviousness concerns “whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.” *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). The “mere fact that these possible arrangements existed in the prior art” does not provide a motivation to substitute the arrangement in one prior art embodiment with the arrangement in another.” *Virtek Vision International ULC v. Assembly Guidance Systems, Inc.*, 97 F.4th 882, 887 (Fed. Cir. 2024). Because a motivation to modify or combine is part of the *prima facie* case for obviousness that must be set forth in the petition, a petitioner should not be permitted to present “an entirely new rationale to explain why one of skill in the art would have been motivated to combine” in its reply. *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1370 (Fed. Cir. 2016).

“An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.” 35 U.S.C. § 112 ¶ 6. Even were a claim does not utilize the word “means,” § 112 ¶ 6 will apply if “the claim term fails to recite

sufficiently definite structure or else recites function without reciting sufficient structure for performing that function.” *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015).

For a reference to be considered in the obviousness analysis, it must be analogous *to the invention of the challenged claims*. *Corephotonics, Ltd. v. Apple Inc.*, 84 F.4th 990, 1003–04 (Fed. Cir. 2023) (“Prior art references are applicable to the obviousness inquiry only when they are analogous to the claims being challenged.”) There are two tests for defining the scope of analogous art: “(1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.” *Id.* (quoting *Airbus S.A.S. v. Firepass Corp.*, 941 F.3d 1374, 1379 (Fed. Cir. 2019)).

VI. CLAIM CONSTRUCTION

Petitioners contend that several phrases involving the terms “driving component” and “control component” are means-plus-function limitations subject to 35 U.S.C. section 112, paragraph 6, under *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2014). (Paper 3 at 2–7.) Patent Owner agrees that the “driving component...” and “control component...” terms are subject to § 112 ¶ 6.

Patent Owner does not believe that the phrase involving a “driving component” needs to be construed in order to resolve any issue in this proceeding. However, as discussed further below, a proper construction of the “control component” terms should lead the Board to find the challenged claims not unpatentable.

A. “control component...”

For the “control component...” term of independent claims 1 and 19, Petitioners identify the corresponding structure as “one of the switches shown in Figures 5A-6 and described at 5:52-6:5, 6:9-16, and the processor (also referred to as microprocessor, microcontroller, or CPU) that performs the algorithm shown in Figures 7A-7C and described at 6:52-8:40.” (Paper 3 at 4.) For independent claim 20, Petitioners add to the algorithm the teachings at 13:20–59. (Paper 3 at 4–5.)

In the district court case between Patent Owner and Apple, the court has adopted a claim construction that is similar to Apple’s IPR (and district court) construction, but with some differences:

a microcontroller, a processor, a microprocessor, or a CPU

that performs the algorithm shown in Steps 706 through 716 in Figure 7A, with reference to all steps shown in Figure 7B other than Step 734 and all steps show in Figure 7C,

or the algorithm described in the corresponding text, See, e.g.
7:20–7:34, 7:42–7:52, 7:60–8:40 and/or equivalents thereof.

(Ex. 2002 at 6–7.) Importantly, the district court’s construction requires at least “a microcontroller, a processor, a microprocessor, or a CPU” and requires one of the algorithm shown in Figure 7A–7C or the algorithm described in the “corresponding” specification text, 7:20–7:34, 7:42–7:52, 7:60–8:40.

For the alternative in the court’s construction based upon the figures, Figure 7C provides steps that are a part of the larger algorithm depicted in Figure 7A. (Ex. 1001 at 8:20–21 (“FIG. 7C provides a control-flow diagram for the routine ‘control,’ called in step **716** in FIG. 7A.”) In particular, Figure 7C includes step 762: “compute output p to power supply; output p to power supply”:

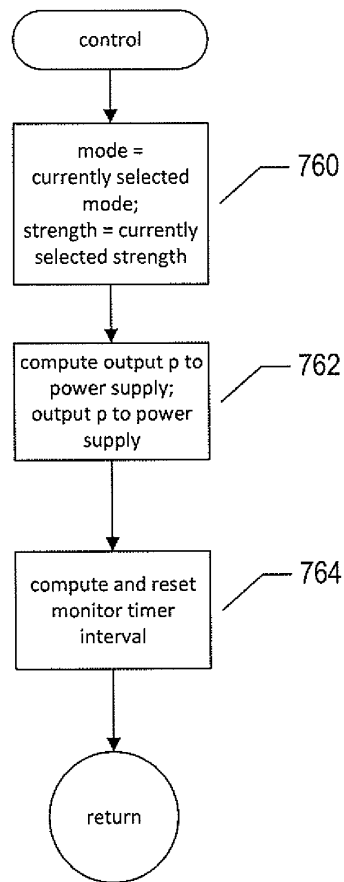


FIG. 7C

Ex. 1001, Fig. 7C.

