

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

RESONANT SYSTEMS, INC.,
Patent Owner.

Case No. IPR2024-00983
U.S. Patent No. 11,152,882

PATENT OWNER'S SUR-REPLY

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PATENT OWNER'S EXHIBIT LIST

<i>Exhibit No</i>	<i>Description</i>
2001	Court's Claim Construction Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 91)
2002	Claim Construction Memorandum and Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 103)
2003	Order Modifying Scheduling Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 57)
2004	Amended Scheduling Order (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.), Dkt. 95, Ex. 1)
2005	Federal Court Management Statistics, Western District of Texas, 2018-2023
2006	Excerpt of Defendant's Final Invalidity Contentions (<i>Resonant Systems, Inc. v. Apple Inc.</i> , Case No. 23-cv-00077-ADA (W.D. Tex.))
2007	[Reserved]
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	[Reserved]
2015	[Reserved]
2016	[Reserved]
2017	[Reserved]
2018	Declaration of Paul A. Kroeger in Support of <i>Pro Hac Vice</i> Recognition
2019	Declaration of Christian W. Conkle in Support of <i>Pro Hac Vice</i> Recognition

Case No. IPR2024-00983
U.S. Patent No. 11,152,882

<i>Exhibit No</i>	<i>Description</i>
2020	Transcript of Deposition of Blake Hannaford, Ph.D., June 27, 2025

I. INTRODUCTION

Apple's Reply fails to remedy the failures in each of the grounds of its Petition. As to Ground 1, Apple fails to demonstrate that the Alexander reference is analogous art *to the claimed inventions*. Alexander is directed to sex toys that have no resonant frequency, while each of the claims is directed to "oscillating resonant module[s]." Even if Alexander were analogous art, Apple fails to demonstrate a motivation to combine Alexander with Cosper, which is directed to operating a resonant system specifically at its resonant frequency. As to Grounds 2A–2H, Apple fails to show a motivation to utilize both position and velocity in order to operate at a resonant frequency, in the Gregorio prior art system that measures only the position directly. For these reasons, and the other reasons set forth in the Response and herein, Apple's grounds should be rejected and the validity of the challenged claims affirmed.

II. ARGUMENT

A. Alexander and Cosper Are Not Analogous Art and a POSITA Would Not Have Been Motivated to Combine (Ground 1)

It is immaterial that the limitations of a claim can be found by cobbling together a combination of different references, if it would not have been obvious to combine those references in the way proposed. Here, Apple has failed to demonstrate that it would have been obvious to combine Alexander and Cosper in the way proposed.

1. Alexander is not in the same field of endeavor as the claimed inventions

As explained in the Response, the claimed inventions of the '882 patent are directed to “oscillating resonant modules.” (Paper 11 at 9.) In particular, each independent claims requires either an “oscillating resonant module” or “one or more oscillating resonant modules,” in both its preamble and its body. (Ex. 1001 at 32:52, 32:55, 33:40–41, 33:44.) The Reply ignores this key fact, focusing instead on statements from the specification, taken out of context. (Paper 15 at 2–3.) Even focusing on the specification, the “Summary” section of the specification makes clear that the patent is “directed to” oscillating resonant modules:

The current document is directed to various types of oscillating resonant modules (“ORMs”), 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 2:64–3:3.)

Apple’s focus on out-of-context portions of the specification—to the exclusion of the claims—to determine analogousness is contrary to law, as confirmed by the cases Apple itself cites. *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004) (“References within the statutory terms of 35 U.S.C. § 102 qualify as prior art for an obviousness determination *only when analogous to the*

claimed invention.” (emphasis added)); *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1001 (Fed. Cir. 2016) (“If a reference disclosure and *the claimed invention* have a same purpose, the reference relates to the same problem, which supports an obviousness rejection.” (emphasis added)); *Donner Technology, LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020) (“when addressing whether a reference is analogous art *with respect to a claimed invention* under a reasonable-pertinence theory, the problems to which both relate must be identified and compared” (emphasis added)).

