No. 24-129

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

IN RE APPLE INC.,

Petitioner.

On Petition for Writ of Mandamus to the United States District Court for the Western District of Texas, No. 7:23-cv-00077-ADA, Judge Alan D. Albright

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RESONANT SYSTEMS, INC.'S NON-CONFIDENTIAL RESPONSE TO APPLE'S PETITION FOR WRIT OF MANDAMUS

June 17, 2024

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UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

CERTIFICATE OF INTEREST

Case Number 2024-129

Short Case Caption In re: APPLE INC.,

Filing Party/Entity Respondent, Resonant Systems, Inc.

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Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities. ☑ None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities. ☑ None/Not Applicable
Resonant Systems, Inc.		

☐ Additional pages attached

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CONFIDENTIAL MATERIAL OMITTED

Materials are omitted solely because Resonant owes a duty of confidentiality for materials that Apple and Cirrus deemed confidential.

Pages 2, 5, 9, 16, 24, and 25 omit Apple's specific headcount of employees at its Austin campus with an engineering, finance, marketing, or similar degree.

Pages 4, 5, 9, 28, and 29 omit the specific class of electrical component supplied by Cirrus.

Pages 5 and 8 omit a type of agreement that Apple deems confidential.

Page 5 omits job titles that Apple deems confidential.

Page 29 omits a type of financial business arrangement between Apple and Cirrus.

INTRODUCTION

Apple's mandamus petition stems from its own failure to supply evidence that allows the district court to compare the relative convenience of the Northern District of California ("NDCA") and the Western District of Texas ("WDTX"). Proving whether transfer is clearly *more* convenient does not require proving a negative or "refut[ing] any hypothetical possibility of relevant connections to the transferor forum." Pet. at 1. But "clearly more convenient" requires more than simply proffering evidence in favor of the movant's preferred forum, while remaining willfully blind to all evidence of relevance of the plaintiff's chosen forum—which is precisely what Apple did here.

Apple attempted to meet the standard using declarations solely from NDCA-based employees swearing that they were "not aware" of relevant employees or sources of proof in Texas. The district court took these declarations at face value, that the declarants had no personal knowledge of what happens at Apple's Austin offices. The district court reasonably declined to extend their limited testimony as definitive proof that no evidence exists in Texas, especially because (1) Apple's primary declarant limited his testimony to one accused component and excluded all other accused components, (2) Apple refused to provide discovery regarding its Texas sources of proof, (3) Apple completely withheld the methodology it used to investigate its Texas sources of proof, and (4) some of Apple's number Austin employees worked on accused products. Resonant provided evidence regarding Texas's connections to this case by identifying relevant third-party Cirrus Logic, Inc. ("Cirrus"), who designs and sells accused components, along with eleven witnesses with relevant, material knowledge regarding these components.

Apple's arguments boil down to its disagreement with the district court's credibility assessments, weighing of facts, and refusal to extend declarations beyond what they say. But the transfer analysis involves "fact-intensive matters often subject to reasonable dispute," the resolution of which is "entrusted to the discretion of the district court." *In re Apple Inc.*, 818 F. App'x 1001, 1004 (Fed. Cir. 2020) ("*Apple I*"). Apple's petition should be denied.

BACKGROUND

I. Apple's History of Transfer Discovery Abuse

The hard numbers show that because Apple's employees and suppliers are spread throughout the country, Apple's employees and suppliers should statistically find trial about equally convenient in both venues. SAppx85 (summarizing SAppx73–83). To defy these statistics and manufacture arguments for transfer in every recent patent case in Texas, Apple selectively presents biased evidence. *Scramoge Tech. Ltd. v. Apple Inc.*, No. 6:21-CV-00579-ADA, 2022 WL 1667561, at *2–4 (W.D. Tex. May 25, 2022) (explaining history of Apple's discovery abuse).

> Worst of all, the [Apple] Declaration uses language that carefully limits the scope of declared facts to his personal, selectively fed knowledge. For example, the Mr. Rollins's supplemental declaration states, "I am not aware of any Apple employees located in WDTX who worked on the research, design, or development of the Accused Features." Then, his qualified statements are cited by Apple's attorneys in transfer motions as though they are authoritative truths. . . . the [Apple] Declaration contains no description of the methodology he used to find all Apple engineers who work in WDTX and to then determine their relevance.

Id. at *3. When these overextended, "authoritative truths" argued by Apple's attorneys are rebutted by evidence, Apple's declarations have "little to no evidentiary value." *Id.* at *3–4.

Apple's discovery misconduct history is unique. Other tech companies like Meta (Facebook) and Google are forthcoming with their evidence and methodology. *XR Commc'ns v. Apple Inc.*, No. 6:21-cv-00620, Dkt. 72 at 7–10 (W.D. Tex. Sept. 9, 2024) (hereinafter "*XR Comms*"). For example, Meta provided discovery about "every employee in every group that the plaintiff contended was relevant" using reliable methodology. *Id.* at 8. Google's declarant Mr. Rope conducts independent, multi-day investigations and interviews more than twenty individuals to inform his knowledge of just four of Google's products. *Id*. Apple's witness spoke to just five people at Apple to inform his knowledge about 50 products. *Id.* at 11.

Here, the district court found that "Apple appears to be up to some of its old tricks." Appx10.

II. Resonant Filed in Texas, Where Apple's Thousands of Engineers Work on Accused Products and Where Cirrus Can Be Compelled to Testify

Resonant filed in the WDTX before Judge Counts. Appx39. The patents-in-suit generally relate to haptic vibration technology that can make certain iPhones vibrate in a very specific way when receiving a message or call. *Id.* Exemplary claim 1 of asserted patent 9,941,830 recites: "A vibration module comprising: a housing; a moveable component; a power supply; user-input features; a driving component that drives the moveable component 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 one or more stored values." SAppx31. Because it is undisputed that the accused iPhones have a housing, receive user input, and can vibrate, trial will likely focus on the delivery and control of power via Cirrus's part to oscillate at the specifically claimed frequency and amplitude. *See* SAppx40–53 (showing technological complexity). On November 10, 2023, shortly after Apple filed its transfer motion, Apple made a production of relevant documents, of which 2,419 include the word "Cirrus."

Resonant filed this case in Texas because Apple has thousands of likely relevant employees there, and Texas is the only place where Cirrus can be compelled to testify.

At its Austin campus, Apple has number employees in engineering, finance, accounting, or marketing. Appx154–221. Some of these employees worked on the accused products. Appx20–21 (confidential agreement by Apple); Appx228. The combination of this evidence and job titles makes it likely that Apple's title engineers" integrate and lay out the accused vibrating components in the accused phones; that Apple's title engineers work on the interface of Cirrus's analog component with digital controllers; that Apple's title and title engineers validate or verify the designs of Zhang's team; and that Apple's title engineers work on power delivery to the Taptic Engine using Cirrus component that Zhang knew nothing about. Appx154–221.

Cirrus is headquartered in Austin, Texas and supplies Apple with certain part components that infringe the claimed "driving component" and/or[1] "control component" in the Asserted Patents. SAppx31, SAppx35. Cirrus's components are accused in both this Apple case and the related Samsung case. *See* Appx230 (identifying Samsung case). Resonant needs technical information from Cirrus to determine whether its components cause the accused resonators to vibrate

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[1] Until Apple and Cirrus produce confidential engineering schematics later in discovery, it remains unclear which element is infringed, preventing Resonant from serving final infringement contentions.

as specifically claimed, and Resonant needs financial information from Cirrus for damages apportionment.

III. Apple Moved to Transfer Based on Limited Declarations, Withholding Methodology, and Withholding Evidence That It Had the Burden of Producing

On October 10, 2023, Apple moved to transfer to the NDCA. Appx95. Apple's motion relied on four declarations (Zhang, Ankenbrandt, Spevak, and Goldberg). None of them live or work in Texas, so none of them have any personal knowledge about who works at Apple's Austin campus. Appx116–126. Contrary to Apple's attorney arguments, none of these witnesses affirmatively declared that there are no relevant Apple witnesses in Austin.

Resonant sought the basis for the statements of Apple's declarants and issued and interrogatory for "the complete methodology used by each of Apple's declarants," providing Apple the opportunity to explain the full extent of the investigation conducted by its declarants and why it is reliable. Appx243. Apple responded by hiding the entire methodology behind a privilege objection. *Id.*; Appx224 at 2 ("Resonant is seeking privileged information, Apple will not provide such information."). Thus, Apple's declarants did not conduct *any* independently nonprivileged investigation—everything was fed by Apple's attorneys. *Id.* Resonant wanted to know what type of searching they conducted, whether it was thorough, whether they actually went to Apple's Austin campus to investigate, and whether they may have overlooked things or made erroneous assumptions. Despite the district court previously warning Apple against using unreliable methodology in comparison to Google and Facebook, Apple further downgraded the reliability of its methodology by completely withholding it from the district court. *Scramoge*, 2022 WL 1667561, at *2–4; *XR Comms* at 7–9.

Whatever the privileged methodology was, it caused every Apple declarant to overlook Cirrus. Appx116–127. Additionally, it caused Zhang to focus on the "Taptic Engine" and exclude other accused components like the A9-A17/M1/M2 chips. Appx122–125 ¶ 12; Appx11.

Resonant served the maximum amount of venue discovery requests allowed by the Court's default rules. Appx234–244. Given the vague limitations in Apple's declarations, Resonant demanded that Apple perform an objective investigation by identifying the number of employees in Austin who have emails that hit uniquely relevant search terms, including terms like A9-A17/M1/M2 omitted from Apple's declarations. Appx242. To spare Apple from burdensome doc review, Resonant sought only the custodian hit counts, not the underlying emails themselves. Still, Apple refused, presumably for fear that a high hit count would demonstrate the relevance of its Austin employees and expose flaws in Apple's investigation methodology.

Resonant also demanded that Apple identify all relevant witnesses "east of the Mississippi River" because, after Apple filed its motion, these witnesses had become relevant again after *In re TikTok* restored the "rigid" application of the Fifth Circuit's 100-mile rule. *See infra* pp. 23–24; *In re TikTok, Inc.*, 85 F.4th 352 (5th Cir. 2023). Apple again refused. Appx236; Appx231 ("Apple has not generated lists of all Apple employees east of the Mississippi River . . . who may be knowledgeable about the accused products").

Resonant also demanded that Apple produce 1) the evidence supposedly in the NDCA and 2) the evidence supposedly reviewed by Apple's declarants. Apple again refused, preventing Resonant from assessing the quantity or reliability of the evidence. Appx225. Apple never allowed Resonant to inspect the evidence at Apple's NDCA office under Fed. R. Civ. P. 34, even at Resonant's own travel cost and burden.

Apple eventually made a confidential agreement admitting to some relevance of its Austin employees. Appx20–21; Appx228.

Resonant subpoenaed Cirrus for evidence. Like Apple, Cirrus resisted discovery into its relevant Texas connections and even worked with Apple to furnish an unreliable declaration against transfer after venue discovery ended, when Resonant could no longer depose Cirrus's witness. *See* SAppx112–116 (criticizing this unfair tactic). After Resonant moved to compel Cirrus, Cirrus produced limited information, including the identification of 10 employees located in Austin who have relevant information about the operation, marketing, and/or accounting of the part components used in Apple's accused products. SAppx58–59 (identifying 10 relevant employees); SAppx63. Only six of these employees have access to Cirrus's part code in Austin. SAppx59. When served discovery seeking the quantity of relevant evidence Cirrus has in Austin (not the evidence itself), Cirrus objected that there was so much potentially relevant evidence to investigate that "it would be unduly burdensome" to even estimate its quantity. SAppx69–70.

IV. Resonant's Briefing Argues the Insufficiency of Apple's Evidence and Reliance on Outdated Law

On February 2, 2024, Resonant filed its opposition to Apple's transfer motion. Appx153. Resonant provided analysis and evidence showing that (1) Apple has 8,407 employees, 515 suppliers, and 13 manufacturing facilities in Texas; (2) number of these employees hold an engineering, software, finance, marketing, or similarly relevant position at its Austin campus; (3) Apple's Austin employees have worked on most of the products accused in this case; (4) Cirrus is a highly relevant third party supplier headquartered in Austin and with at least 11 potential witnesses located in Austin; (5) Cirrus has so much relevant electronic and physical evidence in Austin that it was too burdensome for Cirrus to even quantify; and (6) six Cirrus employees in Austin have access to its relevant source code. Appx138–147. Resonant argued that Apple's limited declarations failed to meet its burden of proof, especially given Apple's undisclosed, privileged methodology. Appx139–145.

Apple filed its reply with the declaration of Cirrus's non-attorney marketing manager who stated that Cirrus "will not object" to a NDCA subpoena to testify but with no explanation of his authority to waive Cirrus's legal objections. Appx251; Appx271. Resonant then filed a sur-reply to address the deficiencies in this improperly late-produced declaration. Appx766–768. Resonant's sur-reply also addressed Apple's misinterpretations and misapplication of Fifth Circuit transfer law, including the recent Fifth Circuit decisions *In re TikTok*, *supra*, and *In re Clarke*, 94 F.4th 502 (5th Cir. Mar. 1, 2024). Appx760–765; Appx768. Resonant argued that because the Fifth Circuit substantively changed transfer law after Apple filed its motion, Apple's original evidence legally failed to meet the Fifth Circuit's updated standards. Appx760–765; Appx768.

V. Related Briefing

While the transfer motion was pending before Judge Counts, Apple filed a motion to stay arguing that this District's "standard practice . . . require[s] this case to be stayed pending Apple's transfer motion." SAppx100. Resonant explained that Apple was wrong. Standard practice was to give transfer motions "top priority" and resolve them before a *Markman* hearing, not to *immediately* stay the case upon filing a transfer motion. SAppx133–134. Resonant worried that Apple was trying to take advantage of Judge Counts's relative inexperience with the district's standard practices, so Resonant noted that the dispute could be resolved by calling the Waco Division to ensure uniformity across the district. *Id.* n.1. The case was likely reassigned to Judge Albright to prevent Apple from misleading Judge Counts.

REASONS FOR DENYING THE PETITION

Mandamus is "reserved for extraordinary situations." *In re Sand Revolution LLC*, 823 F. App'x 983, 984 (Fed. Cir. 2020).

In the context of a motion to transfer, a petition must show of a "clear abuse of discretion that produced a patently erroneous result." *Apple I*, 818 F. App'x at 1003. When considering transfers under Fifth Circuit law, mandamus ***must be denied*** "unless it is clear 'that the facts and circumstances are without any basis for a judgment of discretion.'" *In re SK hynix Inc.*, No. 2021-114, 2021 WL 733390, at *3 (Fed. Cir. 2021)[2]; *see also In re True Chem. Sols., LLC*, 841 F. App'x 240, 241 (Fed. Cir. 2021) (Under the "exacting standard [of mandamus in the context of a transfer ruling], we ***must deny mandamus*** unless it is clear 'that the facts and circumstances are without any basis for a judgment of discretion.'"); *In re Vistaprint*

[2] All quotations cleaned up and emphases added unless otherwise noted.

Ltd., 628 F.3d 1342, 1347 (Fed. Cir. 2010) ("as long as there is plausible support of record" for a district court's decision to deny transfer, "we will not second guess such a determination, even if the convenience factors call for a different result"); *In re Genentech*, 566 F.3d 1338, 1347 (Fed. Cir. 2009) (mandamus relief should be denied "[i]f the facts and circumstances are rationally capable of providing reasons for what the district court has done").

"And even when those requirements are met, the court must still be satisfied that the issuance of the writ is appropriate under the circumstances." *In re Google LLC*, 823 F. App'x 982, 983 (Fed. Cir. 2020). As emphasized by this Court, mandamus relief should be issued "sparingly and ***only in 'extraordinary' circumstances***." *Apple I*, 818 F. App'x at 1003.

I. Apple Failed to Meet Its Heavy Burden to Show a "Clear and Indisputable" Right to Mandamus Relief

Apple had the sole burden of proving that transfer was not just convenient to some, but that its chosen venue is *clearly more* convenient and that significant convenience will *actually* materialize. *In re Clarke*, 94 F.4th at 508. Apple's evidence merely proved that the NDCA would be more convenient for a select subset of witnesses. Apple's evidence did not allow the district court to perform any assessment of relative convenience of all witnesses who will materialize at trial, much less prove it with clarity.

Apple's petition reveals Apple's twisted, underlying motivation: "defendants will be forced to undertake highly burdensome investigations" under the Fifth Circuit's standard of proof, so Apple should be allowed to ignore it by presenting only limited, favorable evidence and withhold unfavorable evidence that it deems too burdensome. Pet. at 42. This allows Apple to save the small cost of email searching while the 11 Cirrus witnesses incur great costs of a weeklong trial in the expensive city of San Francisco. *Greenthread, LLC v. Intel Corp.,* No. 6:22-CV-00105-ADA, 2022 WL 4004781, at *6 (W.D. Tex. 2022) (addressing insincere "burden" objections).

A. The district court applied the correct legal standard for motions to transfer, as recently clarified by the Fifth Circuit.

Fifth Circuit law controls the transfer analysis under § 1404. *In re EMC Corp.*, 677 F.3d 1351, 1354 (Fed. Cir. 2012) ("transfer motions are governed by regional circuit law"). When Federal Circuit decisions conflict with Fifth Circuit law, Fifth Circuit law controls. *Panduit Corp. v. All States Plastic Mfg. Co.*, 744 F.2d 1564, 1575 (Fed. Cir. 1984).

Transfer is appropriate *only if* the moving party "clearly establishes good cause" by "clearly demonstrating that a transfer is for the convenience of parties and witnesses, in the interest of justice." *In re Clarke*, 94 F.4th at 508. "It is the movant's burden—and the movant's alone—to 'adduce evidence and arguments.'" *Id*. at 508.