Likewise for the alternative in the court’s construction based upon the specification, “the routine ‘control’ computes an output value *p* corresponding to the currently selected strength, stored in the variable strength, and outputs

the value p to the power supply so that the power supply outputs an appropriate current to the coil.” (Ex. 1001 at 8:26–30.)

Thus, under either alternative in the court’s construction, the processor must compute an output value p and “output[] p to the power supply.” Since Apple’s construction requires an algorithm based on both the figures and the specification, Apple’s construction requires the same.

Patent Owner agreed in district court that this step was required, at least for a processor, CPU, or microprocessor is the corresponding structure:

Where the corresponding structure is a processor, CPU, or microprocessor, the processor / CPU / microprocessor is programmed with an algorithm comprising the following steps: . . .
(b) *provide a corresponding output to the power supply* so that the power supply provides a corresponding output to the driving component.

(Ex. 2002 at 6–7 (emphasis added).)

The construction of this term was also at issue in IPR2023-00993 between Patent Owner and Samsung. The same term in the ’337 patent is also at issue in IPR2024-00807 between Patent Owner and Apple and in IPR2024-00569 and in related district court litigation between Patent Owner and Sony. The parties’ positions in the various district court and IPR cases differ in some details, but as Patent Owner explains in its preliminary response in IPR2024-

00569, Patent Owner, Samsung, and Sony each agreed in their briefing in their respective district court cases that where the corresponding structure for “control component” in either the ’830 patent or the ’337 patent was a processor, CPU, or microprocessor, that device must be programmed with an algorithm step to “provide a corresponding output to the power supply.” IPR2024-00569, Paper 8 at 8–18.

The Board should likewise require that a processor, CPU, or microprocessor that satisfies the “control component” limitation be programmed with an algorithm that includes the set of providing a corresponding output to the power supply. Most importantly, the processor, CPU, or microprocessor structure must be construed to include a disclosed algorithm. *WMS Gaming, Inc. v. International Game Technology*, 184 F.3d 1339, 1349 (Fed. Cir. 1999) (“In a means-plus-function claim in which the disclosed structure is a computer, or microprocessor, programmed to carry out an algorithm, the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm.”)

Both Apple and Patent Owner base their algorithms for the “control component” in part on the following text from the ’830 patent specification:

FIG. 7C provides a control-flow diagram for the routine “control,” called in step **716** in FIG. 7A. This routine is invoked when

a change in the user controls has occurred. In step **760**, 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. Next, in step **762**, the routine “control” computes an output value p corresponding to the currently selected strength, stored in the variable strength, and outputs the value p to the power supply so that the power supply outputs an appropriate current to the coil.

Ex. 1001 at 8:20–30. This text relates to the following figure:

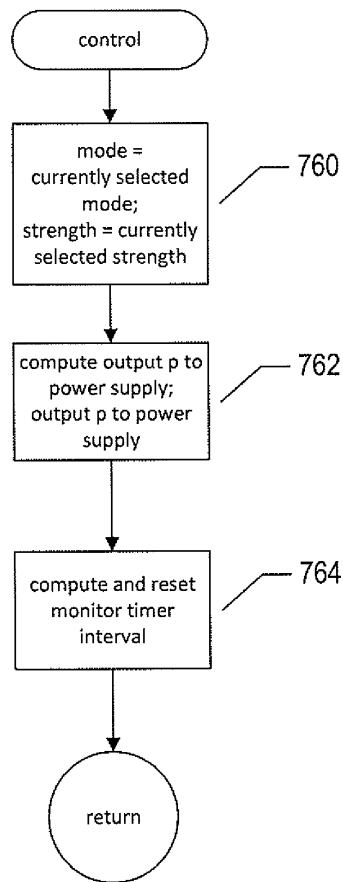


FIG. 7C

Ex. 1001, Fig. 7C.

In its institution decision for the '830 IPR, the Board determined, for the purposes of institution, that the term “control component” of independent claims 1 and 19 is a means-plus-function term. (Paper 11 at 20.) For purposes of institution, the Board adopted the construction proposed by Patent Owner,

which is same construction of the corresponding structure as adopted by the District Court in the Apple Litigation: “a microcontroller, a processor, a microprocessor, or a CPU that performs the algorithm shown in Steps 706 through 716 in Figure 7A, with reference to all steps shown in Figure 7B other than Step 734 and all steps shown in Figure 7C, or the algorithm described in the corresponding text, *See, e.g.*, 7:20–7:34, 7:42–7:52, 7:60–8:40, and equivalents thereof.” (Paper 11 at 13–14.)

Under either alternative in the District Court’s construction (which was the Board’s preliminary construction), and also under Petitioner’s construction, the processor must compute an output value *p* and output that value to the power supply. *See* Ex. 2009 Section VIII.B.2.