Apple’s alternative field of endeavor of “vibrating products for human physical interaction” is too broad to define a meaningful field of endeavor, encompassing everything from pocket pagers, to massage chairs, to surgical instruments. To the extent that Apple suggests that Alexander is directed to “massaging human skin,” that is plainly incorrect. Alexander is directed to a sex toy that penetrates and thrusts into the human body. Ex. 1005, ¶ [0038] (“For example, it could cycle between 1 inch extension and 4 inch extension, back and forth, at, for example, 1 Hz intervals.”), ¶ [0040] (describing a stroke of 6 inches), ¶ [0054] (referring to a “dildo . . . designed to accommodate anatomical comfort), Fig. 1A:

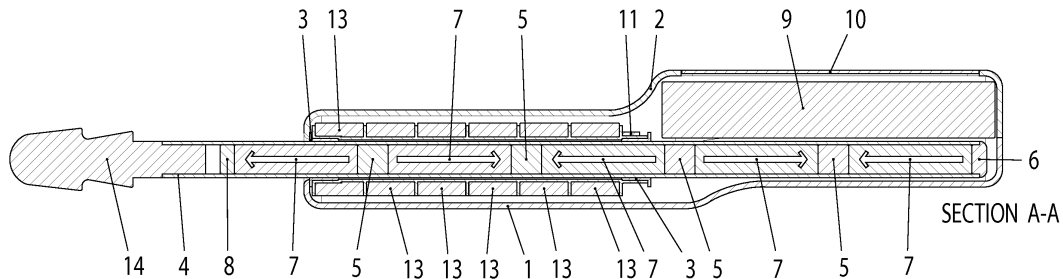


Figure 1A

Such a penetrative sex toy belongs to a different field of endeavor from a skin massager, utilizing substantially smaller oscillations at a substantially higher frequency. (Ex. 1001 at 2:48, Fig. 3.)

2. Alexander is not “reasonably pertinent” to the problems of the inventions claimed in the ’882 patent

Just as with its field of endeavor analysis, Apple’s reasonable pertinence analysis improperly focuses on statements in the specification and improperly ignores what the ’882 patent actually claims. *Donner*, 979 F.3d at 1359 (“when addressing whether a reference is analogous art *with respect to a claimed invention* under a reasonable-pertinence theory, the problems to which both relate must be identified and compared” (emphasis added)); see *Bigio*, 381 F.3d at 1325; *Unwired Planet*, 841 F.3d at 1001.

While it is true that the patentee did not make analogous art arguments when the examiner raised Alexander as combination prior art against depend-

ent claims during prosecution, that is not dispositive for the “reasonably pertinent” question in this proceeding. In its response to the office action citing Alexander, the patentee made other arguments against combination with Alexander, which applied whether Alexander is analogous art or not. (Ex. 1002 at 153–154.) The examiner ultimately allowed the claims based upon patentee’s arguments that the base prior art reference failed to satisfy limitations of the independent claims, making any arguments against Alexander superfluous. (Ex. 1002 at 123–124.)

That patentee chose to make one set of (ultimately successful) arguments against a combination involving Alexander during prosecution does not bar patentee from making different arguments against a different combination involving Alexander in this proceeding.

Nor are Alexander’s teachings reasonably pertinent to the problems of the ’882 patent’s claimed inventions. As noted above, the ’882 patent’s inventions are directed to “oscillating resonant modules.” (Ex. 1001 at 32:52, 32:55, 33:40–41, 33:44.) Alexander’s teachings do not make use of resonance at all, as Apple’s expert Dr. Hannaford acknowledged in deposition:

Q. And you don't offer any opinions in this declaration that Alexander discloses a resonant motor; correct?

A. Well, I — I — I still have the opinion that they — that Alexander — that they don't accurately summarize Alexander in Cosper or how a POSITA would interpret those references, but I don't recall a statement anywhere in my declaration that Alexander discloses resonant motors.

Q. Did you offer any opinion in your declaration that Alexander discloses anything about resonance at all?

A. Not that I recall, sitting here today, other than a system that can be adapted to have resonance.

(Ex. 2020 at 8:13–9:2.)