The Fifth Circuit articulated the burden of proof:

> At minimum, showing "good cause" requires the movant "clearly to demonstrate" that its chosen venue is "clearly more convenient." That standard is not met if the movant merely shows that the transferee venue is more likely than not to be more convenient. Likewise, the fact that litigating would be more convenient for the defendant elsewhere is not enough to justify transfer.
>
> Accordingly, to establish "good cause," a movant must show (1) that the marginal gain in convenience will be *significant*, and (2) that its evidence makes it plainly obvious—i.e., clearly demonstrated—that those marginal gains will *actually* materialize in the transferee venue.

Id. (emphases in original). This burden is not just a preponderance. The district court correctly applied the burden of proof to Apple's motion to transfer venue. *See* Appx3–5 (reciting Fifth Circuit law).

The district court never required Apple to "prove a negative" or "dispel any hypothetical possibility that might support litigation in the transferor forum." Pet. at 20, 42. What Apple really suggests is that it need not rebut the evidence proving that Apple's privileged methodology produces incomplete results.

Apple blatantly attempts to reverse the burden of proof by blaming Resonant for failing to identify relevant employees in Texas and for not deposing Apple's declarants "to probe the limits of their investigations into Texas." Pet. at 28. Resonant was not required to spend resources deposing Apple's witnesses to help Apple carry its own burden of proof, especially when Apple asserted blanket privilege about methodology. If Apple fails to meet its initial evidentiary burden, Resonant need not produce any evidence.

Apple's assertion that the district court erred in finding that "a movant cannot meet its burden solely by offering evidence on 'one side'" (Pet. at 21) is telling. Apple is asking this Court to bless its strategy of only providing evidence in support of it preferred forum while remaining willfully blind unfavorable evidence. This has never been permitted. "At bottom, the transfer factors are *relative*," and the standard has always been to prove that transfer is not just convenient to some, but clearly *more* convenient. *In re Clarke*, 94 F.4th at 508, 510 (emphasis in original).

Given Apple's refusals to produce necessary evidence, the district court correctly concluded: "[t]he Apple declarations therefore prohibit the Court from meaningfully comparing NDCA's apples to WDTX's apples," and "the Court cannot weigh relative ease of access to Apple materials between the two districts." Appx13.

B. The district court made no reversable inferences

Apple's argument about the district court's inferences cannot rise to the level of mandamus relief. *Apple I*, 818 F. App'x at 1003 ("whatever may be said about the validity of drawing inferences and resolving factual disputes in favor of the non-moving party in the context of a transfer motion, we cannot say that Apple's right to relief here is indisputably clear.") The district court had authority to do so. Appx9 n.59.

Apple fails to actually identify any baseless inferences made by the district court. For example, the district court did not weigh any of Apple's 2,351 Austin employees against Apple's three named declarants. Any conclusions about the lack of evidence and/or limits of the declarations are not "adverse inferences"—they are clearly supported factual findings.

All of Apple's cases about inferences are distinguished. None of those cases involve a fact pattern where the declarant 1) hides its entire methodology used for investigation, 2) limits its declarations to just one of many accused components, and 3) withholds the evidence. Apple's transfer evidence is uniquely poor in quality. *XR Comms* at 7–10.

Even if the district court inferred that Apple has at least some relevant witnesses and evidence in WDTX, such inference was justified given Apple's history of hiding evidence and submitting declarations based on unreliably incomplete investigations, especially compared to Meta and Google. *Id;* Appx10 n.65 ("Apple appears to be up to some of its old tricks"). Apple should have jumped at the opportunity to explain why its methodology thoroughly uncovered all relevant witnesses instead of hiding behind privilege. Appx224. Apple should have rolled out the red carpet for Resonant to go to its NDCA office to see all the evidence that could not be conveniently relocated to Texas. Appx225. This is what Meta did when it "had nothing to hide." *XR Comms* at 8.

C. The district court had "broad discretion" to determining the limits of Apple's declarations, and this Court must "defer heavily" to such credibility determinations.

Apple's assertion that the district court legally erred in discounting Apple's declarations (Pet. at 26) also fails.

The district court gave Apple's employee declarations their *full face value* "to the extent that they speak to the declarants' personal experience," and *accepted* Zhang's declaration ("I am not aware of any *third party* in Texas involved in developing the *Taptic Engine* modules in the Accused Products")[3] to mean what it said—nothing more, nothing less. Appx10; Appx18; Appx125. The district court had no obligation to interpret Zhang's statement to mean, "there are clearly no relevant Apple employees in the Austin office for any accused component, including the A9–A17/M1/M2 chips."

DIRECTV does not require the inference Apple seeks. *DIRECTV* requires a district court to credit information that is "reasonably within" a declarant's "sphere of responsibility." *DIRECTV, Inc. v. Budden*, 420 F.3d 521, 530 (5th Cir. 2005).

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[3] This is Apple's best evidence for its erroneous assertion about the "vast majority of witnesses" in its Issued Presented. Pet. at 4–5.

None of the accused A9–A17/M1/M2 chips fall in Zhang's sphere of responsibility, nor does he declare any responsibility for Apple's Austin employees. The evidence shows many employees with different job tiles outside of Zhang's sphere. Appx154–221.

Otherwise, the district court articulated good reasons for finding Apple's declarations limited: Apple failed to "identify with specificity as to the documents and the location of the documents," and "Apple chose declarants who lack personal knowledge (1) as to employees located at Apple's Austin campus and (2) any access to relevant evidence those employees may possess." Appx9. Egregiously, Apple refused to provide a "description of the methodology used to find all relevant sources of proof in WDTX," and Apple refused to provide discovery on its sources of proof located in WDTX. Appx12–13. Given these deficiencies, the district court was unable to "meaningfully determine whether Apple's sources of proof are 'relatively easier to access' in NDCA than WDTX." *Id.*

Apple's argument that "the district court had no reason to disbelieve the adequacy of the investigations performed by Apple's declarants," lacks merit. Pet. at 37. First, the district court had good reason to do so given that Apple completely withheld their methodology, especially after being warned to articulate a reliable methodology. Second, the declarants merely stated that they were personally "not aware" of Texas employees, and the district court *believed* this and merely declined to draw further inferences without the underlying methodology.

Apple's cases about the limits of declarations are again distinguished for the same reasons. None involve a fact pattern where the declarant 1) hides its methodology, 2) limits its declarations to just one of many accused components, and 3) withholds the evidence. In *Google*, a witness provided "*sworn, unequivocal deposition testimony* from each [Texas] employee [identified by the plaintiff] explaining that none of them work on the accused features." *In re Google LLC*, 58 F.4th 1379, 1384 (Fed. Cir. 2023). Further, the declarant specifically identified eleven Google employees in the NDCA and their areas of knowledge, and her investigation "found no Google employee in the Western District of Texas who worked on what Google understood to be the accused features." *Id.* Here, Apple never unequivocally denied the existence of relevant employees in Texas, nor did it do any nonprivileged investigation into Austin.

In re Juniper Networks, Inc. is distinguished because the witness affirmatively declared the NDCA to have the "majority" of evidence, and it was "undisputed that no Juniper evidence relating to the facts of these lawsuits is located in the Western District of Texas." 14 F.4th 1313, 1321 (Fed. Cir. 2021).

In re Netflix, Inc. found that the district court improperly required Netflix to "articulate the precise way that evidence supports its claim." No. 2022-110, 2022 WL 167470, at *3 (Fed. Cir. Jan. 19, 2022). The district court imposed no precision requirement here. Instead, it sought was a sufficient "factual foundation necessary to evaluate the relative convenience" because Apple completely withheld its methodology. Appx8.

Apple's unsupported argument that "Apple is not cherry-picking declarants or information to avoid revealing Texas-based connections" (Pet. at 30) should be rejected. The record speaks for itself—the declarations omit Cirrus and the A9–A17/M1/M2 chips, and Apple refused to search for other relevant witnesses east of Texas. The district court is far better positioned to assess the credibility and reliability of Apple's evidence and deserves substantial deference. *Celsis In Vitro, Inc. v. CellzDirect, Inc.*, 664 F.3d 922, 929 (Fed. Cir. 2012) ("The district court is best suited to make credibility determinations, and we accord such determinations deference."); *Agfa Corp. v. Creo Prod. Inc.*, 451 F.3d 1366, 1379 (Fed. Cir. 2006) ("This court must defer heavily to the trial court's credibility determinations.… Credibility determinations by the trial judge can virtually never be clear error."). Deference is especially appropriate given Apple's history with the district court.

D. The district court applied Fifth Circuit precedent without any clear abuse of discretion.

1. The district court reasonably determined that the relative ease of access to sources of proof is neutral or weighed against transfer.

The district court's analysis complied with controlling precedent. It carefully analyzed and weighed the evidence (and lack thereof) before it, providing six pages of reasoned analysis for this factor. Appx8–14.

It concluded that "[t]he issue is that Apple has failed to provide the factual foundation necessary to evaluate the relative convenience of the present and proposed venues." Appx8. Not only did Apple provide declarations that were too "vague and generalized," and fail to "identify with specificity as to the documents and the location of the documents," Apple further refused Resonant's request to inspect the evidence. Appx9; Appx13. "Apple chose declarants who lack personal knowledge" about Apple's Austin campus and what evidence may be there, preventing the district court from knowing where the bulk of relevant evidence was. Appx8–9. The district court found troubling that Zhang's declaration "only declares as to his personal knowledge related to Taptic Engines" and ignored several other accused components. Appx11. Apple's "limited declarations . . . do not allow the Court to understand which electronic documents are accessible in each district, which are limited by access rights, whether Apple employees in WDTX have those access rights, whether physical sources of proof also exist in WDTX, and where the data centers are located that store shared documents." Appx13.

Fundamentally, Zhang's statement about his lack of personal knowledge of third parties in Texas who work on the Taptic Engine did not allow the district court to perform a relative weighting of the evidence that will materialize at trial with any degree of clarity. Because the standard is one of "relative" ease of access, Apple needed to "do more than thumb one side of the scales to meet its burden." Appx10.

If anything, the district court erred because it gave *too much* weight to Apple's undisclosed evidence. Apple's evidence deserved **no weight** because Apple refused to allow Resonant to inspect the relevant evidence that was supposedly in California or supposedly relied on by its declarants. Appx13; Appx146; Appx225. Under Fed. R. Civ. P. 37(c), Apple was "not allowed to use that information . . . to supply evidence on a motion" when it blocked inspection and production.

This case is unlike *In re Amazon.com, Inc.*, No. 2022-157, 2022 WL 17688072 (Fed. Cir. Dec. 15, 2022) because Apple's evidence and discovery misconduct is distinguished. In that case, unlike here, the district court made no findings regarding the Amazon's failure to provide the factual foundation necessary to weigh the relative ease of access to sources of proof factor. This case is more analogous to *In re Apple Inc.*, 743 F.3d 1377 (Fed. Cir. 2014) ("[I]n light of 'Apple's vague assertions and unknown relevance and location of potential sources,' the district court was unable to weigh the relative ease of access to sources of proof factor in its transfer analysis, because 'the weighing of this factor would be merely speculative.'").

2. The district court correctly analyzed compulsory process

Apple does not dispute the compulsory process analysis was reasonable. Apple instead objects to the district court's analysis of the willing witnesses factor.

3. The district court reasonably determined that the cost of attendance for willing witnesses weighed against transfer

The district court articulated that the Fifth Circuit's *TikTok* decision restored the rigid application of the 100-mile rule. Appx17 (citing *In re TikTok*, 85 F.4th at 361–62); *In re Apple Inc.*, 979 F.3d 1332, 1341–42 (Fed. Cir. 2020) (finding error in "rigidly" applying this rule); Appx760 (explaining history). The district court then noted its obligation to "assess the relevance and materiality of the information the witness may provide." Appx18 (citing *Genentech*, 566 F.3d at 1343).

If anything, the district court erred in Apple's favor. Under the Fifth Circuit's reinstated rigid formulation of the 100-mile rule, Apple's refusal to investigate relevant employees east of the Mississippi is *per se* insufficient to weigh the conveniences of these relevant witnesses who would have found Texas more convenient. Apple's motion should have been denied due to evidentiary insufficiency caused by the intervening change in law.

There can be no error in favor of Resonant. The district court considered the parties' named witnesses, agreeing that all of Apple's named witnesses (Zhang, Spevak, and Ankenbrandt), as well as representatives its NDCA suppliers, will materialize at trial and find the NDCA more convenient. Appx18–19; Appx22. The district court rejected Resonant's argument that Apple's witnesses were of "dubious value." Appx18.

But as to Apple's other 85 unnamed employees, the district court found it "cannot consider them without being caused to speculate." Appx19. The district court cited *Genentech*, multiple secondary sources, and multiple decisions from courts in the Fifth Circuit applying the longstanding rule that where the moving party has merely made a general allegation that certain witnesses are necessary, without identifying them or the substance of their testimony, the motion to transfer *must be denied*. Appx19 n.123. A court is unable to weigh the relevance and materiality of the information known by such unidentified witnesses. *Id.* This was not error. The district court gave the same treatment to Apple's number Austin employees. Apple's complaint that "the district court weighed against transfer the possibility that unspecified Apple employees in Texas might be 'potentially relevant'" is refuted by the district courts 11-to-8 conclusion. Pet. at 36; Appx22.

In concluding that this factor "weighs only slightly against transfer," the district court explained that "Apple's three named witnesses and its five component suppliers would see a decrease in inconvenience if transfer was [denied]," but that "WDTX is a more convenient forum than NDCA for the eleven Cirrus Logic employees in Austin." Appx22. "On balance and as briefed, the bulk of ***named*** material and relevant witnesses are here in WDTX." *Id.*

The *Honeywell* and *Netflix* cases cited by Apple do not show error. No Fifth Circuit precedent blesses Apple's approach of merely tallying its own 85 engineers who will not "materialize" at trial without tallying Apple's Austin number employees who are comparably likely (or unlikely) to materialize. *In re Clarke*, 94 F.4th at 508.

As to the third-party witnesses, Apple asserts that the district court unfairly weighed its five component suppliers against the eleven Cirrus employees specifically identified by Resonant. Pet. at 38–39. But Resonant identified Cirrus employees who are expected to testify on the cost of components for damages apportionment and the engineering specifications and source code to prove how it "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" as recited in the claim. It remains unknown why Apple will call those five suppliers—their supply of those components is not disputed. Also, the district court did not "penalize" Apple by "discount[ing]" its five identified component suppliers (Pet. at 39)—the district court simply did not give Apple additional credit for unnamed employees with unexplained relevance.

Apple also complains that the district court "ignored the California-based Cirrus Logic employee who actually interacts with Apple." Pet. at 38. But Apple improperly identified this employee for the first time on reply after the close of venue discovery, so the district court had no obligation to credit this unnamed witness. Appx270. Even if this support employee should have been counted, it marginally changes the count from 11-to-8 to 11-to-9. The district court's conclusion that this "weighs only slightly against transfer" would remain unchanged, and this is not reversible error. Appx22.

4. The district court reasonably determined that the local interest factor is neutral.

The district court's analysis of this factor reached the right result. As correctly noted by the district court, courts cannot consider the parties' connection to the venue when analyzing this factor because "local interest analysis is a public interest factor." Appx25 (citing *In re Clarke*, 94 F.4th at 511). Due to the "public" nature, courts look at "the interest of non-party citizens in adjudicating the case." *Id.*

In emphasizing that "[w]e look not to 'the parties' significant connections to each form . . . . That point bears repeating: We focus on the *events*—not the *parties*," the Fifth Circuit overruled the Federal Circuit's line of cases that looked to the "development of the accused products" by the defendant for improperly double counting one of the parties. *In re Clarke*, 94 F.4th at 511; *In re Apple Inc.*, 979 F.3d at 1345. Thus, *In re Clarke* reinstated the prior rule, where "the sale of an accused product offered nationwide does not give rise to a substantial interest in any single venue." *In re Hoffmann-La Roche Inc.*, 587 F.3d 1333, 1338 (Fed. Cir. 2009). The *only* relevant non-party events giving rise to infringement are Apple's customers purchasing iPhones and other accused products nationwide. When non-party customers buy, Apple makes an infringing sale. 35 U.S.C. § 271(a). Nationwide sales are a "completely diffuse interest" that "cannot affect the local-interest determination." *In re Clarke*, 94 F.4th at 510. Neither "design" or "development" gives rise to Section 271 infringement. The law should never have departed from *In re Hoffman*.

So under Fifth Circuit law, this factor is neutral. The district court reached this same conclusion, albeit by harmlessly analyzing local interest and ruling that it was neutral because the evidence was unclear as to whether *more* development occurred in Austin or the NDCA.

The district court noted that Apple "largely points to proxies," including its headquarters, witnesses, and evidence in the NDCA. Appx26. Apple also asserted that design and development of the accused products took place in the NDCA. Apple's only evidence is the "faulty" Zhang declaration which only addressed the Taptic Engines and ignored all other accused components, potentially to withhold connections to Austin. *Id.* It was "therefore unclear whether the critical events that gave rise to the suit occurred solely in NDCA or in WDTX as well, and in what proportion." *Id.*

On Resonant's side, the district court noted Cirrus's financial interest in the outcome of the case, and Cirrus's design and development of the part used in the accused products. *Id.*

The district court then explained that "[w]hat is unclear is whether more development and design occurred in NDCA than WDTX." *Id.* While Resonant "more clearly indicated" that some infringement has occurred in Austin, "Apple on the other hand, briefs but does not support its argument that *all* critical events that gave rise to this suit were in NDCA and fails to address in what proportion if they did not." Appx26–27 (emphasis in original). The district court thus reasonably concluded that this factor was neutral, especially given Apple's burden to clearly prove the *relative* convenience.