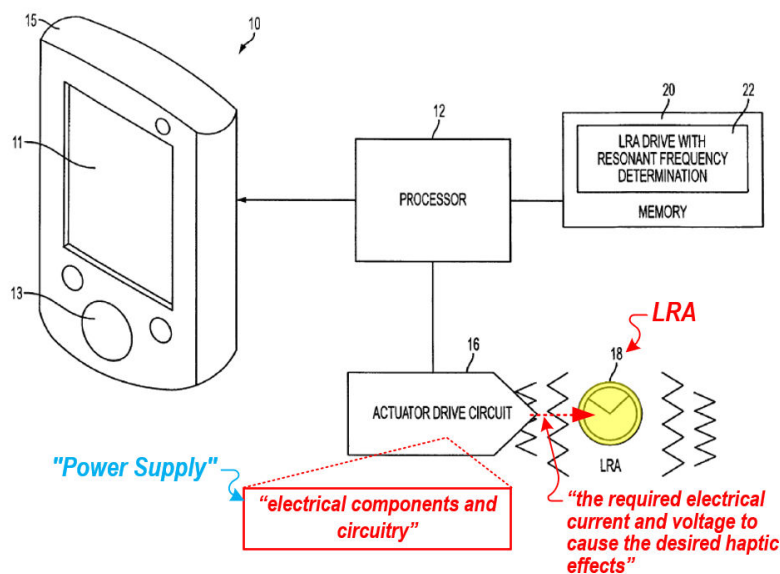
VII. OBVIOUSNESS

A. Ground 1A: Gregorio

1. Claim 1

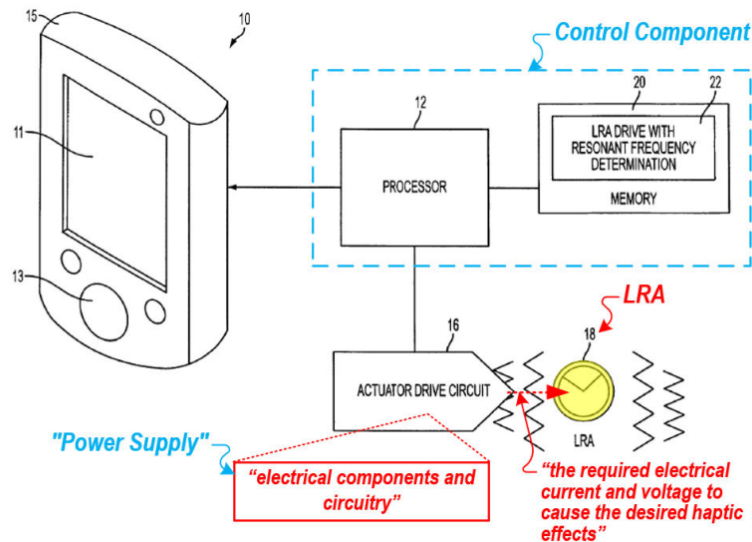
Claim 1 of the ’830 patent requires a “power supply” and, under the proper means-plus-function construction of the “control component” term, a control component that includes steps corresponding to steps 760 and 762, including in particular a step to “provide a corresponding output to the power supply.” *See* Section VI *supra*.

For the “power supply” and “control component” limitations, Ground 1A of the petition relies on the teachings of Gregorio. (Petition at 13–14.) For the claimed “power supply,” the petition asserts that “a person of ordinary skill in the art (POSITA) would have understood that actuator drive circuit 16 corresponds to, or is coupled to, a power supply,” and further notes that “Gregorio also describes ‘current generator 422’ as a power supply to convert a pulse to current that flows into LRA 18.” (Petition at 14.) The petition provides the following annotated illustration:



(*Id.*)

For the claimed “control component,” the petition relies on Gregorio’s “processor 12” and “memory 20,” as shown in the following annotated illustration:



(*Id.* at 17.)

For the first theory of the power supply, “that “a person of ordinary skill in the art (POSITA) would have understood that actuator drive circuit 16 corresponds to, or is coupled to, a power supply,” Petitioner’s own theory concedes that drive circuit 16 may not be a power supply, let alone one that receives a signal, as required by the claim. As Dr. Goossen explains, a POSITA would recognize in the above drawing that a power supply is required that is not shown. (Ex. 2009, ¶ 116.) Petitioner’s assumption that the power supply receives a signal from the processor is a sweeping conclusion that does not follow from any obviousness argument. (*Id.*)

For the Petition’s second theory that the power supply is current generator 422, Dr. Goossen explains that Gregorio clearly shows this in the figure as a dumb voltage-to-current converter. (Ex. 2009, ¶ 117.) The petition does not

and cannot show that current generator 422 receives any input from a processor executing an algorithm as claimed in the '820 patent. *Id.* Correspondingly, the petition does not and cannot show any processor or algorithm that provides a corresponding output to the power supply, as required under the proper construction of “control component,” if the claimed power supply corresponds to Gregorio’s current generator 422. *Id.*