As explained in the Response, the lack of use of resonance is fundamental to the problem that Alexander *is* directed to, that of a penetrative sex toy with strokes that are inches in length and a frequency on the order of 1 Hz.

(Paper 11 at 20–24; Ex. 2009, ¶¶ 84–89.)

Apple's apparent response is that Alexander and the '882 patent "both . . . describe applications involving direct physical contact." (Paper 15 at 6.) But such an argument proves too much. Countless items involve "direct physical contact" with a human body, ranging from clothing to eyeglasses to silverware. The mere fact something makes "direct physical contact" does not make its teachings pertinent to the '882 patent claims.

Apple also argues that Alexander and the '882 patent “both address problems common to generating vibration suitable to massage human skin.” (Paper 15 at 6.) As least as to Alexander this is incorrect. Alexander is directed to a sex toy that penetrates and thrusts into the human body. Ex. 1005, ¶ [0038] (“For example, it could cycle between 1 inch extension and 4 inch extension, back and forth, at, for example, 1 Hz intervals.”), ¶ [0040] (describing a stroke of 6 inches), ¶ [0054], Fig. 1A. It is designed to stimulate membranes and internal structures of the human body, not to massage human skin.

3. No motivation to combine Alexander and Cosper in the manner proposed

Apple argues that a POSITA would have been motivated to combine Alexander and Cosper “to effectively implement position sensors for feedback control.” (Paper 15 at 10.) But it is not enough to show a generic motivation to combine Alexander and Cosper in some way. Rather, there must be a motivation to combine into a system that actually satisfies the challenged claims, in particular a system with one or more “oscillating resonant modules.”

In addressing the purported combination involving resonance, Apple’s Reply points to the fact that Alexander is a “handheld” device powered by a “battery” as motivation (Paper 15 at 11), but Apple ignores the purpose of the Alexander system that is purportedly being improved with Cosper’s teachings and the types of oscillating motions that Alexander uses to perform its purpose.

While the stroke length, frequency, or pattern in particular embodiments of Alexander may be illustrative or non-limiting, common sense suggests that there are limits to the types of movements that would be desirable for a sex toy of the type taught in Alexander.

For example, Apple suggests that “a POSITA would have readily configured the combined system to provide resonant operation at a stroke length near the middle of a maximum stroke length.” (Paper 15 at 13.) The only support in the record that suggests that a modification of Alexander to have a substantially shorter stroke at a single resonant frequency would have been a desirable modification is a conclusory statement to that effect by Dr. Hannaford. (Paper 15 at 13; Ex. 1018, ¶ 25.) The record does not suggest any reason to believe that Dr. Hannaford’s “knowledge and experience in the field” (Ex. 1018, ¶ 25) provide the basis for useful opinions on desirable behavior for a product of the type described in Alexander. Accordingly, Apple has failed to carry its burden to show a motivation to combine Alexander with Cosper in this manner. *Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (“In an inter partes review, the burden of persuasion is on the petitioner to prove ‘unpatentability by a preponderance of the evidence,’ 35 U.S.C. § 316(e), and that burden never shifts to the patentee.”)

Moreover, Apple fails to rebut Patent Owner’s evidence concerning a lack of reasonable expectation of success. As explained in the Response, operation at resonance with parameters of the kind described in Alexander would require a very weak spring. (Paper 11 at 21; Ex. 2009, ¶ 85.) It would also result in nonlinear behavior and likely deform or break. (Paper 11 at 21–22; Ex. 2009, ¶ 87.)

The Reply suggests reducing the stroke length to produce “resonant operation at a stroke length near the middle of a maximum stroke length.” (Paper 15 at 13.) But this change, even if it were not part of an untimely argument and even if we assume it would produce an acceptable device, would make the force from the spring even weaker. As Dr. Goossen explains, a spring produces a force proportional to the distance stretched, e.g., 0.023 lbs of force for every inch of stretch, in the example where a 0.1 kg mass is oscillating at resonance at 1 Hz. (Ex. 2009, ¶ 85.) Making the stroke substantially shorter than that taught in Alexander would likewise make the force exerted by the spring substantially less than that calculated by Dr. Goossen, which was already significantly less than the force of gravity on the oscillating object. (*Id.*)

