

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

RESONANT SYSTEMS, INC.,
Patent Owner.

Case No. IPR2024-00698
U.S. Patent No. 8,093,767

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

Case No. IPR2024-00698

U.S. Patent No. 8,093,767

<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 https://ccrma.stanford.edu/~jos/fp/Quality_Factor_Q.html
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 including the combination of Shahoian and Cosper. 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 show, in any ground, [1.5.3] "a switch that receives a directional signal d from the processor."

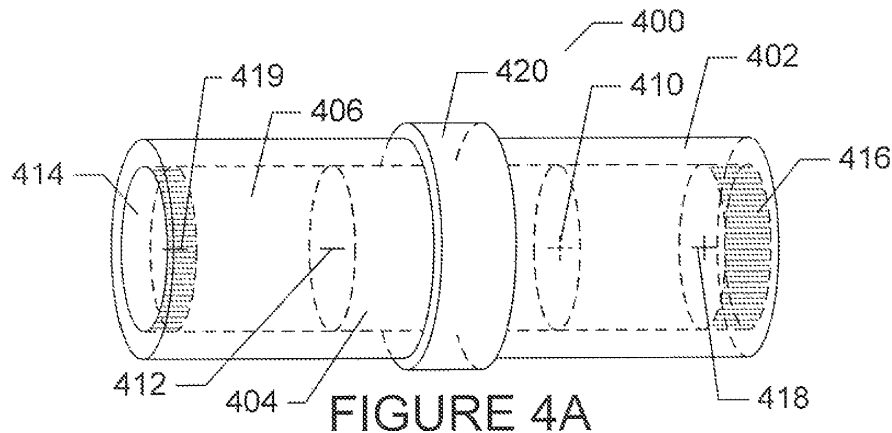
Furthermore, the Petition's Grounds 1B, 1D, and 2B fail to show disclosure of both [2.3] "a directional-signal splitter/inverter that generates two complementary internal signals d and $\bar{d}$ " and [2.4] "two pairs of solid-state switches, a first switch of each pair controlled by internal signal d and a second switch of the pair controlled by internal signal $\bar{d}$," and thus fail for that independently sufficient ground.

Finally, Grounds 1B and 2B fail to show either the "vibration sensor" or "continuously monitors" limitations of Claim 3 and thus fail as to that claim.

III. BACKGROUND

A. Background to the '767 Patent

Many electronic devices such as mobile phones and game controllers make use of components that produce vibrational forces. The '767 patent teaches and claims improved vibration modules with features suitable for such applications:



(Ex. 1001 at 5.) Compared to prior art solutions, the inventions of the '767 patent offer greater durability, greater efficiency, an ability to generate useful vibrations over a range of frequencies, and more desirable patterns of vibration.

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 engi-

neering, 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

In the District Court, Petitioner has asserted that the preamble of claim 1 is limiting. Ex. 2001 (Apple’s Proposed Claim Constructions) at 2. Patent Owner consented to that proposal and the District Court entered a construction that the preamble of claim 1 is limiting. Ex. 2002 (*Markman* order) at 1. The Board should enter the same construction, finding that the preamble of claim 1 is limiting based on Petitioner’s assertion in the District Court and based on the District Court’s order. Furthermore, the Board may also consider the arguments made by Petitioner before the District Court in connection with the identical preambles of other patents and reach a conclusion on the merits that the preamble is limiting. For example, Petitioner argued before the District Court that the preambles of several claims, including ’767 Patent claim 1,

“limiting because the specifications are replete with references to the ‘invention’ as described in the preamble.” Ex. 2003 (Apple opening claim construction brief) at 12 (citing ’767 patent, 10:9–14). Petitioner relied on case law that, in Petitioner’s view, held that a preamble should be construed as limiting when “[t]he specification is replete with references to the invention as [described in the preamble], including the title of the patent itself and the ‘Summary of the Invention.’” *Id.* at 23 (quoting *Poly-Am., L.P. v. GSE Lining Tech., Inc.*, 383 F.3d 1303, 1310 (Fed. Cir. 2004)). For these reasons, the Board should apply the construction that Petitioner asserted in the District Court, that the preamble of claim 1 as limiting.

The claim construction arguments expressly raised in the Petition regarding means-plus-function terms relate to issues not relevant to the arguments made in this Response, such that there is no need for the Board to make claim construction determinations about Section 112, Paragraph 6. *See* Pet. at 5-10; *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999); *Apple Inc. v. Uniloc Luxembourg S.A.*, IPR2018-00420, Paper No. 7 at 8 (PTAB Aug. 6, 2018). For reference, the District Court agreed with Patent Owner and ordered that the “control component” term has its plain and ordinary meaning and is not subject to means-plus-function treatment. Ex. 2002 at 3-4.