Gregorio’s processor 12, which the petition relies on as the “control component,” is part of one embodiment, shown in overview form in Gregorio’s Figure 1; the processor’s functionality is illustrated as a flow diagram in Figure 3 and its digital or software-based implementation is described in connection with Figure 3. (Ex. 1004, Figs. 2, 3, 2:10-20, and 4:15-20; Ex. 2009, ¶ 118.) Current generator 422, on the other hand, is part of an alternative embodiment, shown in the figure below:

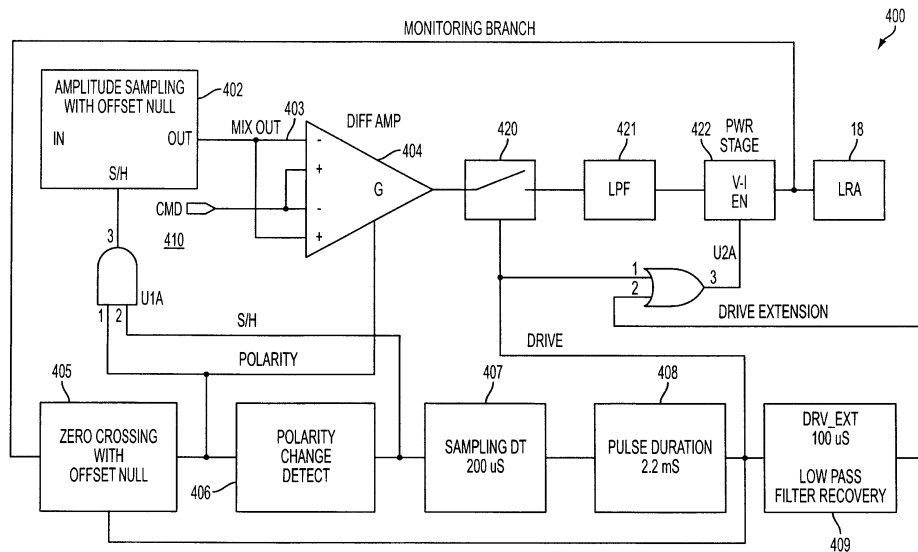


FIG. 4

(Ex. 1004, Fig. 4.)

Gregorio describes Figure 4 as follows:

FIG. 4 is a block diagram of a circuit 400 for generating the functionality of FIG. 3 for driving LRA 18 in accordance with one embodiment. In the embodiment of FIG. 4, the driving signal is generated primarily in hardware as opposed to FIG. 3 which can be generated by any combination of software (via module 22) or hardware.

Ex. 1004 at 4:66–5:4. In other words, whereas the primary embodiment of Figures 1 and 3 is a processor-based embodiment that can use software (stored in module 22), Figure 4 is an alternative embodiment that does not depend on software or use a processor; rather, Figure 4 implements the same “functionality” as figure 3 “primarily in hardware.” (Ex. 2009, ¶ 120.) As Dr. Goossen

explains, Figure 4 itself and the associated description make clear that the alternative embodiment of Figure 4 is entirely formed of analog circuitry and cannot comprise a processor. (*Id.*; Ex. 1004 at 5:5–55.) The only input to this circuit is the “command” signal 410. (*Id.*) The petition does not discuss the command signal 410 or contend that command signal 410 is an output of the processor at all, much less an “output value p corresponding to the currently selected strength” or an “output p to the power supply,” one or both of which is required under the proper means-plus-function construction. (*Id.*)

As shown in Gregorio, the main input to current generator 422 comes from the low-pass filter 421; there is also an input corresponding to signal U2A, provided by an OR gate. The OR gate’s inputs are connected to components 405, 408, 409, and 420. None of these are outputs from a processor. (Ex. 2009, ¶ 121.)

Furthermore, a POSITA reviewing Gregorio’s Figure 4 and the corresponding description would readily understand that there is no disclosed or obvious way to connect either input of current generator 422 to a processor with an algorithm as claimed in the ’820 patent. (Ex. 2009, ¶ 122.)

The petition does not contend that Gregorio discloses any processor or algorithm that provides an “output value p corresponding to the currently selected strength” or an “output p to the power supply,” one or both of which is

required under the proper means-plus-function construction if the claimed power supply corresponds to Gregorio's actuator drive circuit 16. (Petition at 16-18, 70-73.) Also, the means-plus-function construction requires at least two outputs from the control component, namely the output "d," corresponding to the desired direction, as produced by the frequency timer, and the output "p" to the power supply. (Ex. 2009, ¶ 123.) The petition does not and cannot show both of these outputs.

For these reasons, Petition's Ground 1A fails as to both challenged independent claims.

2. Claims 2-6

Claims 2-6 all depend from Claim 1. Ground 1A relies on its Claim 1 analysis for each dependent claim. (Petition at 19-25.) Ground 1A therefore fails for these claims for the same reasons as Claim 1.

B. Ground 1B: Gregorio-Wakuda

1. Claim 8, 14, and 19

For all challenged claims under Ground 1B, Petitioner relies on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Ground 1A. (Petition at 29, 36.) Therefore, Ground 1B fails for the same reasons as Ground 1A.

such as aluminum and would not have been motivated to replace Wakuda's magnetic material with a paramagnetic material. (Ex. 2009, ¶ 130.)