Apple fails to demonstrate that the district court clearly abused its discretion under this factor. Apple insists that its "sworn declarations demonstrated that this design and development took place overwhelmingly in the transferee forum." Pet. at 40 (citing only to the Zhang declaration). But that is simply not true. *See Scramoge*, 2022 WL 1667561, at *3 (warning Apple not to overrepresent declarations). The Zhang declaration merely recites that 85 engineers worked on *one* accused component (some of which are in San Diego, not the NDCA). Appx123–124. Zhang is silent about which employees worked on other accused components, such as the A9–A17/M1/M2 chips. Zhang also makes no representations regarding the *proportion* of design and development that takes place in the NDCA relative to the WDTX. The Court had no reason to assume that all (or even most) design and development took place in the NDCA.

Apple also relies on Taptic Engine suppliers in the NDCA to support local interest. As mere suppliers (not designers or developers), the degree of their interest remains unclear, especially against Cirrus's interest as an part designer and developer with local code, and against Cirrus's direct financial agreement interest. Appx125, Appx232.

Finally, as explained at length above, the district court never credited unfounded speculation that "relevant events might have taken place in Texas." Pet.

at 40. It is clear that relevant events *did* take place in Texas, including at least Cirrus's design and development of accused components, including coding and engineering work.

If the district court erred by not applying the *Hoffman* rule, such error was harmless because the district court reached the same conclusion of neutrality, and the district court's factual findings under this factor were reasonable and entitled to deference. *Id.*

5. The district court erred in Apple's favor in finding the time to trial factor neutral.

The district court erred in Apple's favor by finding this factor neutral, despite recognizing that this case "is on track for a timely trial, which 'normally weighs against transfer'" under Fifth Circuit law. Appx25 (citing Fifth Circuit law at n.158). Trial is scheduled for August 4, 2025, about 2 years after filing. Appx31–35. For reference, the latest case settled between Plaintiff's counsel and Apple in the NDCA languished over 6 years without trial. *Corephotonics, Ltd. v. Apple, Inc.*, No. 3:17-cv-006457-JD (N.D. Cal. Nov. 6, 2017). However, the district court felt bound to ignore the Fifth Circuit and apply conflicting Federal Circuit law from *In re Google LLC*, 58 F.4th at 1383, which requires present "competition" in the market. Appx25 n.162. This applied the wrong conflicting law. *Panduit*, 744 F.2d at 1575.

The Fifth Circuit consistently articulated this factor without requiring injunctive relief or competitor status. *Volkswagen*, 371 F.3d at 203–04 (articulating and applying this element in an auto accident case with no business competitors seeking injunctive relief); *TikTok*, 85 F.4th at 363–64 (rearticulating this factor with no "competitor" requirement in October 2023, months after *In re Google LLC*, 58 F.4th 1379 (Fed. Cir. Feb. 1, 2023) imposed a "competitor" requirement).

The Fifth Circuit requires transfer to be "in the interest of justice." *Clarke*, 94 F.4th at 508. Resonant made devices with vibrating motors and considered Apple to be its direct competitor. Appx25 (citing Appx247, SAppx94). Without patent license revenue from Apple, Resonant went out of business during the COVID pandemic. Appx247. No justice results from allowing Apple to infringe Resonant's patents until Resonant goes out of business and then ruling that Resonant no longer cares about a timely trial due to loss of competitor status. If this case transfers to the NDCA and drags for over 6 years like the *Corephotonics* case instead of going to trial in Texas by August 2025, that will be an extra 4 years that Resonant remains unable to resume its business due to uncompensated patent infringement.

Under Fifth Circuit law, this should have weighed against transfer.

6. The district court meaningfully considered the transfer factors and reasonably determined that, on balance, Apple failed to meet its burden to show that the NDCA is *clearly* more convenient.

The district court reasonably found that the NDCA is not the ***clearly*** more convenient forum for this suit. There was no "clear abuse of discretion" in that factual finding or "patently erroneous result" here. *Apple I*, 818 F. App'x at 1003. The district court carefully considered the facts and evidence before it, weighed each of the relevant transfer factors in accordance with the applicable law, and determined that each factor was either neutral or weighed against transfer. And the court issued a detailed order with its analysis and reasons explaining a clear basis for its judgment of discretion.

Apple simply disagrees with the district court's ***weighing*** of the facts. But that is not enough. The Fifth Circuit has "stress[ed] that the decision of whether to transfer a case is committed to the district court's discretion." *In re Planned Parenthood Fed'n of Am., Inc.*, 52 F.4th 625, 629 (5th Cir. 2022). Absent a "clear abuse of discretion" and "patently erroneous result," the resolution of disputed facts is "entrusted to the discretion of the district court." *Apple I*, 818 F. App'x at 1004.

The real issue presented is: does a district court abuse its discretion by refusing to treat a declarant's lack of personal knowledge about relevant witnesses and evidence in Austin, when limited to fraction of accused components and unsupported by any nonprivileged methodology, as affirmative evidence that absolutely no relevant witnesses or evidence are in Austin? Absolutely not.

II. The Writ Is Inappropriate Under the Circumstances

The Court must stop Apple's transfer discovery abuse by ruling that selective, incomplete evidence cannot support transfer *per se*. All the evidence shows is that transfer will be convenient for a subset of Apple's employees, not that transfer will be *more* convenient overall. One cannot prove that a proposed venue is clearly more convenient than the original venue by solely presenting evidence of the convenience of the proposed venue while withholding all discovery that would show the convenience of the original venue. Indeed, one cannot prove which of two bags clearly has more weight without either 1) knowing the weight of both bags, or 2) objectively weighing them against each other, such as on a balance. Neither option requires Apple to prove a negative.

The standard for transfer—clearly more convenient—is high. *In re Clarke*, 94 F.4th at 508. Meta exemplified what it takes to meet this burden with its candor and thorough discovery responses by identifying every employee the plaintiff contended was relevant and by conducting its own, thorough investigation that revealed relevant employees in Texas. *XR Comms* at 7–8. Because Meta "had nothing to hide," it produced all requested discovery, and the district court granted transfer in part because the witnesses in the NDCA still far outnumbered those in Texas, even when using plaintiff's criteria for measuring relevance. *Id*.

Apple did the opposite. Apple's declarations omit accused components so that the district court will not know which witnesses from Texas will materialize to testify about them. Apple refused to put the NDCA and WDTX on the same scale by comparing the number of witnesses whose emails include case-specific terminology. Apple hid its declarants' unreliable methodology from the district court under the guise of privilege.[4] Apple refused to investigate relevant employees in states east of Texas.

Granting the mandamus petition signals that Apple's discovery tactics are not only acceptable, but that this appellate court will rule that a district court commits "clear abuse of discretion that produced a patently erroneous result" by being unpersuaded by shoddy evidence. Meta's strategy of "exceptional candor" to the Court will likely devolve into Apple's withholding of evidence. The integrity of the judicial system will suffer.

The Court should expect that when a defendant moves to transfer a case, it puts *all* relevant evidence, both good and bad, before the Court. *See In re*

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[4] Indeed, if the Court rules that hiding methodology behind privilege is sufficiently reliable for "clearly" proving relative convenience, then the *Daubert* standard, which does not require "clearly" proving anything, loses all meaning.

Volkswagen, 545 F.3d 304, 317 (5th Cir. 2008) ("Volkswagen has submitted a list of potential witnesses."). Only then can courts make rulings that are just and fair.

CONCLUSION

For these reasons, the Court should not only deny Apple's mandamus petition, but the Court should clarify the standard for transfer under Fifth Circuit law and explicitly discourage discovery abuse.

If the Court grants any part of Apple's petition, the Court should remand with instructions for an initial ruling on whether Apple's pre-*TikTok* evidence fails *per se* under the Fifth Circuit's reinstituted rigid 100-mile rule, which the district court did not yet rule on.

June 17, 2024

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No. 24-129

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

IN RE APPLE INC.,

Petitioner.

On Petition for Writ of Mandamus to the United States District Court for the Western District of Texas, No. 7:23-cv-00077-ADA, Judge Alan D. Albright

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RESONANT SYSTEMS, INC.'S NON-CONFIDENTIAL SUPPLEMENTAL APPENDIX IN SUPPORT OF RESPONSE TO APPLE'S PETITION FOR WRIT OF MANDAMUS

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June 17, 2024

Supplemental Appendix in Response to Petition for Writ of Mandamus

No. 23-1035

TABLE OF CONTENTS[1]

[1] Documents marked with an asterisk (*) contain the confidential business information of petitioner Apple, Inc., third-party Cirrus Logic, and/or Resonant. Apple's and Cirrus Logic's information pertain to the names, locations, and job titles/descriptions of Apple's and/or Cirrus Logic's employees, as well as information relating to certain accused products and components. This information was designated confidential by Apple and Cirrus Logic. Exhibit 15 contains Resonant's confidential business analysis marked confidential by Resonant.

CONFIDENTIAL MATERIAL OMITTED

SAppx33–38; SAppx39–55; SAppx56–61; SAppx67–71; SAppx87–94; SAppx108–118.

Exhibit 5

US009941830B2

(12) **United States Patent**
Elenga et al.

(10) **Patent No.: US 9,941,830 B2**
(45) **Date of Patent: Apr. 10, 2018**

(54) **LINEAR VIBRATION MODULES AND LINEAR-RESONANT VIBRATION MODULES**

(71) Applicant: **Resonant Systems, Inc.**, Seattle, WA (US)

(72) Inventors: **Robin Elenga**, Seattle, WA (US); **Brian Marc Pepin**, Oakland, CA (US); **Glen Tompkins**, Woodinville, WA (US)

(73) Assignee: **Resonant Systems, Inc.**, Seattle, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/181,249**

(22) Filed: **Jun. 13, 2016**

(65) **Prior Publication Data**

US 2016/0301346 A1 Oct. 13, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/469,210, filed on Aug. 26, 2014, now Pat. No. 9,369,081, which is a continuation of application No. 13/345,607, filed on Jan. 6, 2012, now Pat. No. 8,860,337, which is a continuation-in-part of application No. 12/782,697, filed on May 18, 2010, now Pat. No. 8,093,767.

(60) Provisional application No. 61/179,109, filed on May 18, 2009.

(51) **Int. Cl.**

H02K 33/00	(2006.01)
H02P 25/032	(2016.01)
H02K 33/16	(2006.01)

(52) **U.S. Cl.**
CPC ***H02P 25/032*** (2016.02); ***H02K 33/16*** (2013.01)

(58) **Field of Classification Search**
CPC H02P 25/032; H02K 7/1876; B06B 1/166
See application file for complete search history.

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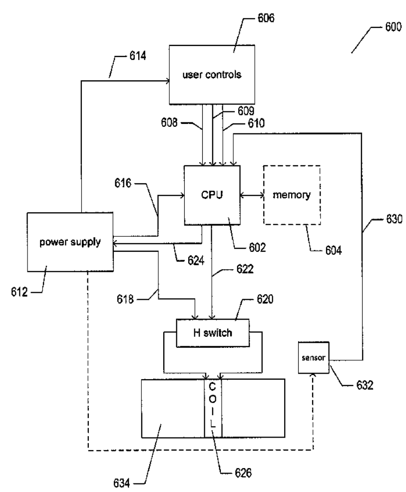
Primary Examiner — Karen Masih
(74) *Attorney, Agent, or Firm* — Olympic Patent Works PLLC

(57) **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. Feedback control is used to maintain the vibrational frequency of linear-resonant vibration module at or near the resonant frequency for the linear-resonant vibration module. Both linear vibration modules and linear-resonant vibration modules can be designed to produce vibrational amplitude/frequency combinations throughout a large region of amplitude/frequency space.

20 Claims, 20 Drawing Sheets



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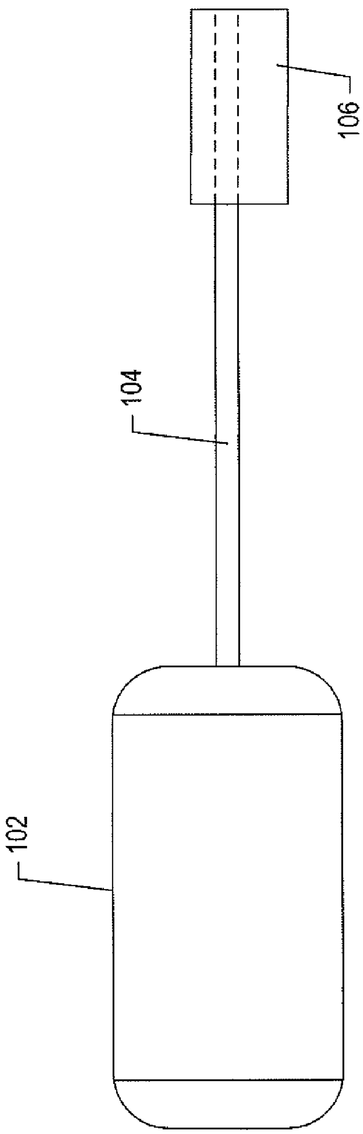

FIG. 1A
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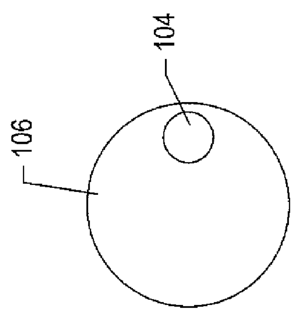