In its institution decision, the Board determined, for the purposes of institution, that the preamble of '767 patent claim 1 is limiting. (Paper 9 at 10.) The parties had agreed to that construction in their related district court litigation. (Ex. 3001 at 10.)

In its institution decision, the Board determined, for the purposes of institution, that the term “driving component” is a means-plus-function term, with a function “drives the moveable component in each of two opposite directions” and a corresponding structure that includes “coils 420, 514, 626, 1202, 1204, 1302, 1304, 1412, 1414, 1510 (also shown in Figs. 16–17); electromagnets shown in Figs. 10–11; and equivalents thereof.” (Paper 9 at 10–11.) The parties had agreed to that construction in their related district court litigation. (Ex. 3001 at 11.)

In its institution decision, the Board determined, for the purposes of institution, that the term “control component” is not a means-plus-function term. (Paper 9 at 11.) In particular, the Board determined that: “Given the context provided by claim 1 as a whole, a person having ordinary skill in the art would have understood the ‘control component’ as identifying a specific structure (requiring a microprocessor, control program, and switch as claim 1 recites).” (Paper 9 at 11.)

Patent Owner agrees that the limitations in claim 1 including “microprocessor,” “control program,” and “switch” identify specific structure for performing the functions of the “control component.” The means-plus-function provision of 35 U.S.C. § 112 ¶ 6 therefore do not apply.

VII. OBVIOUSNESS

A. Limitation [1.5.3] (All Grounds, All Claims)

Limitation [1.5.3] of the ’767 patent includes the requirement of “a switch that receives a directional signal d from the processor.” (’767 Patent at 11:21–22.) For each of the grounds of the -00698 IPR, the petition relies on Izumi as teaching this feature.

For example, Ground 1A relies on a combination of Izumi with Cosper, but both in the petition and in the declaration of Dr. Hannaford it relies upon the only citations to prior art for this limitation are citations to Izumi. (Petition at 27–28; Ex. 1003, ¶¶ 134–138.) Ground 1B adds citations to the Rossi reference for limitation [1.5.3], but not for evidence of a processor or that the processor is the source of the directional signal d. (Petition at 36–38; Ex. 1003, ¶¶ 150–151.) Grounds 1C, 1D, 2A, and 2B add no further citations to prior art references for limitation [1.5.3]. (Petition at 51–53, 71, 74; Ex. 1003, ¶¶ 153, 175, 219, 228.) Accordingly, all grounds rest on the Ground 1A citations to

Izumi to satisfy the “switch that receives a directional signal d from the processor” limitation. (Ex. 2009, ¶ 92.)

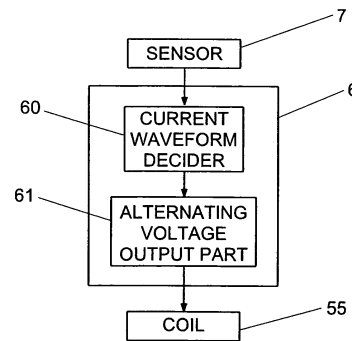
Focusing on Ground 1A then, the sole argument presented for this limitation is the following paragraph (Petition at 28):

In the combination, the switch receives the control signals (e.g. S1-S4) from the microprocessor. APPLE-1005, [0060] (“The switching elements Q1 to Q4 are controlled by control signals S1 to S4, respectively, which are inputted into the base terminals by the current waveform decider 60.”); see also [0049]-[0051], [0057]-[0059], [0061]; APPLE-1003, ¶138.

The evidence presented by Dr. Hannaford for this aspect of limitation [1.5.3] is substantively the same as in the paragraph quote above. (Ex. 1003, ¶ 138.)

All that the quoted portion of Izumi says is that the control signals come from “the current waveform decider 60.” (Ex. 1005, ¶ [0060]; Ex. 2009, ¶ 95.) Nowhere does Izumi say that the current waveform decider is a “microprocessor” or that the arrow in Figure 2 connecting it to “alternating voltage output part” 61 is a signal “from [a] processor” (Ex. 1005, Fig. 2.):

FIG. 2



None of the cited paragraphs [0049]-[0051], [0057]-[0061] mentions a processor or suggest that the output of the current waveform decider is—or even would be obvious to be—a signal “from the processor.” (Ex. 2009, ¶ 96.)