First, the petition and Hannaford declaration point to exhibit 1032 as evidence that the class of paramagnetic materials are one of a limited number of types of “magnetic” materials. (Petition at 32, Ex. 1003, ¶ 155; Ex. 2009, ¶ 131.) But this document states that “**All** materials are magnetic in the sense that they are affected by magnetic fields” and that “all materials are diamagnetic,” one of the three categories of “magnetic materials” listed in exhibit 1032. (Ex. 1032.) It also states that “most applications of magnetic materials call for ferromagnetic materials,” confirming that the categories in exhibit 1032 would not be seen by a POSITA as equally suitable for use in Wakuda's device. (Ex. 1032.) Wakuda expressly calls for the use of both “a magnetic substance” and “a non-magnetic substance” for different elements of its Figure 1 design. (Ex. 1005 at 4:34–38, 4:48–54.) Thus a POSITA would understand that Wakuda does not consider all of the “magnetic materials” listed in exhibit 1032 to be “magnetic substances,” as if diamagnetic materials were “magnetic” as Wakuda uses the term, then there would be no “non-magnetic substances.” (Ex. 2009, ¶ 131.)

Other documents cited in the petition makes clear that paramagnetic materials are commonly considered to be “non-magnetic.” For example, exhibit

1037 listed five “major groups” of materials according to their magnetic behavior: diamagnetism, paramagnetism, ferromagnetism, ferrimagnetism, and antiferromagnetism. (Ex. 1037 at 1.) The document then states: “Ferromagnetic and ferrimagnetic materials are usually what we consider as being magnetic (ie., behaving like iron). The remaining three are so weakly magnetic that they are usually thought of as ‘nonmagnetic’.” (Ex. 1037 at 1.) In other words, paramagnetic materials are “usually thought of as ‘nonmagnetic.’” (Ex. 2009, ¶ 132.)

Apple’s exhibit 1031 is a patent to Brooks. (Ex. 1031 at 1.) In a paragraph that Dr. Hannaford quotes in part, (Ex. 1003, ¶ 155.), this patent states:

In applications where it is desired to ensure actuation times are as low as possible, the piston 92 is made of material having a suitably high ratio that is also *non-magnetic*, non-ferrous *and*, if desired, *can be paramagnetic*. *Aluminum*, copper and magnesium and alloys thereof are *examples of suitable materials meeting these requirements*. Actuation time is advantageously optimized because a piston 92 *made of a such a non-magnetic*, non-ferrous *material* is not susceptible to any potentially acceleration reducing self-induction or solenoid effect, as would likely be the case if it were ferromagnetic.

(Ex. 1031 at 21:61–22:3.) This paragraph clearly refers to paramagnetic materials—and to aluminum specifically—as “non-magnetic.” (Ex. 2009, ¶ 134.)

Wakuda Figure 1B and the associated specification text would provide a POSITA with further reasons not to be motivated to use a paramagnetic material such as aluminum to implement the teachings of Wakuda, as illustrated further in the McLyman textbook cited by the petition. (Ex. 2009, ¶ 135.) If a magnet like the magnet M of Wakuda is located away from magnetic materials, it will have a dipole magnetic field with magnetic flux lines filling the surrounding air in all directions:

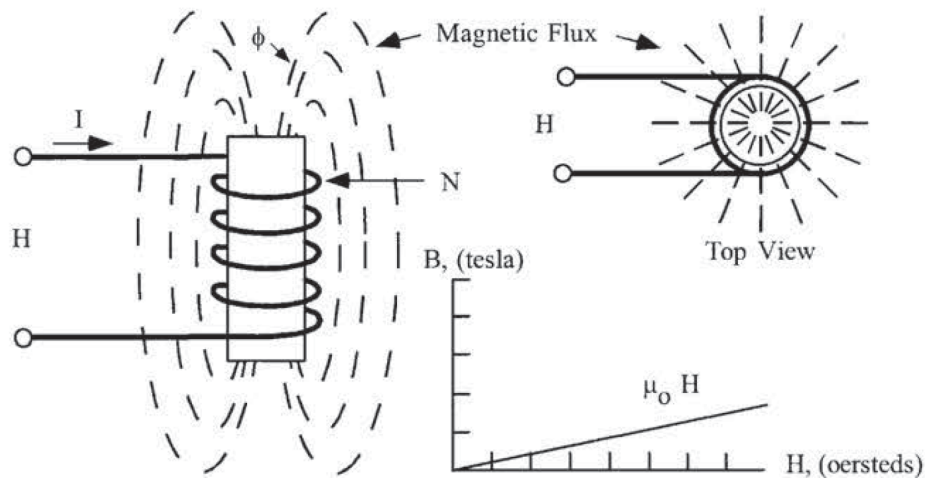


Figure 1-10. Air-Core Coil Emitting Magnetic Flux when Excited.