FIG. 1B
--Prior Art--

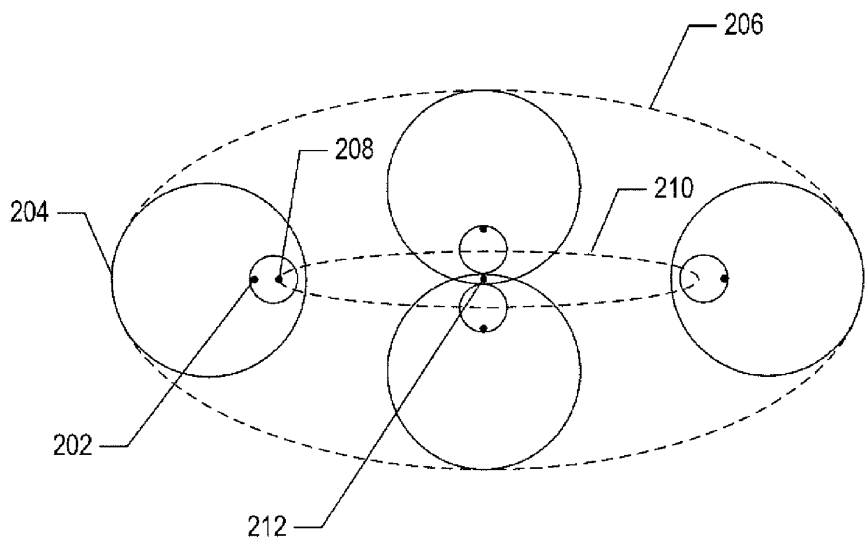

FIG. 2A
--Prior Art--

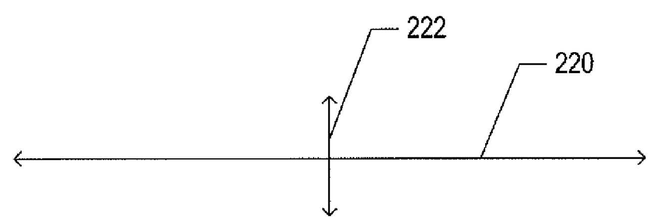

FIG. 2B
--Prior Art--

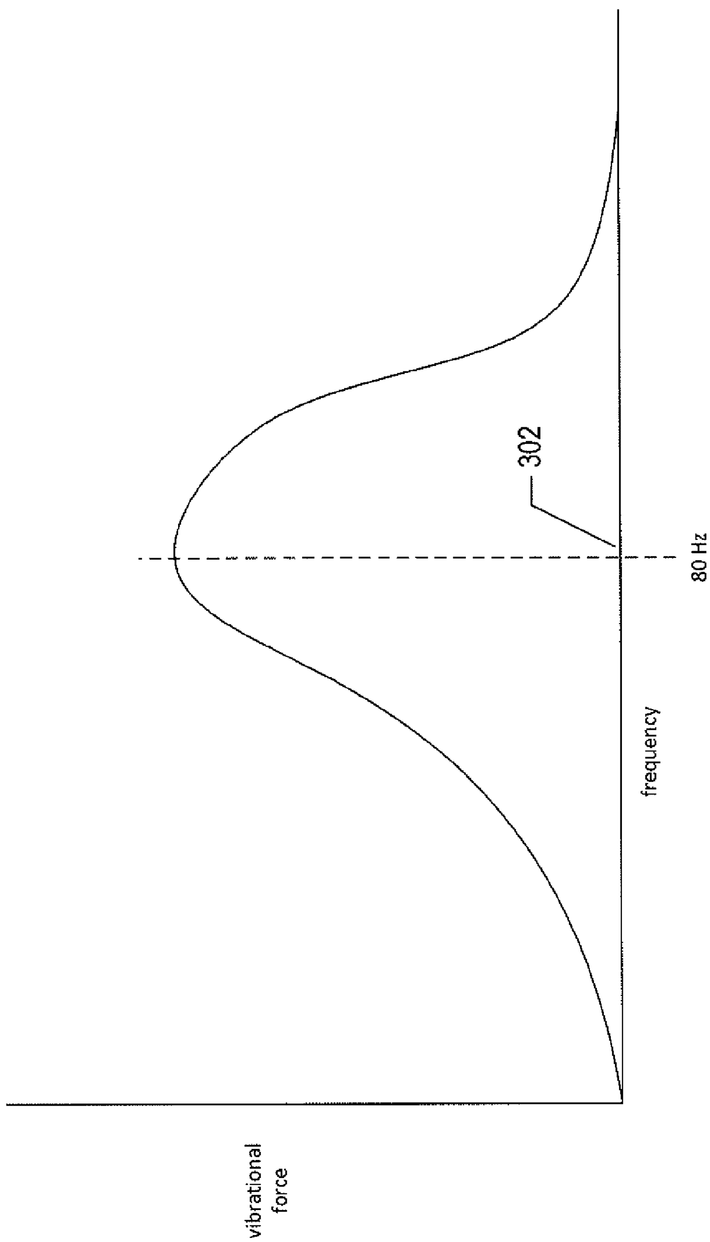

FIG. 3
--Prior Art--

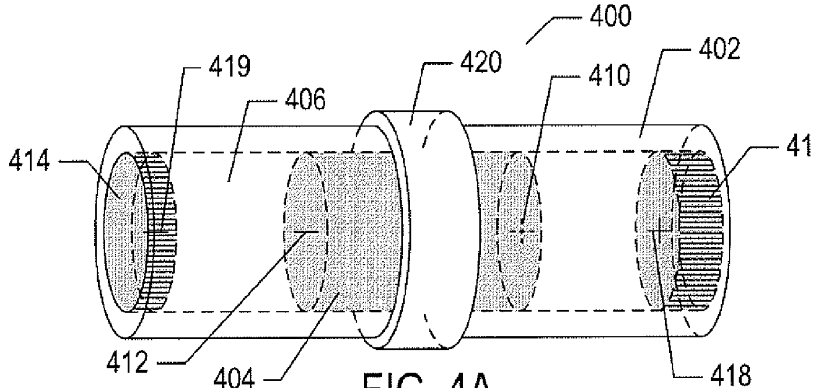

FIG. 4A

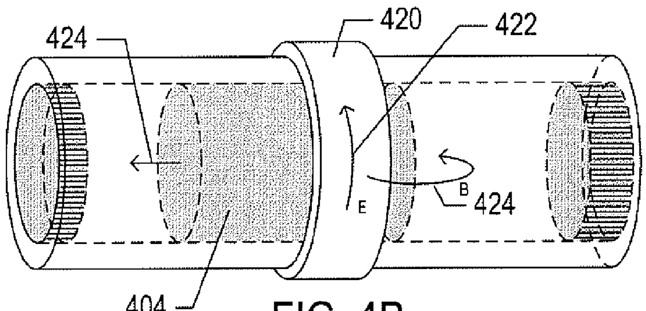

FIG. 4B

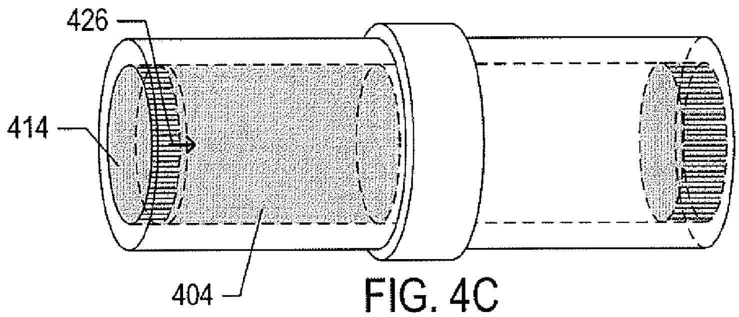

FIG. 4C

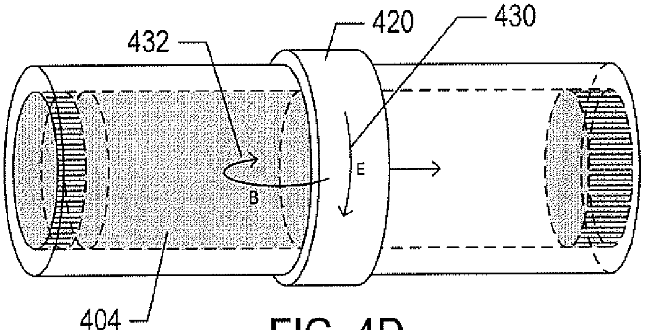

FIG. 4D

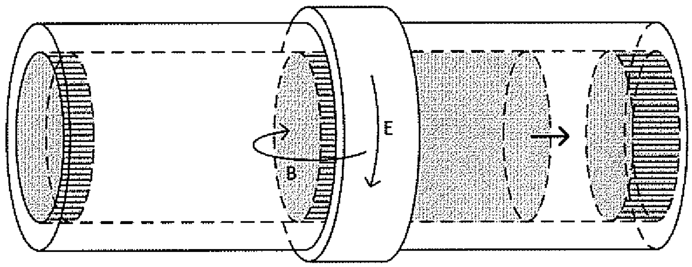

FIG. 4E

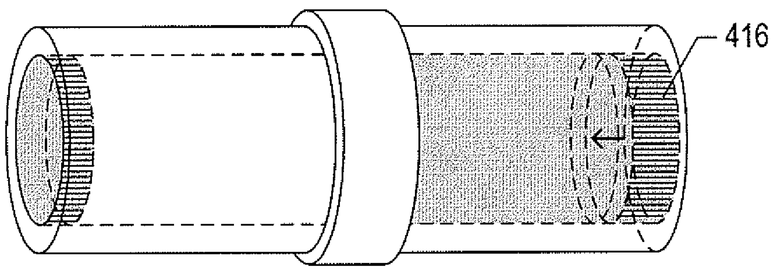

FIG. 4F

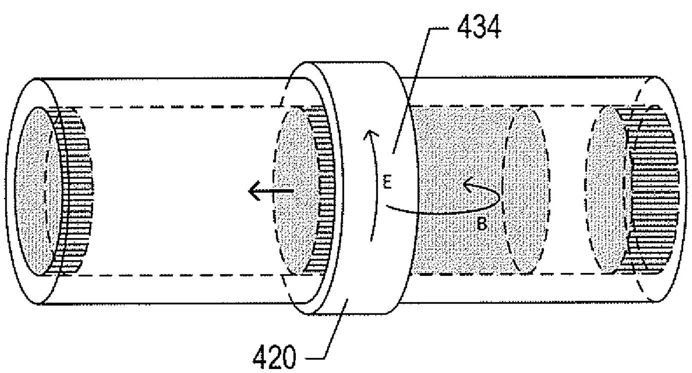

FIG. 4G

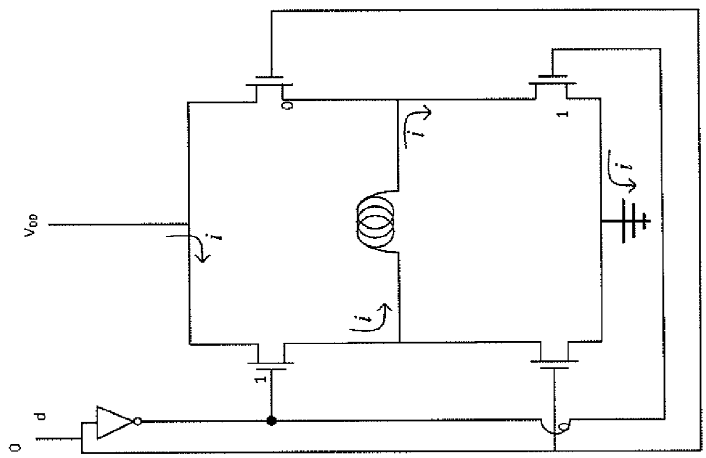

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FIG. 5B

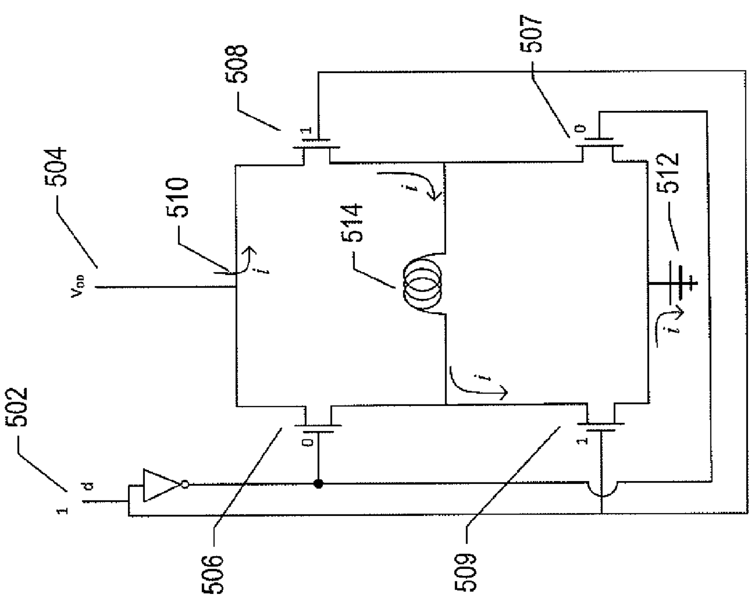

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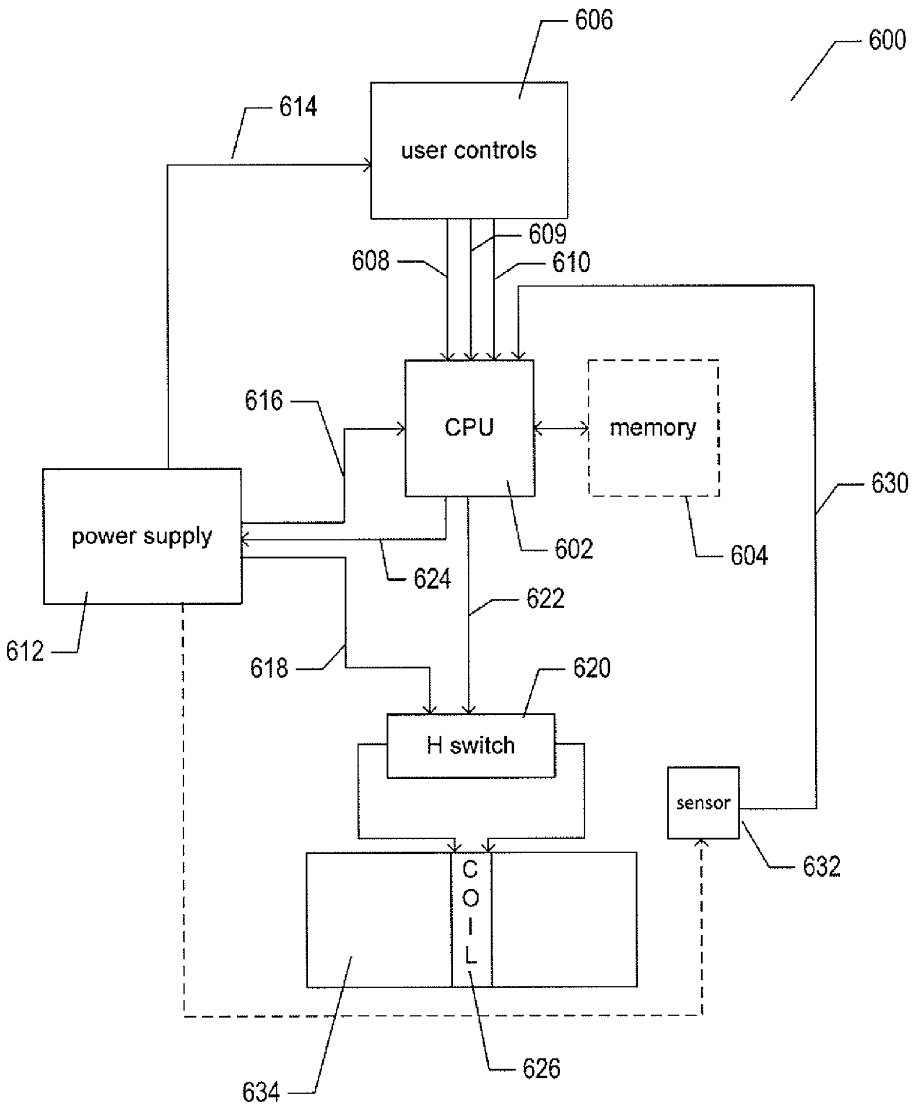
FIG. 5A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634

FIG. 6

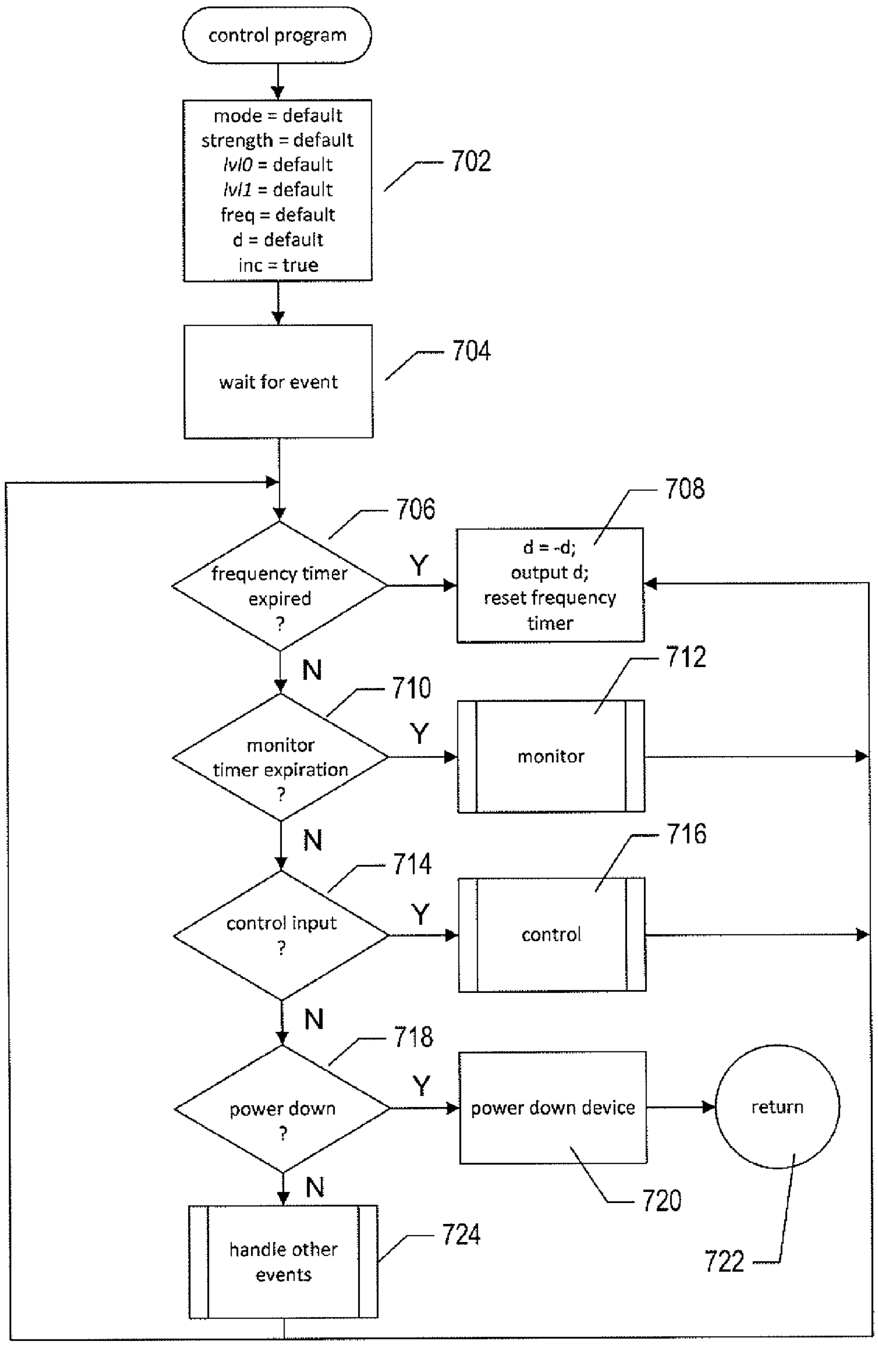
control program
mode = default
strength = default
lvl0 = default
lvl1 = default
freq = default
d = default
inc = true
702
wait for event
704
706
frequency timer expired ?
Y
d = -d;
output d;
reset frequency timer
708
N
710
monitor timer expiration ?
Y
monitor
712
N
714
control input ?
Y
control
716
N
718
power down ?
Y
power down device
return
720
722
N
handle other events
724