A different paragraph of Izumi mentions a “CPU”:

Although each of the ON-time and the OFF-time of the voltage is controlled in order to form the intended current waveform in this embodiment, in the actual real time control, it can be difficult to perform complicated control at every half-cycle or one cycle of the moving element 1 due to a constraint of the control device, *such as CPU speed, ROM capacity*, etc. So, the controller may control a ratio of the ON-time (T1) to the OFF-time (T2), namely a duty ratio (T1/T2), while keeping the sum of the ON-time and the OFF-time (T3=T1+T2) constant. *That is, the controller may use a so-called PWM control method. In this case, the controller 6 can form an intended current waveform without using a complex control system.*

(Ex. 1005, ¶ [0063].)

While this mentions a CPU, it does not mention a directional signal d that is “from the [CPU].” (Ex. 2009, ¶ 98.) Rather, it suggests that any CPU would not be a signal “from” the CPU, because implementing such a “complex control system” on the CPU would run into constraints of “CPU speed” or “ROM capacity.” (*Id.*) Instead, this paragraph suggests that the controller form the waveform using “PWM control.” (Ex. 1005, ¶ [0063]; Ex. 2009, ¶ 98.)

A POSITA would understand that “PWM control” would not require that the directional signal itself be generated by, or otherwise be “from,” a processor. (Ex. 2009, ¶ 99.) Indeed, a POSITA would understand that pulse width modulation (PWM) can readily be performed by entirely analog circuit, such as the following circuit from a Texas Instruments reference design, taking an analog voltage V_{IN} as its input:

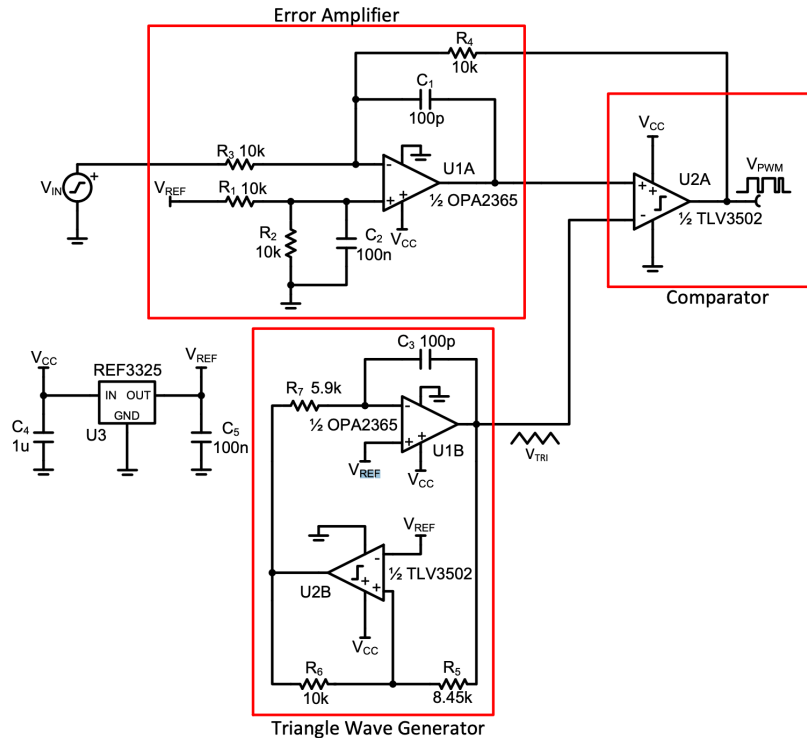


Figure 2: Complete circuit schematic with functional portions highlighted.

(Ex. 2017 at 3; Ex. 2009, ¶ 99.)

For these reasons, Izumi does not teach the claimed “switch that receives a directional signal d from the processor.” (Ex. 2009, ¶ 100.) Dr. Hannaford’s backup argument that it would be obvious to modify Izumi to satisfy this limitation provides no motivation for doing so, beyond the assertion that it “would have furthered Izumi’s straightforward teachings, and efficiently utilized the microprocessor of the combined system.” (Ex. 1003, ¶ 136.) But as explained above, Izumi’s only teachings that mention a CPU are describing the “constraints” that stand in the way of implementing a “complex control system” on the CPU. (Ex. 2009, ¶ 100.) Neither the petition nor Dr. Hannaford

point to any motivation a POSITA would have had to disregard these teachings and utilize “a directional signal d from the processor” anyway. (*Id.*)

Because Apple has failed to show that the prior art discloses a “switch that receives a directional signal d from the processor” and has failed to demonstrate that a POSITA would have been motivated to modify the art to add this feature, it has failed to show that claim 1 or any of claims 2–5 that depend from it are obvious under any of the proposed grounds. (Ex. 2009, ¶ 101.)