(Ex. 1012 at 27; Ex. 2009, ¶ 135.)

If a yoke of magnetic material is formed that connects the north of south poles of the magnet, the magnetic field and associated flux lines will be concentrated within that magnetic material, much it is shown to be concentrated in the magnetic core of McLyman Figure 1-11:

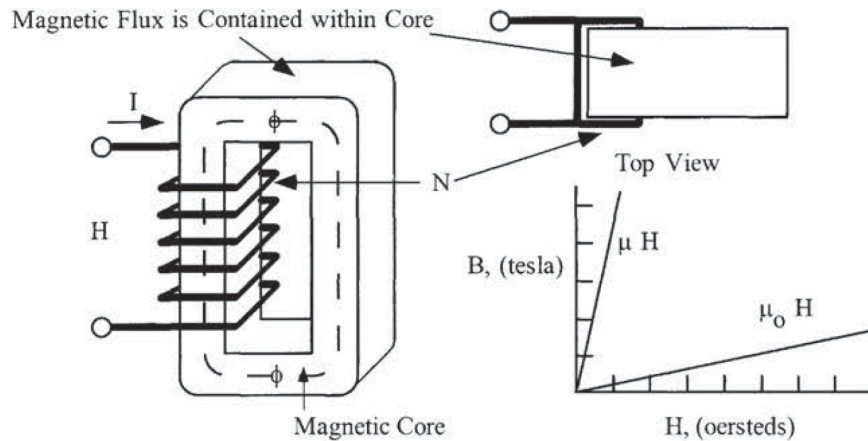
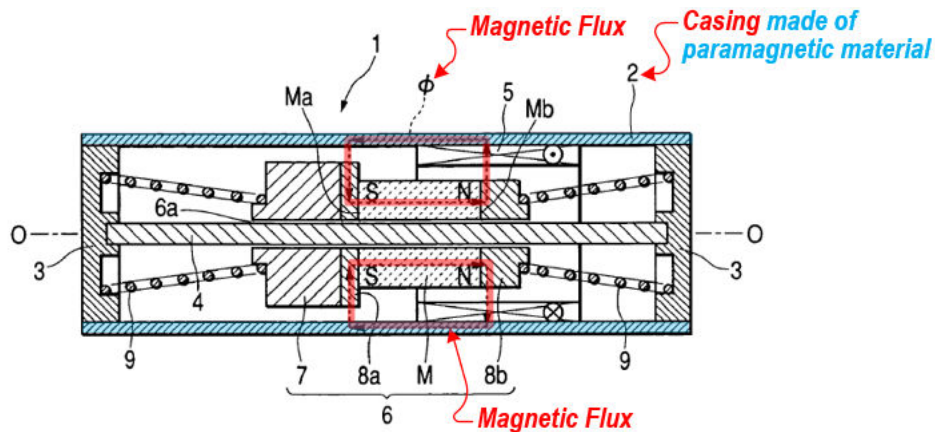


Figure 1-11. Introduction of a Magnetic Core.

(Ex. 1012 at 27; Ex. 2009, ¶ 136.)

While Wakuda differs in having a permanent magnet instead of the electromagnet of these McLyman figures and in having air gaps, the same basic effect of flux lines concentrating in the magnetic material is shown in Wakuda Figure 1B:



(Petition at 32; Ex. 2009, ¶ 137.)

In order to dramatically change the magnetic field from that produced by the magnet alone, as shown in the change from McLyman Figure 1-10 to 1-11, the magnetic material of the core or yoke must produce a substantial magnetic field. (Ex. 2009, ¶ 138.)

As this figure is drawn, showing strong bending of the magnetic field lines into the casing, it is clearly represented as ferromagnetic. (Ex. 2009, ¶ 139.) A paramagnetic material would not so strongly bend the lines. (*Id.*) Furthermore Wakuda states that the casing forms the magnetic circuit, and thus must bend and guide the magnetic field lines:

In the embodiment shown in FIG. 1, the end surface Mb assumes the N pole and the end surface Ma assumes the S pole. In this case, magnetic flux ϕ generated by the magnet M are output through one of the yoke members 8b in an outer peripheral direction to traverse the coil 5 perpendicularly to reach the casing 2. Further, the magnetic flux ϕ form a magnetic path, along

which the flux pass inside the casing **2** made of a magnetic substance to be conducted to a position opposed to the other of the yoke members **8a**, and are output toward the yoke member **8a** from the position to reach the S pole of the magnet M.

(Ex. 1005 at 5:54–64.) Thus replacing the casing with a paramagnetic material would result in the device not working, according to Wakuda’s design. (Ex. 2009, ¶ 140.)

The magnetic field within a material is described by the following formula (in the CGS system of units):

$$\mathbf{B}=\mathbf{H}+4\pi\mathbf{M}$$

(Ex. 1037 at 14; Ex. 2009, ¶ 141.)