FIG. 7A

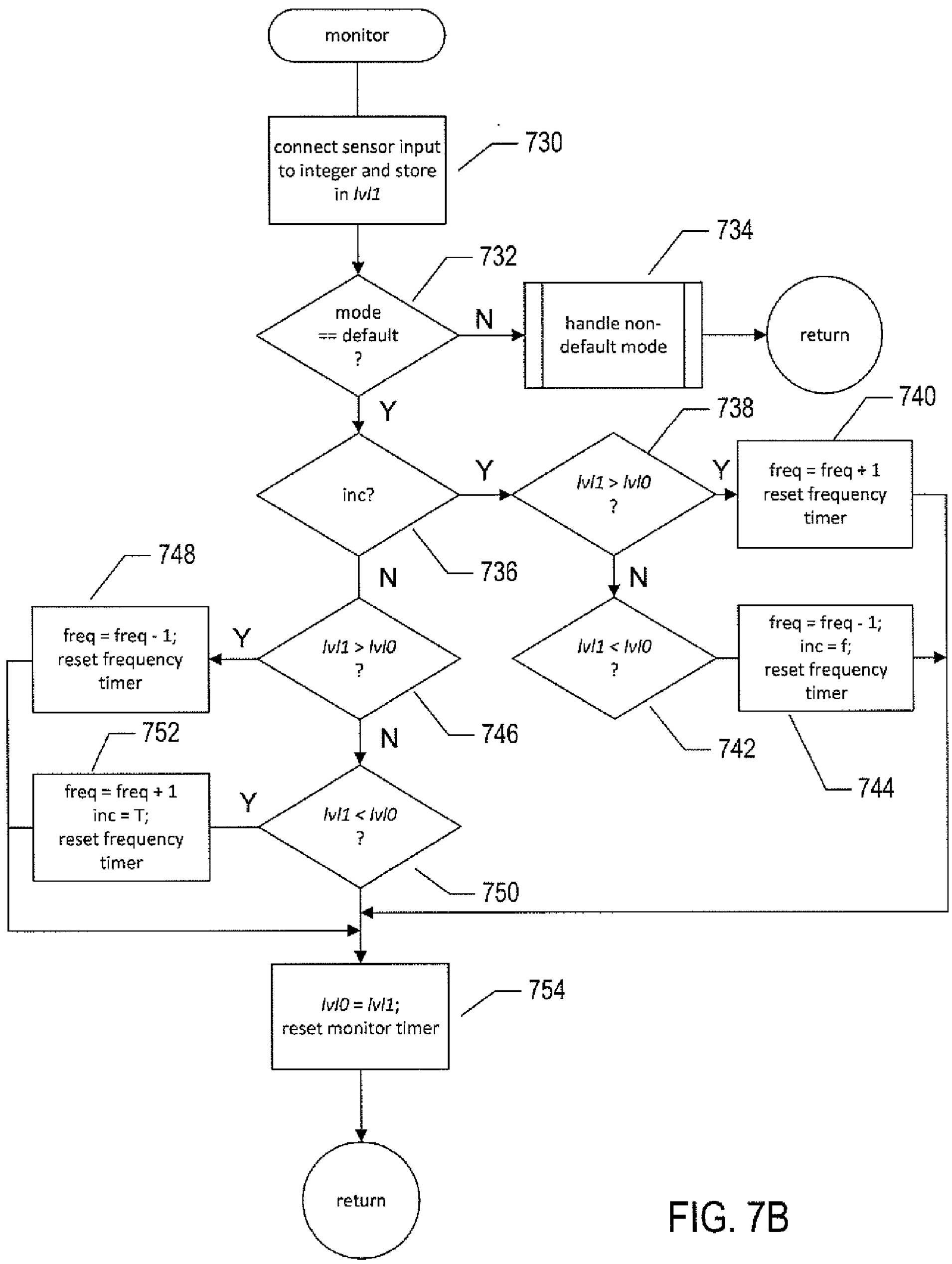
monitor
connect sensor input to integer and store in lvl1
730
mode == default ?
732
N
handle non-default mode
734
return
Y
inc?
736
Y
lvl1 > lvl0 ?
738
Y
freq = freq + 1 reset frequency timer
740
N
lvl1 < lvl0 ?
742
freq = freq - 1; inc = f; reset frequency timer
744
N
lvl1 > lvl0 ?
746
Y
freq = freq - 1; reset frequency timer
748
N
lvl1 < lvl0 ?
750
Y
freq = freq + 1 inc = T; reset frequency timer
752
lvl0 = lvl1; reset monitor timer
754
return

FIG. 7B

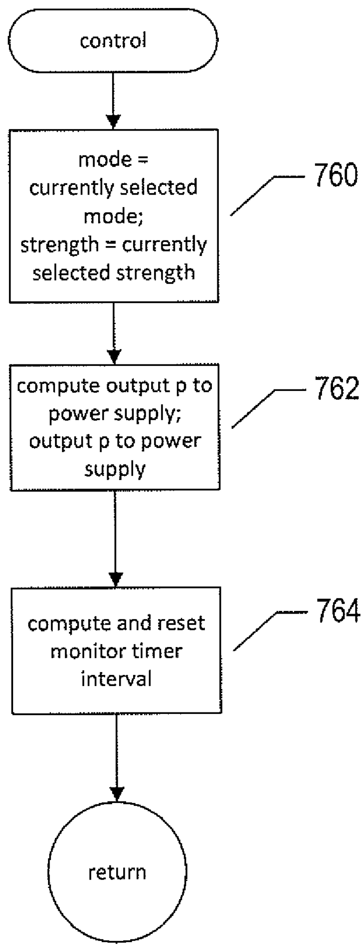
control
mode = currently selected mode; strength = currently selected strength
760
compute output p to power supply; output p to power supply
762
compute and reset monitor timer interval
764
return