B. Limitations [2.3] and [2.4] (Grounds 1B, 1D, and 2B)

Claim 2 of the ‘767 Patent includes the limitations:

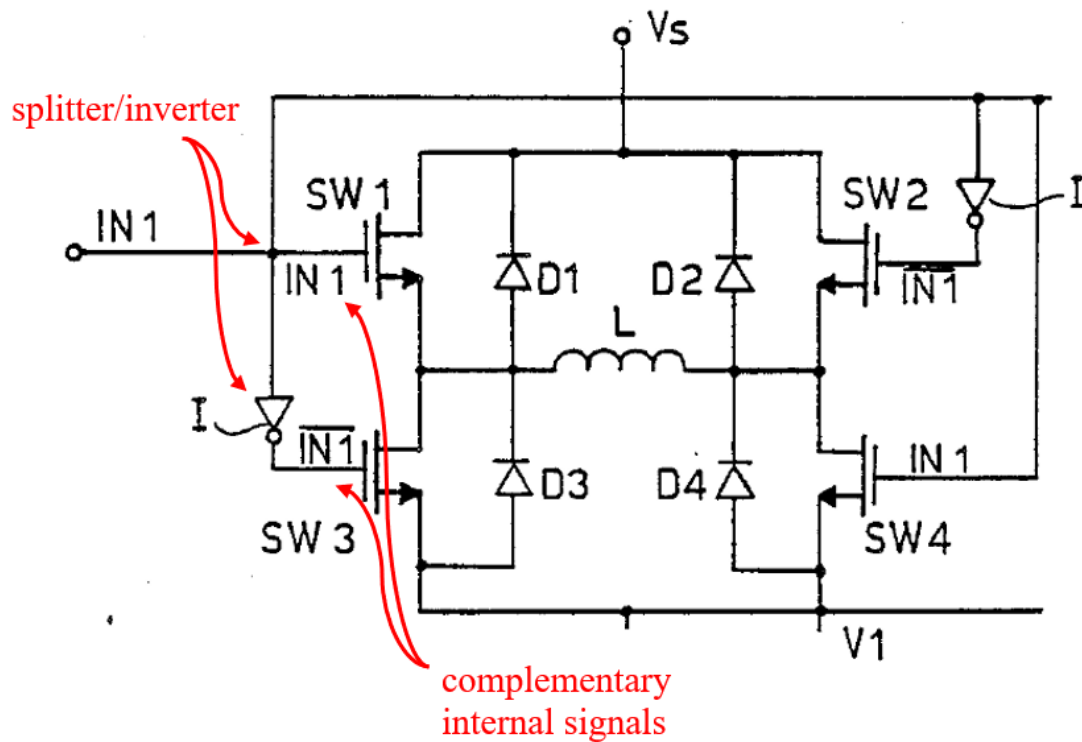
[2.3] a directional-signal splitter/inverter that generates *two complementary internal signals, d and $\bar{d}$* , corresponding to directional-signal d ; and

[2.4] *two pairs of solid-state switches, a first switch of each pair controlled by internal signal d and a second switch of the pair controlled by internal signal $\bar{d}$* , that apply the input voltage in a first direction to the driving component when the d is in a first voltage state and that apply the input voltage in a second direction to the driving component when the d is in a second voltage state.

(‘767 Patent at 12:3–12.)

Claims 3–5 depend from claim 2 and thus also include these limitations. ('767 Patent at 12:13–33.)

To satisfy these limitations in each of Grounds 1B, 1D, 2B of -00698 IPR, the petitions depend on the “H-bridge switching circuit” of the Rossi reference (Petition at 30–31, 40–45, 51–52, 75; annotated figure is from Petition at 41):



As the petitions state, each of the symbols made up of a triangle with a small circle at one vertex, labeled “I,” is an inverter. (Petition at 40.) According to the petitions, the junction and inverter “I” with red arrows pointing to them correspond to the “splitter/inverter” of limitation [2.3], and the signals

“IN 1” and “ $\overline{\text{IN 1}}$ ” correspond to the claimed internal signals d and $\bar{d}$ of limitation [2.3], respectively. (Petition at 40.)