Here, the magnetic induction **B** equals the sum of the magnetic field **H** produced by sources outside the material and a term reflecting the magnetization **M** of the material. (Ex. 1037 at 12–14.) The ratio of **B/H**, called the “permeability,” is a measure of how much the magnetic **B** field is affected by the magnetic response of the material. (Ex. 1037 at 14.) As McLyman explains:

Most materials are poor conductors of magnetic flux; they have low permeability. *A vacuum has a permeability of 1.0, and non-magnetic materials, such as air, paper, and copper have permeabilities of the same order.* There are a few materials, such as

iron, nickel, cobalt, and their alloys that have high permeability, sometimes ranging into the hundreds of thousands. To achieve an improvement over the air-coil, as shown in Figure 1-10, a magnetic core can be introduced, as shown in Figure 1-11. *In addition to its high permeability*, the advantages of the magnetic core over the air-core are that the magnetic path length (MPL) is well-defined, *and the flux is essentially confined to the core*, except in the immediate vicinity of the winding.

(Ex. 1012 at 27.) As this explains, a permeability substantially greater than 1 (i.e., in the thousands) is needed to confine the flux, like what is illustrated in McLyman Figure 1-11 or Wakuda Figure 1B. (Ex. 2009, ¶ 143.) To understand where the properties of aluminum place it in this discussion from McLyman, we can determine its permeability. (*Id.*) In the CGS units used in McLyman, the permeability can be written in terms of susceptibility κ :

$$\frac{B}{H} = 1 + 4\pi\kappa$$

(Ex. 2009, ¶ 144 (citing Ex. 1037 at 14.))

The CGS susceptibility of solid aluminum is 16.5×10^{-6} , making the permeability $1 + 4\pi\kappa$ approximately 1.000022, and making it one of the “non-magnetic materials” with “permeabilities of the same order” as 1.0, according to McLyman. (Ex. 2009, ¶ 144; Ex. 1012 at 27.) Importantly, the magnetization due to paramagnetism in aluminum will only alter the magnetic B field by

around 0.002% of the value that field would have in a vacuum. (Ex. 2009, ¶ 144.) A POSITA would recognize that such a weak effect would not alter the magnetic flux lines from McLyman Figure 1-10 to be concentrated as in McLyman Figure 1-11, and it would not produce the magnetic flux paths confined to the magnetic material as shown in Wakuda Figure 1B. (*Id.*)

A POSITA seeking to apply the teachings of Wakuda Figure 1B would not be motivated to use a paramagnetic material such as aluminum in place of the magnetic material taught by Wakuda. (Ex. 2009, ¶ 145.) Accordingly, the combination of Gregario with Wakuda does not render claim 14 obvious. Because the petition points to no teachings of Ramsay, Rossi, or Aldrich that would suggest using a paramagnetic material, the combinations under Grounds 1E and 2B also do not render claim 14 obvious. (Petition at 1, 53–54, 75–76)

C. Ground 1C: Gregorio-Tierling

For the challenged claims under Ground 1C, Petitioner relies on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Ground 1A. (Petition at 40, 45.) Therefore, Ground 1B fails for the same reasons as Ground 1A.

D. Ground 1D: Gregorio-Ramsay

For the challenged claims under Ground 1D, Petitioner relies on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Ground 1A. (Petition at 50–51, 53.) Therefore, Ground 1B fails for the same reasons as Ground 1A.

E. Grounds 1E-1F: Gregorio-Ramsay

For the challenged claims under Grounds 1E and 1F, Petitioner relies on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Grounds 1B and 1C. (Petition at 29, 36.) Therefore, Grounds 1E and 1F fail for the same reasons as Ground 1A.

Ground 1E also relies on Ground 1B with respect to claim 14. (Petition at 53.) This ground therefore also fails as to claim 14 for the independently sufficient reasons as Ground 1B.

F. Ground 2A: Gregorio-Ramsay-Rossi-Aldrich

For the challenged claims under Ground 2A, Petitioner relies in part on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Ground 1A. (Petition at 63–64, 72, 74.) Therefore, to the extent Ground 2A fails to

correct the deficiencies of Ground 1A, it fails for the same reasons as Ground 1A.

The Petition further asserts that “the Gregorio-Ramsay-Rossi-Aldrich combination provides that the processor is programmed with the algorithm described in Figures 7A-7C of the ’830 patent under the means-plus-function construction.” (Petition at 65.) Petitioner asserts that the combined system of Gregorio-Ramsay-Rossi-Aldrich involves a step of “the user input provides a change in vibration strength (e.g., in accordance with Ramsay)” during a “monitoring period,” and “the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user unput [sic].” (*Id.* at 72.) This is conclusory and nonspecific and does not show any disclosure or obviousness. As Dr. Goossen explains, the combined system of Gregorio-Ramsay-Rossi-Aldrich does not teach the claimed output to the power supply. (Ex. 2009, ¶ 124.)