More fundamentally, Apple fails to demonstrate that a POSITA would have found a place to put an appropriate spring or other “bias member” in a

modified version of Alexander so as to produce a purportedly desirable resonant behavior. The Response and Dr. Goossen explained why a POSITA would not have found such a place. (Paper 11 at 22–24; Ex. 2009, ¶¶ 88–89.) The Reply simply cites to Dr. Hannaford stating “a POSITA would have readily configured the bias member to accommodate a range of operating profiles, consistent with Alexander’s objectives.” (Paper 15 at 15; Ex. 1018, ¶ 26.) Neither the Reply nor Dr. Hannaford gives an example of where the bias member could be successfully added or explains how a POSITA could have achieved such a configuration. Dr. Hannaford’s conclusory statement is entitled to little weight and does not outweigh Dr. Goossen’s reasoned opinion or carry the Petitioner’s burden. 37 C.F.R. § 42.65(a) (“Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.”); *Xerox Corp. v. Bytemark, Inc.*, Case No. IPR2022-00624, Paper 9 at 15 (PTAB Aug. 24, 2022) (precedential) (“the cited declaration testimony is conclusory and unsupported, adds little to the conclusory assertion for which it is offered to support, and is entitled to little weight”); *Dynamic Drinkware*, 800 F.3d at 1378 (the burden of persuasion is on the petitioner).

**B. Failure to Satisfy Steps 4519 and 4520 of “control component”
(Grounds 2A–2H)**

1. Grounds 2A–2D

The Reply makes clear that for at least grounds 2A–2D Apple relies upon variations on Gregorio that measure position (using a sensor such as a Hall sensor) and that derive velocity from that position data. (Paper 15 at 16–19.) In particular, the Reply disavows any embodiment that would utilize direct position measurements (as from a Hall sensor) and direct velocity measurements (as from back-EMF). (*Id.* at 19–20.) The Reply justifies this variation on Gregorio by citing to *Intel* and arguing that the Petition’s variation on Gregorio was a “suitable” option. (Paper 15 at 19.) But Apple misstates the Federal Circuit’s holding concerning “suitable” options in *Intel*. As the court said:

[I]f there's a known technique ***to address a known problem*** using “prior art elements ***according to their established functions***,” then there is a motivation to combine. And we specify ***address a known problem*** because “[i]t's not necessary to show that a combination is the best option, only that it be a suitable option.”

Intel Corporation v. PACT XPP Schweiz AG, 61 F.4th 1373, 1380 (Fed. Cir. 2023) (internal citation omitted, emphasis added). The argument the Federal Circuit rejected in *Intel* was the argument that use of a particular prior art element had to be the “best option” for modifying a prior art reference. But

the *Intel* court did not dispense with requirement of a ***motivation*** to combine.

The modification still needs to address a known ***problem*** and thereby improve the system in some manner that would be recognized by a POSITA. In other words, “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).

Both the Petition and the Reply fail to establish ***any*** benefit from the proposed modification for solving any identified problem. The purported reason for determining both position and velocity in the proposed variation on Gregario is “determination of the resonant frequency” or “to achieve oscillation at a resonant frequency.” (Paper 15 at 18–19.) But contrary to the arguments in the Reply, a velocity derived from position provides no additional information on amplitude or frequency beyond that provided by the position data directly.

As Dr. Hannaford acknowledged during his deposition, both the plots of position versus time and velocity versus time for a device operating at or near resonance will be sinusoids, and both will have the same frequency and period:

Q. Would you agree that for a device operating at or near resonance, each of the graphs of position versus time, velocity versus time, and acceleration versus time will be approximately sinusoids?

A. Yeah, in the — sorry. In the abstract, mathematically speaking, yes, I agree with that.

Q. Would you agree that for a given frequency, each of those graphs of position, velocity, acceleration will have the same period?