FIG. 7C

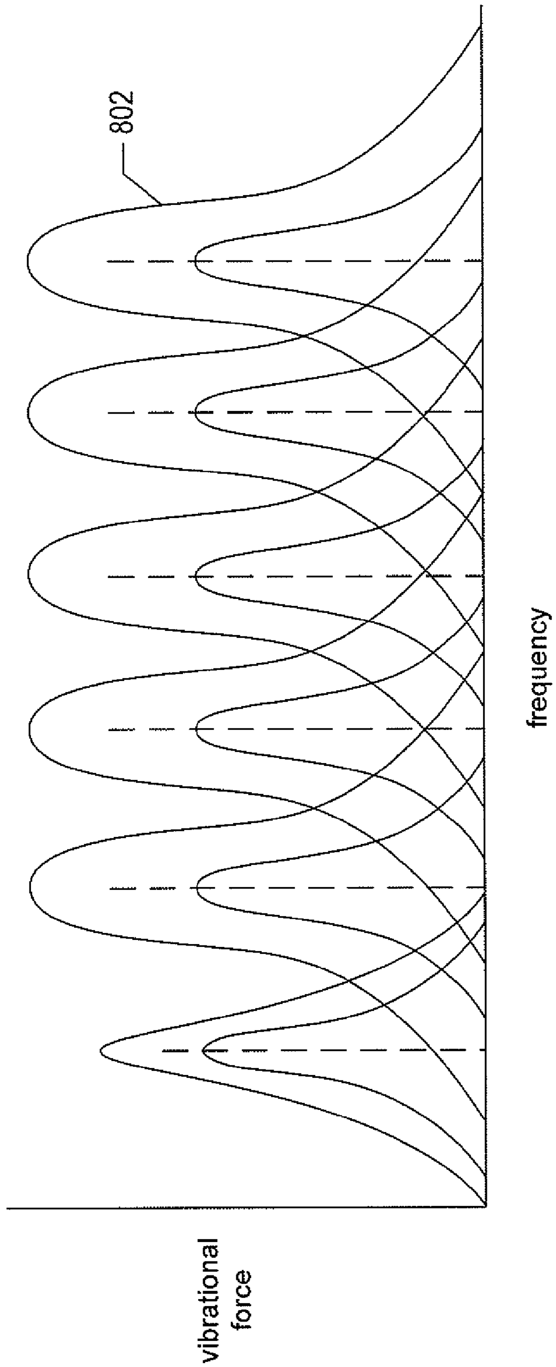

FIG. 8

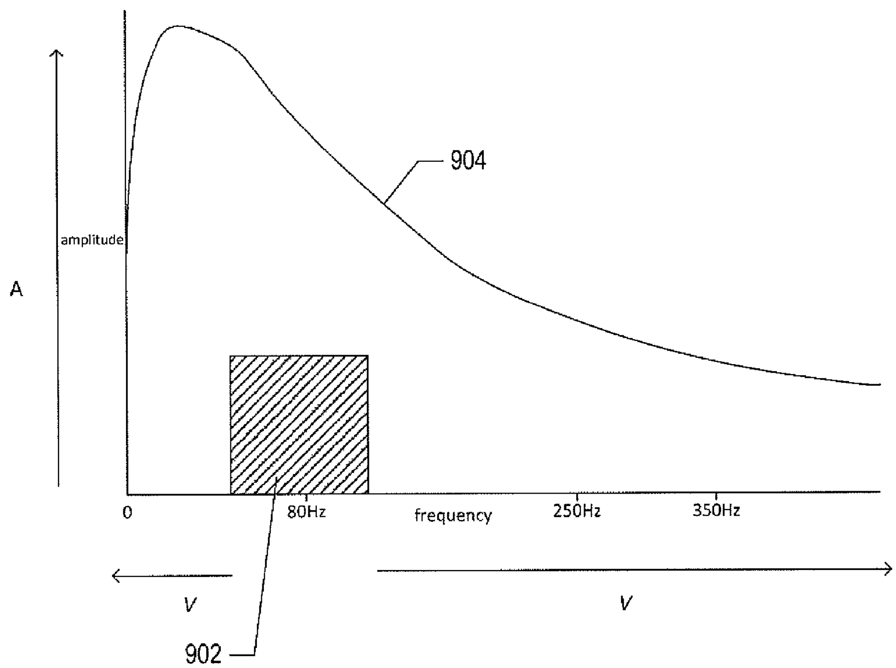

FIG. 9

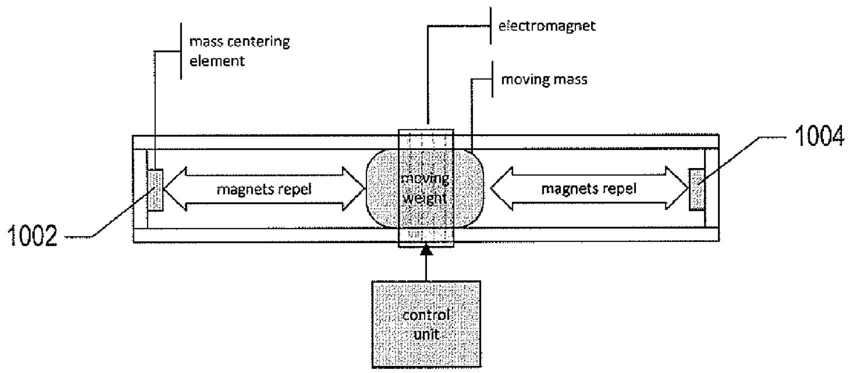

FIG. 10

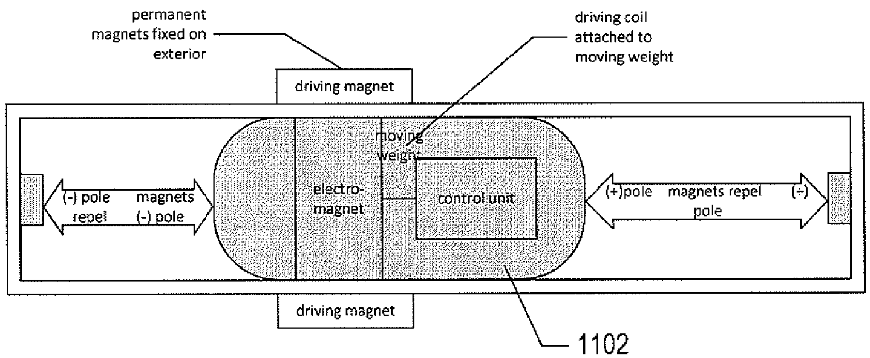

FIG. 11

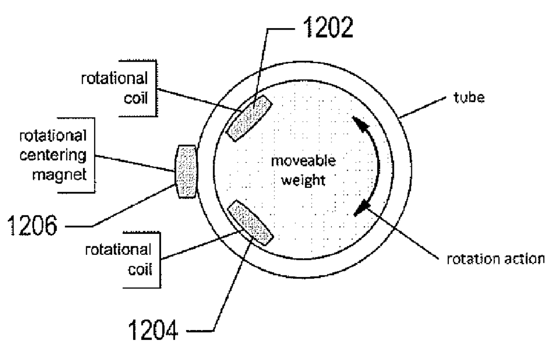

FIG. 12

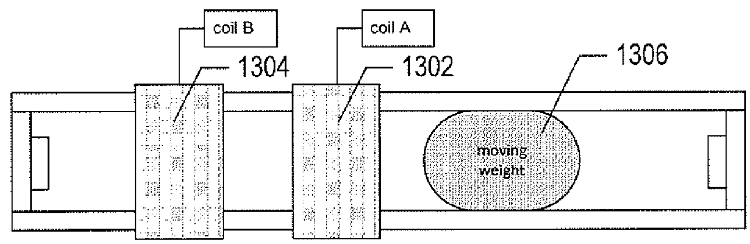

FIG. 13

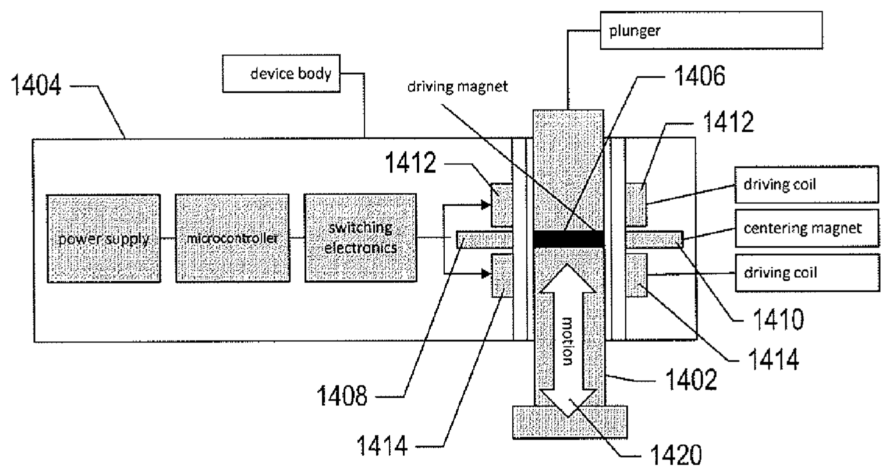

FIG. 14

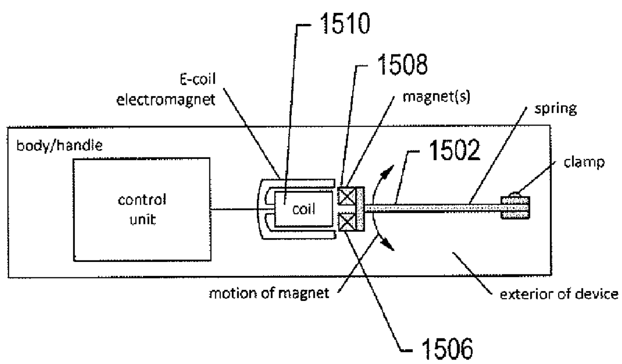

FIG. 15

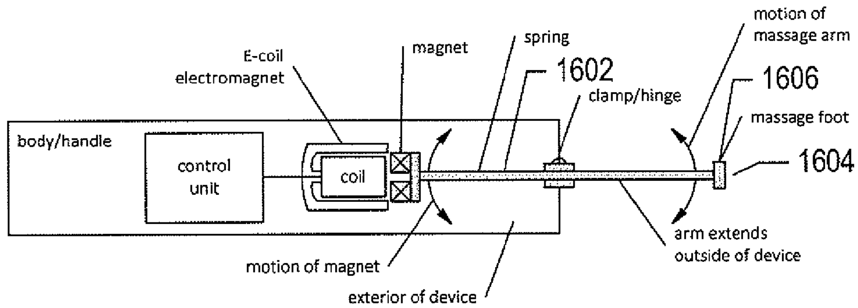

FIG. 16

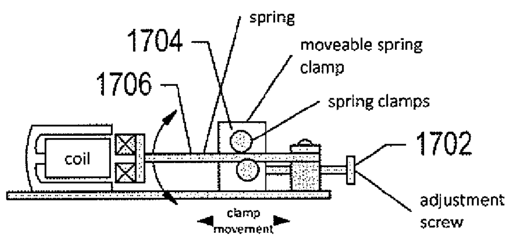

FIG. 17

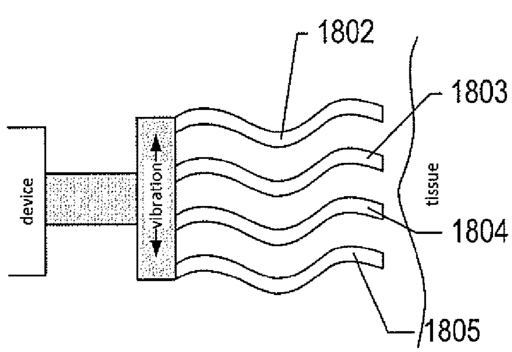

FIG. 18

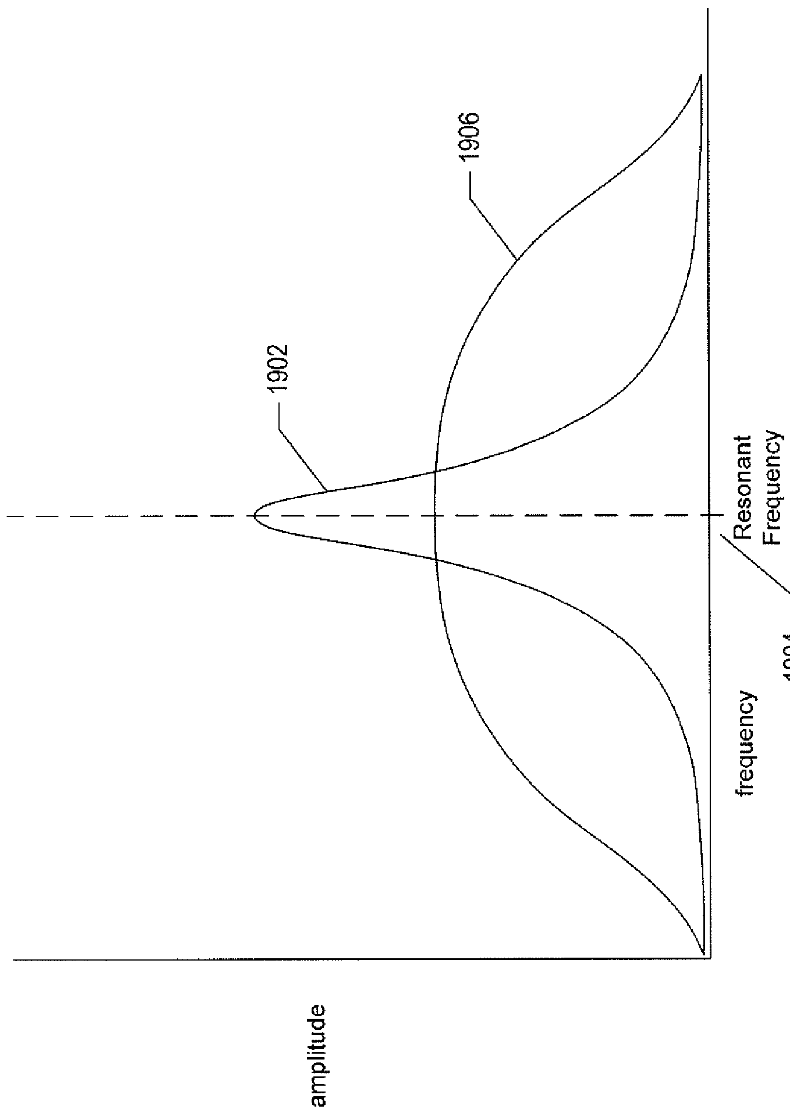

FIG. 19

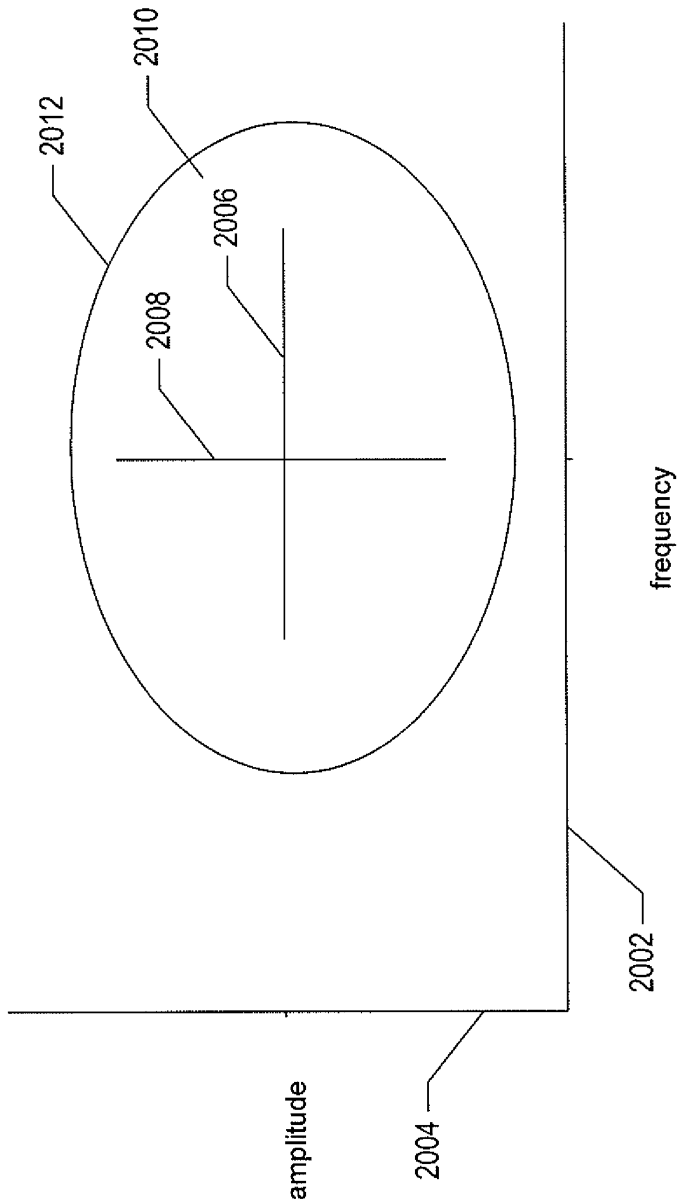

FIG. 20

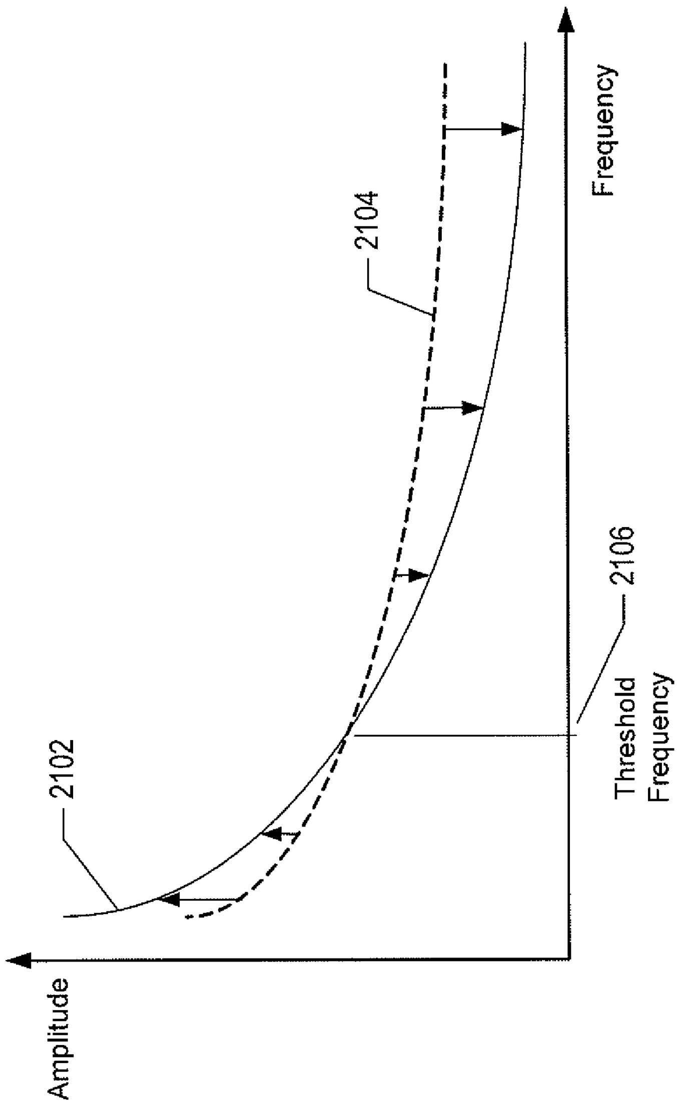

FIG. 21

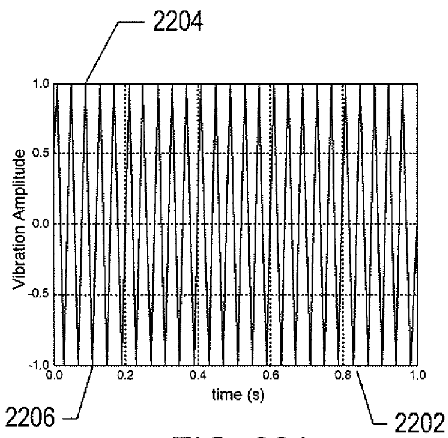

FIG. 22A

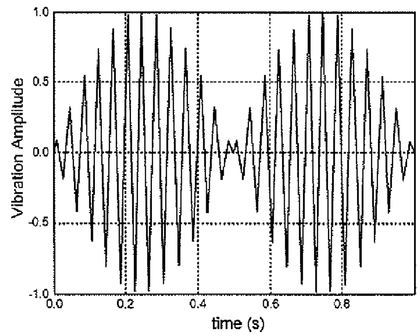

FIG. 22B

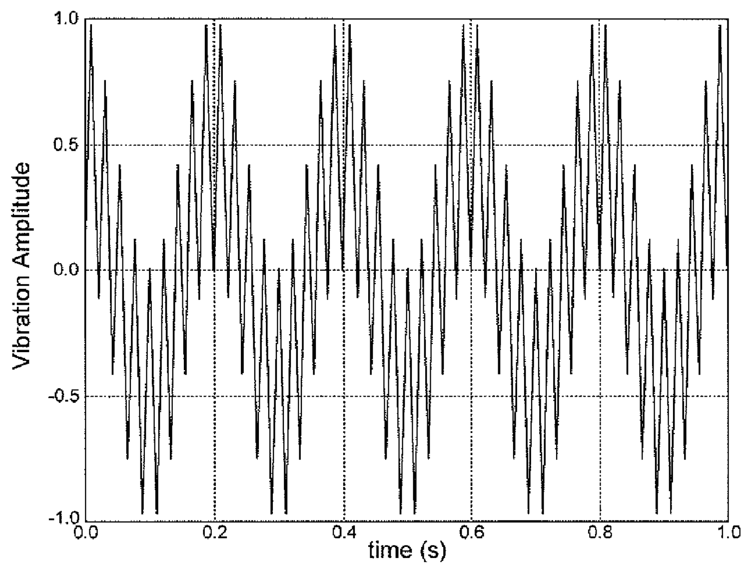

FIG. 23

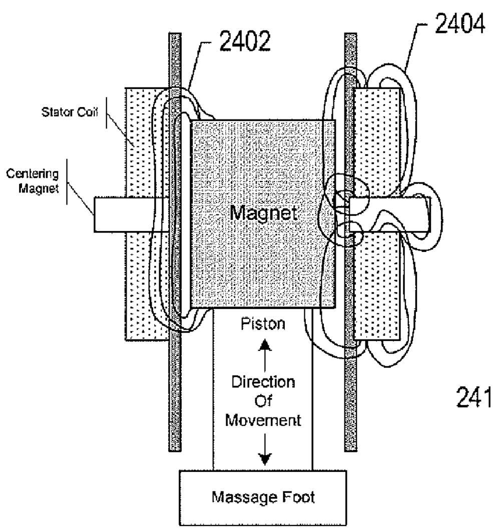

FIG. 24A

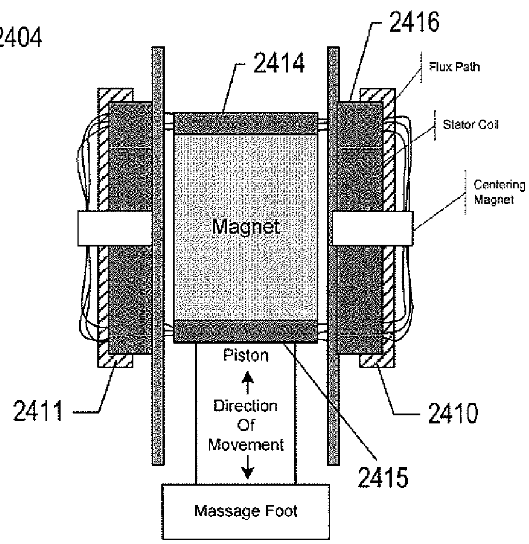

FIG. 24B

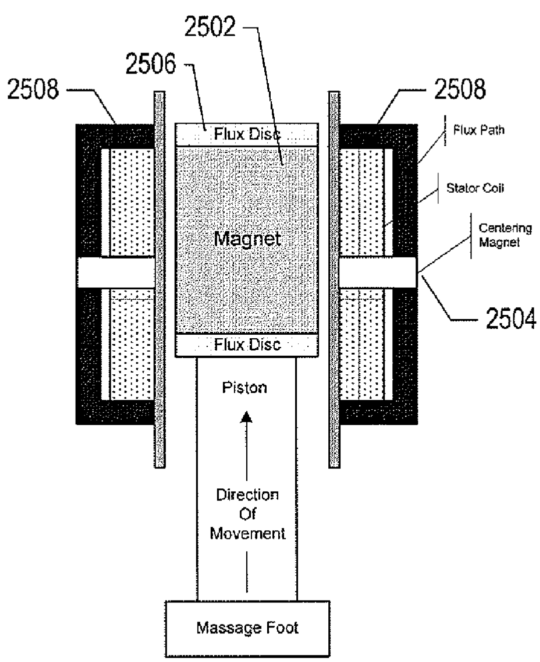

FIG. 25

LINEAR VIBRATION MODULES AND LINEAR-RESONANT VIBRATION MODULES

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of application Ser. No. 14/469,210, filed Aug. 26, 2014, which is a continuation of U.S. Pat. No. 8,860,337, issued Oct. 14, 2014, which is a continuation-in-part of U.S. Pat. No. 8,093,767, issued Jan. 10, 2012, which claims the benefit of Provisional Patent Application No. 61/179,109, filed May 18, 2009.

TECHNICAL FIELD

The current application is related to vibration-generating devices and, in particular, to vibration modules that can be incorporated into a wide variety of different types of electromechanical devices and systems to produce vibrations of selected amplitudes and frequencies over a wide range of amplitude/frequency space.

BACKGROUND

Vibration-inducing motors and mechanisms have been used for many years in a wide variety of different consumer appliances, toys, and other devices and systems. Examples include vibration signals generated by pagers, vibration-driven appliances, such as hair-trimming appliances, electric toothbrushes, electric toy football games, and many other appliances, devices, and systems. The most common electromechanical system used for generating vibrations is an intentionally unbalanced electric motor.

FIGS. **1**A-B illustrate an unbalanced electric motor typically used for generating vibrations in a wide variety of different devices. As shown in FIG. **1**A, a small, relatively low-power electric motor **102** rotates a cylindrical shaft **104** onto which a weight **106** is asymmetrically or mounted. FIG. **1**B shows the weight asymmetrically mounted to the shaft, looking down at the weight and shaft in the direction of the axis of the shaft. As shown in FIG. **1**B, the weight **106** is mounted off-center on the electric-motor shaft **104**. FIGS. **2**A-B illustrate the vibrational motion produced by the unbalanced electric motor shown in FIGS. **1**A-B. As shown in FIGS. **2**A-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. FIG. **2**A shows displacement of the weight and shaft from the stationary shaft axis as the shaft is rotated, looking down on the weight and shaft along the shaft axis, as in FIG. **1**B. In FIG. **2**A, a small mark **202** is provided at the periphery of the disk-shaped end the of electric-motor shaft to illustrate rotation of the shaft. When the shaft rotates at high speed, a point **204** on the edge of the weight traces an ellipsoid **206** and the center of the shaft **208** traces a narrower and smaller ellipsoid **210**. Were the shaft balanced, the center of the shaft would remain at a position **212** in the center of the diagram during rotation, but the presence of the asymmetrically-mounted weight attached to the shaft, as well as other geometric and weight-distribution characteristics of the electric motor, shaft, and unbalanced weight together create forces that move the end of the shaft along the elliptical path **210** when the shaft is rotated at relatively high speed. The movement can be characterized, as shown in FIG. **2**B, by a major axis **220** and minor axis **222** of vibration, with the direction of the major axis of vibration equal to the direction of the major axis of the ellipsoids, shown in FIG. **2**A, and the length of the major axis corresponding to the amplitude of vibration in this direction. In many applications, in which a linear oscillation is desired, designers seek to force the major-axis-amplitude/minor-axis-amplitude ratio to be as large as possible, but, because the vibration is produced by a rotational force, it is generally not possible to achieve linear oscillation. In many cases, the path traced by the shaft center may be close to circular. The frequency of vibration of the unbalanced electric motor is equal to the rotational frequency of the electric-motor shaft, and is therefore constrained by the rate at which the motor can rotate the shaft. At low rotational speeds, little vibration is produced.

While effective in producing vibrations, there are many problems associated with the unbalanced-electric-motor vibration-generating units, such as that shown in FIG. **1**A, commonly used in the various devices, systems, and applications discussed above. First, unbalancing the shaft of an electric motor not only produces useful vibrations that can be harnessed for various applications, but also produces destructive, unbalanced forces within the motor that contribute to rapid deterioration of motor parts. Enormous care and effort is undertaken to precisely balance rotating parts of motors, vehicles, and other types of machinery, and the consequences of unbalanced rotating parts are well known to anyone familiar with automobiles, machine tools, and other such devices and systems. The useful lifetimes of many devices and appliances, particularly hand-held devices and appliances, that employ unbalanced electric motors for generating vibrations may range from a few tens of hours to a few thousands of hours of use, after which the vibrational amplitude produced by the devices declines precipitously as the electric motor and other parts deteriorate.

A second problem with unbalanced electric motors is that they are relatively inefficient at producing vibrational motion. A far greater amount of power is consumed by an unbalanced electrical motor to produce a given vibrational force than the theoretical minimum power required to produce the given vibrational force. As a result, many hand-held devices that employ unbalanced electric motors for generating vibrations quickly consume batteries during use.

A third problem with unbalanced electric motors, discussed above, is that they generally produce elliptical vibrational modes. Although such modes may be useful in particular applications, many applications can better use a linear oscillation, with greater directional concentration of vibrational forces. Linear oscillation cannot generally be produced by unbalanced electric motors.

A fourth, and perhaps most fundamental, problem associated with using unbalanced electric motors to generate vibrations is that only a very limited portion of the total vibrational-force/frequency space is accessible to unbalanced electric motors. FIG. **3** shows a graph of vibrational force with respect to frequency for various types of unbalanced electric motors. The graph is shown as a continuous hypothetical curve, although, of course, actual data would be discrete. As shown in FIG. **3**, for relatively low-power electric motors used in hand-held appliances, only a fairly narrow range of frequencies centered about 80 Hz (**302** in FIG. **3**) generate a significant vibrational force. Moreover, the vibrational force is relatively modest. The bulk of energy consumed by an unbalanced electric motor is used to spin the shaft and unbalanced weight and to overcome frictional and inertial forces within the motor. Only a relatively small portion of the consumed energy is translated into desired vibrational forces.

Because of the above-discussed disadvantages with the commonly employed unbalanced-electric-motor vibration-generation units, designers, manufacturers, and, ultimately, users of a wide variety of different vibration-based devices, appliances, and systems continue to seek more efficient and capable vibration-generating units for incorporation into many consumer appliances, devices, and systems.