The Petition’s discussion of the algorithm appears to be identical to its discussion of the different Wakuda-Ramsay-Rossi-Aldrich combination in IPR2024-00807, confirming that the analysis is not specific to either Gregorio-Ramsay-Rossi-Aldrich or Wakuda-Ramsay-Rossi-Aldrich. (IPR2024-00807 Petition at 47; Ex. 2009, ¶ 124.)

In its Institution Decision, the Board considered additional theories set out in the declaration of Petitioner’s expert that were not disclosed in the Petition itself. (Paper 11 at 31.) The Board should not permit Petitioner to assert new theories. The Petition’s attempt to incorporate by reference additional theories from Dr. Hannaford’s declaration contravenes the statutory word limits governing IPRs, especially when the Petition is within 10 words of the statutory limit. 37 C.F.R. § 42.24(a)(1)(i) (petition limited to 14,000 words); 37 C.F.R. § 42.22(a)(1)(2) (petition must include “full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence including material facts”); 37 C.F.R. § 42.6(a)(3) (“Arguments must not be incorporated by reference from one document into another document.”); *see 3M Company v. Evergreen Adhesives, Inc.*, 860 Fed.Appx. 724, 728 (Fed. Cir. 2021) (affirming PTAB decision to exclude arguments made in expert testimony where the corresponding arguments in the petition and reply were “skeletal at best”).

Specifically, Dr. Hannaford’s apparent analysis that Ramsay discloses or renders obvious a signal to the power supply has no foundation in the Petition, other than the citation to Dr. Hannaford’s declaration itself. The Petition does not state or imply that Ramsay discloses such a signal or renders it obvious.

The Petition cites no portion of Ramsay for that proposition. The Petition, in short, contains no analysis of this limitation.

In any event, Dr. Hannaford's additional opinion does not support the Petition's conclusion. As Dr. Goossen explains, although Dr. Hannaford explains how the control component responds to user input in specific ways in order to produce the "directional signal d output to the H-bridge switch circuit" within his theory, he does not provide any similar discussion of an output p to the power supply, as required. (Ex. 2009, ¶ 125 (citing Ex. 1003 ¶¶ 259-61.)) In particular, the only thing Dr. Hannaford says about the algorithm for the output to the power supply is the same conclusory sentence from the petition: "the software executing on the microprocessor outputs a corresponding control signal to the power supply in accordance with the user unput [sic]." *Id.* This is nonspecific and does not show any disclosure or obviousness.

Dr. Hannaford also states that "in the combined system, the software executed by the microprocessor receives user input adjusting the magnitude (e.g., height, frequency, etc.) of the waveform via a user interface, in accordance with Ramsay, thereby directing a change in vibration strength, and the control component changes the current provided from a power supply to the driving component. APPLE-1006, [0022]-[0026], [0030]-[0033], [0046],

[0053]-[0055].” (Ex. 1003, ¶ 259.) This is a description of Ramsay’s user interface, and the paragraphs cited in exhibit 1006 all relate solely to the user interface. (Ex. 1009, ¶ 126.) Dr. Hannaford’s statement about “the current provided from a power supply to the driving component” has nothing to do with Ramsay’s disclosure. (*Id.*) Dr. Hannaford has not shown that a POSITA would have found it obvious from Ramsay’s teaching of a user interface to provide an output to the power supply that changes the current provided, and if that is his implied opinion, he is incorrect. (*Id.*)

Dr. Hannaford also states that “the current applied to the coil directly impacts the magnitude of the oscillations, implementing the user input directing a change in vibration strength.” (Ex. 1003 ¶ 259.) He cites to an unremarkable statement that the force of an electromagnet depends on the current through it. (*Id.*) This is not a disclosure of an output signal to a power supply. (Ex. 2009, ¶ 127.) Dr. Hannaford has not shown that a POSITA would have found it obvious to implement the specific algorithmic and structural limitations of the ’830 patent regarding an output p to the power supply (separate and apart from the output d), and if that is his implied opinion, he is incorrect. (*Id.*)

G. Grounds 2B-2C: Gregorio-Ramsay-Rossi-Aldrich

For the challenged claims under Grounds 2B and 2C, Petitioner relies on the same disclosures as for the power supply of limitation [1c] and the processor and algorithm of the control component of limitation [1f] in Grounds 1E and 1F, and the same disclosure of the flux paths of claim 14 as Ground 1B and 1E. (Paper 3 at 75.) Therefore, Grounds 2B and 2C fail for the same reasons as Ground 1A.

VIII. CONCLUSION

For the reasons set forth above, Resonant Systems respectfully requests that the Board affirm the validity of all challenged claims.

Dated: February 7, 2025

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CERTIFICATE OF WORD COUNT

I certify that there are 6,044 words in this paper, excluding the portions exempted under 37 C.F.R. § 42.24(a)(1), according to the word count tool in Microsoft Word.

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CERTIFICATE OF SERVICE

I hereby certify that “Patent Owner’s Response” was served on February 7,
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