A. All waves that have the same frequency also have the same period, so yes.

(Ex. 2020 at 12:17–13:7.) Moreover, Dr. Hannaford acknowledged that the velocity would be the derivative of the position, such that if the position as a function of time t were:

$$x = A \sin \omega t$$

the velocity as a function of time t would be:

$$v = A\omega \cos \omega t$$

(Ex. 2020 at 14:3–7.) In other words, the plot of velocity versus time would be a sine wave with the same overall shape as the sine wave plot of amplitude versus time, but with an amplitude that is multiplied by a factor of ω and a

frequency that is unchanged. Whether the velocity amplitude $A\omega$ is even numerically larger than the position amplitude A will depend on the frequency and on the units used to measure it. But at most, the peak in the velocity curve will be higher, not sharper as the reply suggests. (Paper 15 at 18.)

The amplitude of the oscillation is simply the difference between the maximum and minimum values of position. Computing amplitude directly from position data is thus straightforward, and “a POSITA desiring to measure amplitude using a position sensor would do so by comparing position measurements directly.” (Ex. 2009, ¶ 93.) There is no non-conclusory evidence presented that suggests a POSITA would have been motivated to use a more elaborate method of computing amplitude that required both position values and velocity values derived from position.

The fact that Gregorio does not expressly describe measuring amplitude directly from position measurements does not change this fact. Gregorio also does not describe computing velocity from position or computing amplitude using both position and velocity data. Gregorio does describe computing amplitude from acceleration (dv/dt), but it does so in the context of an embodiment that relies upon back EMF for sensing, which provides information on velocity but not position. (Ex. 2009, ¶ 92.) This teaching of using dv/dt to determine amplitude when relying on back-EMF sensing does not suggest a

POSITA would use dv/dt to determine amplitude when there is a Hall sensor providing direct position measurements (and no direct velocity measurements). To the contrary, as Dr. Goossen explained, a POSITA that had a Hall sensor available would use its position values directly to determine amplitude and would not be motivated to use them in combination with velocity and acceleration values that are derived from the position measurements. (Ex. 2009, ¶ 93.)

2. Grounds 2E–2H

As to Grounds 2E–2H, the Petition failed to demonstrate that any of these four combinations satisfied claim 1. In particular, as explained in the Response, Muramatsu does not in any way address oscillations or vibrations of the manipulator whose position and/or velocity are being measured. (Paper 11 at 29–30; Ex. 2009, ¶¶ 99–100.) Its teachings concerning data tables do not make use of a target frequency, as required in step 4520 of the “control component” algorithm. Accordingly, the teachings of Muramatsu do not satisfy limitation [1d], and as explained above Gregorio and the combinations based upon it do not satisfy limitation [1d] either.

The Petition’s discussion of Grounds 2E–2H does not mention the “target frequency” or step 4520 of the control component algorithm that computes

control outputs based upon this target frequency. (Paper 2 at 65–71.) Accordingly, the Petition fails to explain how any of Grounds 2E–2H satisfies the control component of independent claim limitation [1d], and it thus fails to show how any of these grounds satisfies claims 3–6 that depend from claim 1. The Reply does nothing to remedy this failure. Beyond the conclusory statement that “steps 4519 and 4520 are rendered obvious,” the Reply provides no analysis of the “target frequency” requirement or of step 4520 as a whole. (Paper 15 at 20–21.)

Because neither the Petition nor the Reply provides a proper analysis to carry Apple’s burden to show claims 3–6 are obvious under Grounds 2E–2H, these grounds should be rejected. However, even to the extent the Board accepts these grounds and finds claims 3–6 obvious, the patentability of the remaining claims, including parent claim 1, should be affirmed. 35 U.S.C. § 312(a)(3) (petition must identify “with particularity, each claim challenged, the grounds on which the challenge to each claim is based, and the evidence that supports the grounds for the challenge to each claim”).

III. CONCLUSION

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

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Dated: July 28, 2025

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CERTIFICATE OF WORD COUNT

I certify that there are 3,384 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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Case No. IPR2024-00983
U.S. Patent No. 11,152,882

CERTIFICATE OF SERVICE

I hereby certify that “Patent Owner’s Sur-Reply” was served on July 28, 2025

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