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. Feedback control is used to maintain the vibrational frequency of linear-resonant vibration module at or near the resonant frequency for the linear-resonant vibration module. Both linear vibration modules and linear-resonant vibration modules can be designed to produce vibrational amplitude/frequency combinations throughout a large region of amplitude/frequency space.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A-B illustrate an unbalanced electric motor typically used for generating vibrations in a wide variety of different devices.

FIGS. **2**A-B illustrate the vibrational motion produced by the unbalanced electric motor shown in FIGS. **1**A-B.

FIG. **3** shows a graph of vibrational force with respect to frequency for various types of unbalanced electric motors.

FIGS. **4**A-G illustrate one particular LRVM, and operation of the particular LRVM, that represents one implementation of the linear-resonant vibration module to which current application is directed.

FIGS. **5**A-B illustrate an H-bridge switch that can be used, in various embodiments of the current application, to change the direction of current applied to the coil that drives linear oscillation within a linear-resonance vibration module ("LRVM").

FIG. **6** provides a block diagram of the LRVM, illustrated in FIGS. **4**A-G, that represents one implementation of the linear-resonant vibration module to which current application is directed.

FIGS. **7**A-C provide control-flow diagrams that illustrate the control program, executed by the CPU, that controls operation of an LRVM that represents one implementation of the linear-resonant vibration module to which current application is directed.

FIG. **8** represents the range of frequencies and vibrational forces that can be achieved by different implementations of LRVM and LRVM control programs that represent embodiments of the current application.

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.

FIGS. **10**-**17** show a variety of different alternative implementations of LRVMs that represent different embodiments of the current application.

FIG. **18** illustrates an enhancement of an implementation of the linear-resonant vibration module to which current application is directed shown in FIG. **16**.

FIG. **19** illustrates plots of amplitude versus frequency for a high-Q and a low-Q vibration device.

FIG. **20** illustrates portions of amplitude/frequency space accessible to various types of vibration modules.

FIG. **21** illustrates 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.

FIGS. **22**A-**23** illustrate interesting vibrational modes produced by driving a linear-resonant vibration module simultaneously at two different frequencies.

FIGS. **24**A-**25** illustrate incorporation of paramagnetic flux paths into a linear vibration module.

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. The linear nature of the LRVM vibration-inducing motion allows the problems associated with unbalanced-electric-motor vibrators, discussed above, to be effectively addressed. An oscillating linear motion does not produce destructive forces that quickly degrade and wear out an unbalanced electric motor. A linearly oscillating mechanism is characterized by parameters that can be straightforwardly varied in order to produce vibrations of a desired amplitude and frequency over a very broad region of amplitude/frequency space. In many implementations of LRVMs and LVMs, the vibration amplitude and vibration frequency can be independently controlled by a user through user-input features, including buttons, sliders, and other types of user-input features. Combining a linearly oscillating vibration-inducing mechanism with feedback control, so that the frequency of vibration falls close to the resonant frequency of the LRVM, results in optimal power consumption with respect to the amplitude and frequency of vibration produced by the LRVM. Clearly, linear oscillation within a LRVM translates into highly direction vibrational forces produced by an appliance or device that incorporates the LRVM.

FIGS. **4**A-G illustrate one particular LRVM, and operation of the particular LRVM, that represents one implementation of the linear-resonant vibration module to which current application is directed. FIGS. **4**A-G all use the same illustration conventions, next discussed with reference to FIG. **4**A. 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**. The weight is a magnet, in the described an implementation of the linear-resonant vibration module to which current application is directed, with polarity indicated by the "+" sign **410** on the right-hand end and the "−" sign **412** on the left-hand end of the weight **404**. The cylindrical chamber **406** is capped by two magnetic disks **414** and **416** with polarities indicated by the "+" sign **418** and the "−" sign **419**. The disk-like magnets **414** and **418** are magnetically oriented opposite from the magnetic orientation of the weight **404**, so that when the weight moves to either the extreme left or extreme right sides of the cylindrical chamber, the weight is repelled by one of the disk-like magnets at the left or right ends of the cylindrical chamber. In other words, the disk-like magnets act much like springs, to facilitate deceleration and reversal of direction of motion of the weight and to minimize or prevent mechanical-impact forces of the weight and the end caps that close off the cylindrical chamber. Finally, a coil of conductive wire **420** girdles the cylindrical housing, or tube **402** at approximately the mid-point of the cylindrical housing.

FIGS. **4**B-G illustrate operation of the LRVM shown in FIG. **4**A. When an electric current is applied to the coil **420** in a first direction **422**, a corresponding magnetic force **424** is generated in a direction parallel to the axis of the cylindrical chamber, which accelerates the weight **404** in the direction of the magnetic force **424**. When the weight reaches a point at or close to the corresponding disk-like magnet **414**, as shown in FIG. **4**C, a magnetic force due to the repulsion of the disk-like magnet **414** and the weight **404**, **426**, is generated in the opposite direction, decelerating the weight and reversing its direction. As the weight reverses direction, as shown in FIG. **4**D, current is applied in an opposite direction **430** to the coil **420**, producing a magnetic force **432** in an opposite direction from the direction of the magnetic force shown in FIG. **4**B, which accelerates the weight **404** in a direction opposite to the direction in which the weight is accelerated in FIG. **4**B. As shown in FIG. **4**E, the weight then moves rightward until, as shown in FIG. **4**F, the weight is decelerated, stopped, and then accelerated in the opposite direction by repulsion of the disk-like magnet **416**. An electrical current is then applied to the coil **420** in the same direction **434** as in FIG. **4**B, again accelerating the solid cylindrical mass in the same direction as in FIG. **4**B. 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.

Clearly, the amplitude of the vibration and vibrational forces produced are related to the length of the hollow chamber in which the weight oscillates, the current applied to the coil, the mass of the weight, the acceleration of the weight produced by the coil, and the mass of the entire LRVM. All of these parameters are essentially design parameters for the LRVM, and thus the LRVM can be designed to produce a wide variety of different amplitudes.

The frequency of the oscillation of the solid, cylindrical mass is determined by the frequency at which the direction of the current applied to the coil is changed. FIGS. **5**A-B illustrate an H-bridge switch that can be used, in various embodiments of the current application, to change the direction of current applied to the coil that drives linear oscillation within an LRVM. FIGS. **5**A-B both use the same illustration conventions, described next with respect to FIG. **5**A. The H-bridge switch receives, as input, a directional signal d **502** and direct-current ("DC") power **504**. The direction-control signal d **502** controls four switches **506**-**509**, shown as transistors in FIG. **5**A. When the input control signal d **502** is high, or "1," as shown in FIG. **5**A, switches **508** and **509** are closed and switches **506** and **507** are open, and therefore current flows, as indicated by curved arrows, such as curved arrow **510**, from the power-source input **504** to ground **512** in a leftward direction through the coil **514**. When the input-control signal d is low, or "0," as shown in FIG. **5**B, the direction of the current through the coil is reversed. The H-bridge switch, shown in FIGS. **5**A-B, is but one example of various different types of electrical and electromechanical switches that can be used to rapidly alternate the direction of current within the coil of an LRVM.

FIG. **6** provides a block diagram of the LRVM, illustrated in FIGS. **4**A-G, that represents one implementation of the linear-resonant vibration module to which current application is directed. The LRVM, in addition to the cylindrical housing, coil, and internal components shown in FIG. **4**A, includes a power supply, a user interface, generally comprising electromechanical buttons or switches, the H-bridge switch, discussed above with reference to FIGS. **5**A-B, a central processing unit ("CPU"), generally a small, low-powered microprocessor, and one or more electromechanical sensors. All of these components are packaged together as an LRVM within a vibration-based appliance, device, or system.

As shown in FIG. **6**, the LRVM **600** is controlled by a control program executed by the CPU microprocessor **602**. The microprocessor may contain sufficient on-board memory to store the control program and other values needed during execution of the control program, or, alternatively, may be coupled to a low-powered memory chip **604** or flash memory for storing the control program. 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 to the coil, a switch to select one of various different operational modes, and a power button. The user controls generate signals input to the CPU **608**-**610**. A power supply **612** provides power, as needed, to user controls **614**, to the CPU **616** and optional, associated memory, to the H-bridge switch **618**, and, when needed, to one or more sensors **632**. The voltage and current supplied by the power supply to the various components may vary, depending on the operational characteristics and requirements of the components. The H-bridge switch **620** receives a control-signal input d **622** from the CPU. 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**. The CPU receives input **630** from one or more electromechanical sensors **632** that generate a signal corresponding to the strength of vibration currently being produced by the linearly oscillating mass **634**. Sensors may include one or more of accelerometers, piezoelectric devices, pressure-sensing devices, or other types of sensors that can generate signals corresponding to the strength of desired vibrational forces.

FIGS. **7**A-C provide control-flow diagrams that illustrate the control program, executed by the CPU, that controls operation of an LRVM that represents one implementation of the linear-resonant vibration module to which current application is directed. FIG. **7**A provides a control-flow diagram for the high-level control program. The program begins execution, in step **702**, upon a power-on event invoked by a user through a power button or other user control. In step **702**, various local variables are set to default values, including the variables: (1) mode, which indicates the current operational mode of the device; (2) strength, a numerical value corresponding to the current user-selected strength of operation, corresponding to the electrical current applied to the coil; (3) lvl0, a previously sensed vibrational strength; (4) lvl1, a currently sensed vibrational strength; (5) freq, the current frequency at which the direction of current is alternated in the coil; (6) d, the control output to the H-bridge switch; and (7) inc, a Boolean value that indicates that the frequency is currently being increased. Next, in step **704**, the control program waits for a next event. The remaining steps represent a continuously executing loop, or event handler, in which each event that occurs is appropriately handled by the control program. In certain implementations of the control program, events may be initiated by interrupt-like mechanisms and stacked for execution while, in more primitive implementations, certain events that overlap in time may be ignored or dropped. In the implementation illustrated in FIGS. **7**A-C, two timers are used, one for controlling the change in direction of the current applied to the coil, at a currently established frequency, and the other for controlling a monitoring interval at which the control program monitors the vibrational force currently produced. Rather than using a formal timer mechanism, certain implementations may simply employ counted loops or other simple programming techniques for periodically carrying out tasks. 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. Otherwise, when the event is a monitor timer expiration event, as determined in step **710**, then a routine “monitor” is called in step **712**. Otherwise, when 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**. Otherwise, when the event is a power-down event, as determined in step **718**, resulting from deactivation of a power button by the user, then the control program appropriately powers down the device, in step **720**, and the control program terminates in step **722**. Any other of various types of events that may occur are handled by a default event handler **724**. These events may include various error conditions that arise during operation of the device.

FIG. **7**B provides a control-flow diagram for the routine “monitor,” called in step **712** of FIG. **7**A. In step **730**, the routine “monitor” converts the sensor input to an integer representing the current vibrational force produced by the LRVM and stores the integer value in the variable lvl1. Next, in step **732**, the routine “monitor” determines whether or not the LRVM is currently operating in the default mode. In the default mode, the LRVM uses continuous feedback control to optimize the vibrational force produced by the LRVM by continuously seeking to operate the LRVM at a frequency as close as possible to the resonant frequency for the LRVM. Other, more complex operational modes may be handled by various more complex routines, represented by step **734** in FIG. **7**B. More complex vibrational modes may systematically and/or periodically alter the frequency or produce various complex, multi-component vibrational modes useful in certain applications, appliances, devices, and systems. These more complex modes are application dependent, and are not further described in the control-flow diagrams. In the case that the operational mode is the default mode, in which the control program seeks to optimize the vibrational force generated by the device, in step **736**, the routine “monitor” determines whether the local variable Inc is set to TRUE. If so, then the control program is currently increasing the frequency at which the device operates in order to obtain the resonance frequency. When lvl1 is greater than lvl0, as determined in step **738**, then the vibrational force has been recently increased by increasing the frequency, and so the routine “monitor” increases the frequency again, in step **740**, and correspondingly resets the frequency timer. Otherwise, when lvl1 is less than lvl0, as determined in step **742**, then the control program has increased the frequency past the resonance frequency, and therefore, in step **744**, the control program decreases the frequency, sets the variable inc to FALSE, and correspondingly resets the frequency timer. In similar fashion, when the variable inc is initially FALSE, as determined in step **736**, and when lvl1 is greater than lvl0, as determined in step **746**, the routine “monitor” decreases the value stored in the variable freq, in step **748** and resets the frequency timer. 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**. Finally, the value in lvl1 is transferred to lvl0 and the monitor timer is reset, in step **754**.

FIG. **7**C provides a control-flow diagram for the routine “control,” called in step **716** in FIG. **7**A. 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. Finally, in step **764**, the routine “control” computes a new monitor timer interval and resets the monitor timer accordingly.

The control program described with reference to FIGS. **7**A-C is one example of many different implementations of the control program that can be carried out, depending on requirements of the LRVM, the parameters and characteristics inherent in a particular LRVM, the types of control inputs received from a particular user interface, the nature of the power supply, and the types of operational modes that are implemented for the LRVM.

FIG. **8** represents the range of frequencies and vibrational forces that can be achieved by different implementations of LRVM and LRVM control programs that represent embodiments of the current application. FIG. **8** has the same axes as the graph shown in FIG. **3**. However, unlike FIG. **3**, FIG. **8** includes many different curves, such as curve **802**, each representing the vibrational forces and frequencies that can be obtained from a particular LRVM implementation. Again, the LRVMs that represent embodiments of the current application generally have a resonant frequency that is characteristic of the geometry and weights of various components of the LRVM, and each LRVM is naturally operated at a frequency close to this resonant frequency in order to achieve maximum vibrational force. Thus, rather than being restricted, over all possible implementations, to a relatively narrow range of frequencies and vibrational forces, as in the case of unbalanced electrical motors, LRVMs that represent embodiments of the current application can be designed and implemented to produce desired vibrational forces over a wide range of vibrational frequencies, and desired vibrational frequencies over a wide range of desired vibrational forces. The contrast is perhaps best seen in FIG. **9**. 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. Unbalanced electric motors can be implemented to produce amplitude/frequency combinations roughly within the cross-hatched square region **902** within amplitude/frequency space. By contrast, LRVMs can be designed and implemented to produce amplitude/frequency combinations underlying curve **904**. Thus, LRVMs can achieve much higher operational frequencies and much lower operational frequencies than can be practically obtained by unbalanced electric motors, and can produce much higher amplitudes and vibrational forces than can be achieved by relatively low-powered unbalanced electrical motors used in hand-held appliances and other commonly encountered devices and systems. Furthermore, when larger vibrational forces are needed, balanced electrical motors are generally impractical or infeasible, due to the destructive forces produced within the electrical motors. In general, a single implemented LVM or LVRM can access a much larger region of amplitude/frequency space than currently available vibration modules, which generally operate at fixed amplitudes and/or fixed frequencies, as further discussed below.

FIGS. **10-17** show a variety of different alternative implementations of LRVMs that represent different embodiments of the current application. FIG. **10** provides a schematic illustration of an LRVM similar to that discussed above with reference to FIG. **4**A. Note that, in place of the end magnets **1002** and **1004**, mechanical springs may alternatively be used. These may be traditional helical springs made from metal or springs made from a compressible and durable material or mechanical device that seeks to restore its initial shape when depressed or compressed. Note that the weight and chamber may be cylindrical, in cross section, as discussed above with reference to FIG. **4**A, or may have other shapes, including rectangular or hexagonal cross-sections.

FIG. **11** shows a similar implementation in which the control unit and power supply are incorporated into the moving mass **1102**. In this implementation, the relative masses of the moving mass **1102** and remaining components of the LRVM is maximized, thus maximizing the vibrational forces produced at a given level of power consumption.

FIG. **12** shows yet an alternative LRVM an implementation of the linear-resonant vibration module to which current application is directed. In this alternative implementation, additional coils **1202** and **1204** are incorporated in the moving mass, and a centering magnet or coil **1206** is positioned in a fixed location on the housing so that, when the direction of the current applied to the coils **1202** and **1204** is alternated, an oscillating rotational force is generated to cause the movable weight to oscillate both in a plane perpendicular to the axis of the chamber as well as linearly oscillating the direction of the chamber.

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.

When the housing is fully enclosed, air within the chamber serves to dampen oscillation of the moving mass. This dampening may be minimized by providing channels, on the

sides of the moving mass, to allow air to pass from one side of the moving mass to the other, by channels through the moving mass, or by providing openings in the housing to allow air to be forced from the housing and drawn into the housing. Additionally, different fluids or liquids may be employed within the chamber to change the dampening effect produced by displacement of the fluids and gasses as the moving mass linearly oscillates.

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. 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**.

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.

FIG. **16** shows an alternative an implementation of the linear-resonant vibration module to which current application is directed similar to the embodiment shown in FIG. **15**. In this embodiment, the spring member **1602** is extended to provide an external massage arm **1604** that extends out from the housing to provide a linearly oscillating massage-foot member **1606** for massaging human skin or some other substrate, depending on the application.

FIG. **17** shows a mechanical vibration adjustment feature that can be added to either of the embodiments shown in FIGS. **15** and **16**. An adjustment screw **1702** can be manipulated to alter the position of a movable spring clamp **1704** that acts as a movable clamping point for the spring-like member **1706**. Moving the movable spring clamp **1704** leftward, in FIG. **17**, shortens the length of the spring-like member and thus tends to increase the resonant frequency at a particular power-consumption level. Conversely, moving the movable spring clamp rightward, in FIG. **17**, lengthens the spring-like member and decreases the vibrational frequency.

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.