As for limitation [2.4], the petitions point to switches “SW2” and “SW3” of the Rossi figure as corresponding to the “second switch” of each pair. (Petition at 42.) But these switches fail to satisfy the limitation “controlled by internal signal $\bar{d}$,” as required by [2.4]. (Ex. 2009, ¶ 105.) While each of SW2 and SW3 is shown receiving a signal labelled “ $\overline{\text{IN 1}}$,” only the signal received by SW3 is the “internal signal $\bar{d}$,” i.e. the signal generated by the splitter/inverter of limitation [2.3]. (*Id.*) The signal labelled “ $\overline{\text{IN 1}}$ ” that is received by SW2 is generated by a different inverter “I” on the right hand side of the circuit diagram. (*Id.*)

For these reasons, the “H-bridge switching circuit” of Rossi does not satisfy both limitation [2.3] and [2.4], as they appear together in claims 2–5 of the ’767 patent. (Ex. 2009, ¶ 106.) As a result, the petitions fail to establish that any of these claims is obvious under any of their asserted grounds.

C. Failure to Satisfy Either “Vibration Sensor” or “Continuously Monitors Output from the Vibration Sensor” in Claim 3 (Grounds 1B and 2B)

Limitation [3.1] of the ’767 patent adds the requirement of “a vibration sensor.” (’767 patent at 12:15.) For this “vibration sensor,” each petition points to an “accelerometer” that is distinct from the sensors that were mapped

to the limitations of claim 1. (Petition at 45.) Specifically, the petition in this proceeding points to “a vibration sensor (*accelerometer in accordance with Cosper*) in addition to the sensors associated with ‘position’ and ‘velocity’ that are used as part of the feedback control.” (Petition at 45.)

The petition cites nothing in Cosper or any other reference that is allegedly an accelerometer. (Ex. 2009, ¶ 108.) It does cite to a declaration of Dr. Hannaford’s. (Petition at 45.) Dr. Hannaford is clear in each declaration that he is pointing to an “accelerometer” that is “in accordance with Cosper.” (Ex. 1003, ¶ 162.) But like the petition, his declaration do not point to anything in Cosper that is allegedly an accelerometer. (Ex. 1003, ¶ 162.) The only exhibit that either the petition or Dr. Hannaford’s declaration points to for this limitation that actually mention an accelerometer is the ’767 patent itself. (Petition at 45, Ex. 1003, ¶ 162.)

For these reasons, the petition fails to identify what in the prior art it points to as the claimed “vibration sensor” or what the claimed “vibration sensor” would be in the proposed combination. (Ex. 2009, ¶ 109.)

The petition also fails to explain why a POSITA would have been motivated to add a separate accelerometer for adjusting frequency, in addition to the sensors already being used for the feedback control in the mapping of claim 1. (Ex. 2009, ¶ 110.) While Cosper speaks generically of “one or more

sensors,” (Ex. 1009, ¶ [0050]), it never mentions an accelerometer, let alone an accelerometer in combination with other sensors measuring position and velocity. (Ex. 2009, ¶ 110.) The petition and Dr. Hannaford fail to explain why a POSITA would be motivated to use this particular combination of sensors, in a way that would satisfy claim 3, either to achieve the oscillation near resonance desired in Cosper or for any other reason. For these reasons, each petition fails to show that a combination satisfying limitation [3.1] would have been obvious. (*Id.*)

Limitation [3.2] of the ’767 patent adds the requirement that the control program “continuously monitors output from the vibration sensor.” (’767 patent at 12:16–17.) Both the petition and the declaration from Dr. Hannaford that it cites fails to point to anything in the prior art references that teaches “continuous” monitoring or to explain why it would have been obvious to modify the prior art to perform such “continuous” monitoring. (Petition at 45–46, Ex. 1003, ¶ 163; Ex. 2009, ¶ 111.) Indeed, the only exhibit that either the petition or Dr. Hannaford’s declaration points to for this limitation that actually describes continuous monitoring is the ’767 patent itself. (Petition at 45–46, Ex. 1003, ¶ 163.) For these reasons, the petition fails to show that a combination satisfying limitation [3.2] would have been obvious. (Ex. 2009, ¶ 111.)

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 3,544 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. IPR2024-00698
U.S. Patent No. 8,093,767

CERTIFICATE OF SERVICE

I hereby certify that “Patent Owner’s Preliminary Response” was served on
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