As discussed above with reference to FIG. **6**, including a processor or microcontroller within a linear-resonant vibration module allows for a very large number of different processor-controlled vibration patterns and modes to be exhibited by the linear-resonant vibration module. As discussed above, processor control along with a linear-resonant-vibration-module architecture allows the processor-controlled device to access a much larger portion of a total amplitude/frequency space than can be accessed by currently available unbalanced-electric-motor vibration devices. Thus, processor-controlled linear-resonant vibration modules provide a large increase in functionality with respect to currently available vibration modules. There is, however, a relatively large gap in functionality between processor-controlled linear-resonance vibration modules and currently available unbalanced-electric-motor vibration modules that can be bridged by linear vibration modules that lack processor or microprocessor control.

When discussing vibration modules, electric motors, and other oscillating devices, it is common to use the phrase "Q factor," or "quality factor," to refer to a quality or characteristic of an oscillating device. The Q factor refers to the level of dampening of an oscillator or, in other words, a ratio of the energy stored in the oscillator or resonator to the energy needed to be supplied to the oscillator or resonator during each oscillation cycle in order to maintain a constant oscillation amplitude. FIG. **19** illustrates plots of amplitude versus frequency for a high-Q and a low-Q vibration device. The curve **1902** for a high-Q device generally has a narrower and taller amplitude peak about a resonant frequency **1904** or, in certain cases, several relatively tall, narrow peaks about several resonant frequencies, while a low-Q device exhibits a much broader, but lower-amplitude amplitude-versus-frequency curve **1906**. A linear-resonant vibration module, when controlled to vibrate at a resonant frequency, as described above, generally operates as a high-Q device. However, when controlled by user input or programmatically to vibrate at non-resonant frequencies, the linear-resonant vibration module may instead operate as a low-Q device. Linear vibration modules and other types of vibration modules that lack feedback control generally do not operate at resonant frequencies for extended periods of time, and thus tend to be low-Q devices.

Unbalanced-electric-motor vibration modules and even currently available resonating motors generally operate at either a fixed amplitude or a fixed frequency. For example, unbalanced-electric-motor vibration modules are generally operated at high revolutions per minute ("RPM") to create any vibration, and once operating at a given speed have a relatively fixed amplitude determined by the geometry of the unbalanced weight and rotor shaft. Other types of vibration modules that are currently available include resonating motors, such as the vibration modules found in certain electric toothbrushes, but these resonating motors operate only at a fixed frequency. In both cases, only a very limited portion of the amplitude/frequency space can be accessed by essentially fixed-amplitude or fixed-frequency vibration modules.

Alternative, lower-cost linear-vibration modules can be designed and manufactured by replacing the processor or microcontroller (**602** in FIG. **6**) of the above-described linear-resonant vibration module with a simpler oscillator circuit with additional control circuitry. The H switch (**620** in FIG. **6**) can be controlled by an oscillating current input rather than digital outputs from a microprocessor. Replacing the CPU or microprocessor with an oscillator and additional simple control circuitry produces a less functional, generally lower-Q, but also more economical linear vibration module that, although lacking the extremely broad range of vibration patterns and modes available to processor or microprocessor-controlled vibration modules, can nonetheless access a much larger portion of the amplitude/frequency space than can be accessed by currently available fixed-amplitude or fixed-frequency vibration modules.

In one example implementation of an oscillator-controlled linear vibration module, a variable-frequency oscillator circuit 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. A user is provided an input feature that allows the user to directly adjust the frequency of the variable oscillator and thus the vibrational frequency produced by the linear vibration module. 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. Thus, a user can control both the frequency of vibration and the amplitude of vibration.

FIG. **20** illustrates portions of amplitude/frequency space accessible to various types of vibration modules. In FIG. **20**, frequency is plotted with respect to a horizontal axis **2002** and amplitude is plotted with respect to a vertical axis **2004**. The plane indexed by these axes represents the amplitude/frequency space, portions of which can be accessed by a given type of vibration module. The above-described unbalanced-electric-motor vibrators are essentially constant-amplitude devices, and can thus access some range of frequencies at a fixed amplitude, represented by line segment **2006** in FIG. **20**. Different unbalanced-electric-motor vibrators may have different fixed amplitudes, but, for a given device, the portion of amplitude/frequency space that they can access can generally represented by a line segment or high-aspect-ratio rectangle oriented orthogonally to the amplitude axis. The resonant-motor vibration devices, which each operates at a fixed frequency, can generally access a range of amplitudes at the fixed frequency, as represented by line segment **2008** in FIG. **20**. By contrast, a linear vibration module user-input-controlled variable frequency and variable amplitude can access a two-dimensional subspace within the amplitude/frequency space, such as the region **2010** within elliptical boundary **2012** in FIG. **20**. Clearly, 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. A processor or microcontroller-controlled linear-resonant vibration module, as discussed above with reference to FIGS. **4A-18**, can access an even larger region of amplitude/frequency space that includes region **2010** with a subspace.

In certain low-Q linear vibration modules that lack microprocessor or microcontroller control, for any given frequency of operation, the amplitude tends to increase with decreasing frequency of operation. FIG. **21** illustrates 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. In FIG. **21**, solid curve **2102** represents the dependence of amplitude on frequency for a low-Q linear vibration module without additional control circuitry. As the frequency decreases, the amplitude begins to steeply and non-linearly increase. In certain applications, a constant or relatively constant amplitude is desired over a broad range of frequencies. A low-Q linear vibration module without microprocessor or microcontroller control can obtain a more constant amplitude over a broader range of frequencies by adjusting the current or duty cycle downward at lower frequencies. For example, as shown by dashed curve **2104** in FIG. **21**, the control circuitry can be implemented to detect when user-input-controlled operational frequency of a linear vibration module is below a threshold frequency **2106**, at which point control circuitry can lower the driving current or duty cycle to decrease the vibrational amplitude when the linear vibration module is operating at frequencies below the threshold frequency. Thus, dashed curve **2104** is the sum of a lowered-current low-frequency curve and a higher-current high-frequency curve, with the curves joined at the threshold frequency. Alternatively, control circuitry can be implemented to continuously adjust the current or duty cycle lower as the frequency of operation is lowered by user input in order to even further flatten the amplitude-versus-frequency curve for the linear vibration module. In either case, a user may override these automatic adjustments by increasing the amplitude at lower operational frequencies via user input to an amplitude-control user-input feature.

Returning to microprocessor-controlled or microcontroller-controlled linear vibration modules, it should be noted that processor or 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. Rather simple enhancements can produce interesting enhanced vibrational behavior. 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. **22**A-**23** illustrate interesting vibrational modes produced by driving a linear-resonant vibration module simultaneously at two different frequencies. FIG. **22**A shows a vibration mode of a linear vibration module driven at a frequency of 25 Hz. In a one-second duration of time, plotted with respect to horizontal axis **2202**, 25 cycles, each including a positive and negative amplitude peak, such as positive amplitude peak **2204** and negative amplitude peak **2206**, occur. At a constant 25 Hz frequency of operation, the positive peaks and negative peaks are evenly spaced. FIG. **22**B 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. **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. **22**A, with a second driving frequency of 20 Hz. 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 aperiodic vibration modes that do not repeat time.

In a linear-resonant vibration module, discussed above, by maintaining device operation at a resonant frequency, the linear-resonant vibration module is a relatively high-Q device, and generally operates more efficiently to produce a given vibration amplitude than a low-Q device, such as a linear vibration module lacking microprocessor or microcontroller control and operating at a frequency/amplitude setting that does not correspond to a natural vibration mode of the device. There are, in addition, many other ways to increase the energy efficiency of a linear vibration module.

FIGS. **24**A-**25** illustrate incorporation of paramagnetic flux paths into a linear vibration module. In free air, magnetic field lines radiate outwards in arcs from the north pole to the south, pole of a magnet, completing a magnetic circuit. 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 the flux of the magnetic field. A magnetic field seeks out the path of least resistance, and changes direction, when necessary, to maximize flux between the two magnetic poles. When introduced into a magnetic field, paramagnetic materials provide a lower-resistance path for magnetic flux, providing that they have adequate permeability and size to avoid saturation. Paramagnetic materials of appropriate permeability and size reduce the reluctance of a magnetic circuit and can therefore allow a magnetic field to more efficiently perform more work.

FIG. **24**A shows a linear vibration module without paramagnetic flux paths. On the left-hand side of FIG. **24**A, the magnetic field lines **2402** of the moving magnet are shown. A significant portion of the magnetic field lines can be seen to pass through air. 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. As can be seen by comparing FIG. **24**B to FIG. **24**A, only tiny portions of the flux lines in FIG. **24**B pass through free air, in contrast to the relatively large portions of flux lines that pass through free air in FIG. **24**A. Thus, addition of paramagnetic flux paths to a linear vibration module in order to decrease the portion of magnetic field lines passing through free air provides a more efficient linear vibration module.

FIG. **25** illustrates flux-path magnetic stops incorporated within a linear vibration module to which the current application is directed. During operation of the linear vibration module, and without the influence of any external force on the piston, the mid-plane of the shuttle magnet **2502** oscillates about the fixed mid-plane of the centering magnet **2504**. When the device encounters a resisting normal force on the end of the piston, the shuttle magnet biases into the motor and oscillates about a datum offset from the fixed mid-plane of the centering magnet. When the resisting force is greater than the electromagnetic force generated by the motor, the piston assembly continues to be driven into the bore until the flux disc **2506** is in line with the return lip **2508** of the flux path. In this position, the air gap of the magnetic circuit is reduced due to the proximity of the flux disc to the return lip. Maximum magnetic flux flow is achieved between these two components in a radial direction. Additional external axial force is required to force the piston assembly to move beyond this limit, effectively producing a magnetic stop. This effect also prevents the piston from being ejected from the motor at high power and low frequency settings at which the piston carries significant momentum.

Although the present invention has been described in terms of particular embodiments, it is not intended that the invention be limited to these embodiments. Modifications will be apparent to those skilled in the art. For example, as discussed above, LRVMs can be designed to produce desired vibrational amplitudes and frequencies over a wide region of amplitude/frequency space by varying various different design parameters and characteristics, including the amplitude of a moving mass that linearly oscillates within the LRVM, altering the dimensions of the LRVM and internal components of the LRVM, altering the weight of the moving mass and other components of the LRVM, changing the ratio of the moving mass to the ratio of the remaining components of the LRVM, increasing or decreasing the number of turns in the coil or coils used to drive linear oscillation, increasing or decreasing the current supply to the coils, altering the dampening produced by displacement of fluid or gas by the moving mass within the LRVM as well as by various additional frictional forces, altering the strength of the end-cap magnets or mechanical springs used to facilitate reversal of direction of the moving mass, and by changing any of various additional parameters and characteristics. Any of various different microprocessors and other microcontrollers can be used in alternative embodiments of the LRVM, as well as different power supplies, current-switching devices, and other components. The control program executed by the LRVM can be implemented in many different ways by varying any of many different design parameters, including programming language, control structures, data structures, modular organization, and other such design parameters. The components of the LRVM, including the housing, moving mass, fixed magnets, and electromagnets, can be fashioned from many different types of materials, from polymers and plastics to metals and alloys in various composite materials. LRVMs may contain one, two, or more electromagnets and/or permanent magnets in order to produce linear oscillation of a moving mass or spring-like mass, and various different control programs can be implemented to produce many different types of single-component and multi-component vibrational modes, some of which may regularly or erratically change, over time, to produce a wide variety of different types of vibrational characteristics. An additional housing made from a material with a relatively large magnetic permeability can be added to various embodiments of the current application to concentrate and increase the linear magnetic forces produced by the various coils.

The foregoing description, for purposes of explanation, used specific nomenclature to provide a thorough understanding of the invention. However, it will be apparent to one skilled in the art that the specific details are not required in order to practice the invention. The foregoing descriptions of specific embodiments of the present invention are presented for purpose of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments are shown and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents:

The invention claimed is:

1. A vibration module comprising:
- a housing;
- a moveable component;
- a power supply;
- user-input features;
- a driving component that drives the moveable component 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 one or more stored values.

2. The vibration module of claim **1** wherein the control component is one of:
- an variable oscillator circuit with additional control circuitry; and
- a control component that includes
  - a microprocessor,
  - 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.

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.

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.

5. 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
- 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.

6. 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
- 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.

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.

8. 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;
- wherein the movable component is a magnet shaped to slide within the tube; and
- wherein the driving component is an electromagnetic coil.

9. The vibration module of claim **1**
- wherein the housing is a tube, capped at both ends by movable-component-repelling components; and
- wherein the moveable component includes an electromagnetic-coil driving component and microprocessor.

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.

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.

12. 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;

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.

13. The 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.

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.

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.

16. The 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.

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.

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

19. A vibration module comprising:

a housing;

a moveable component;

a power supply;

user-input features;

a driving component that drives the moveable component to oscillate within the housing;

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

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.

20. A vibration module comprising:

a housing;

a moveable component;

a power supply;

user-input features;

a driving component that drives the moveable component 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 one or more stored values,

wherein the control component drives simultaneous oscillation of the moveable component at two or more frequencies to generate complex vibration modes.

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Pages SAPPX39 - SAPPX55

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Pages SAPPX56 - SAPPX61 Removed
Due to Confidential Material

Exhibit 4

Contact

www.linkedin.com/in/robert-kratsas-149a9b8 (LinkedIn)

Robert Kratsas

Director of Power Devices at Cirrus Logic
Austin, Texas, United States

Summary

Seasoned executive with extensive business & technical management experience in advanced microelectronic systems. Expert in generating new market opportunities with direct financial return for my company, by finding the timely intersecting of innovative technology with our customers needs in the form of next generation integrated circuits.

Repeatable track record of meeting forecasted financial goals, as well as consistent execution of new product developments for demanding customers in high volume quality driven environments.

Leadership & People Management Skills: Directly managed multiple technical teams located in many different geographical locations.

Results Oriented: Led multiple cross-functional teams through multiple product launches as well as developing new products

Experience

Cirrus Logic

23 years 7 months

Director of Charging & Power Group (CPG)
July 2021 - Present (2 years 7 months)
Austin, Texas, United States

Currently overseeing the integration of the Lion Semiconductor Inc team into Cirrus Logic as a standalone business.

Responsibilities include:
1. Growing the Design, Systems, & Marketing teams to capitalize on and expand current revenue opportunities .
2. Developing a Strategic Vision for the Power Team to help focus new investment opportunities
3. Overall P&L ownership

Director of Strategy

February 2020 - December 2021 (1 year 11 months)

Austin, Texas, United States

As the leader for the Cirrus Logic Strategy Group, reporting to the CEO, I have been tasked with investigating new areas of growth for the company. Our mission is to take a small focused group of technology and business leaders and highlight opportunities within the semiconductor market that are aligned with Cirrus's core values. These investigations will start by highlighting new foundational technologies which can intersect growing markets within the semiconductor industry, and ultimately result in new product lines for the company. Duties also include working with the Cirrus Corp M&A team to highlight investment opportunities for new IP , as well as acquisition targets that will increase the companies revenue and further diversification.

Director of Strategic Business Development

January 2019 - February 2020 (1 year 2 months)

Austin, Texas, United States

Cirrus Logic Strategy Group

Worked as a individual contributor in the newly formed Cirrus Logic Strategy Group focused on finding and developing new growth opportunities for the company.

Director of Audio Amplifier Team - $70M in Annual Business

October 2015 - January 2019 (3 years 4 months)

Austin, Tx

Worked with Design, Systems, Applications, and Firmware Team to start a Amplifier Imperative focused on driving New Revenue Opportunities inside Cirrus Logic

- In 2018 won Five New Amplifier Designs at the two largest Mobile Phone OEMS in the World
- Was involved in growing the business from no revenue to a $70M business in under three years.

Director of Portable Products - $1.2B in Annual Business

June 2013 - December 2017 (4 years 7 months)

Austin, Tx

Direct Responsibility over all Products For Cirrus Logic's Main Strategic Customer

Lead a team of Four Product Managers who oversaw Amplifiers, Audio Codecs , and all Accessory Products, culminating in yearly revenue worth $1.2B

Portable Product Line Manager - $600M in Annual Business
July 2007 - June 2013 (6 years)
Austin Texas

Product Line Manager for Cirrus Portable Audio Products

2009 - "Marketing Manager of The Year"

Directly Responsible for over $600 Million worth of Yearly Business

Duties Include:

- All Portable Product Definition
- Strategic Customer Support, and Product Life-cycle Oversight

Audio Codec Product Line Manager - $200M in Lifetime Business
July 2005 - July 2007 (2 years 1 month)

Audio Codec Responsibilities with a Focus On Automotive

Duties Include :

- Audio Codec Product Definition
- Strategic Customer Interface and Business Oversight.
- Responsible for Lifetime revenue in excess of $200M.

Foundry Manager
March 2001 - June 2005 (4 years 4 months)

Foundry Manager

Duties Include:

- Foundry Manufacturing Oversight
- Wafer Price Negotiations
- Wafer Production Planning

Failure Analysis Engineer
July 2000 - February 2001 (8 months)

Semiconductor FA

- LEM
- SEM
- Micro-probing Techniques down to .25um

AMD
Yield Analysis Engineer
September 1997 - June 2000 (2 years 10 months)

Defect Yield Analysis and Modeling using KLA & Tencor tools to find and locate sources of yield loss.

Texas Instruments
Product Engineering

May 1995 - August 1997 (2 years 4 months)
McKinney Texas

Worked on Team of Engineers responsible for Sub-Assemblies that feed FLIR and Guidance Devices products.

Education

University of Colorado at Boulder
B.S., Chemical Engineering · (1988 - 1993)

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Exhibit 6

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Alabama

355 Apple employees

8,800 App Store ecosystem jobs

163 Suppliers

2 Retail stores

Apple employment in the state has grown by 41 percent over the past two years.

Apps created in AL

iCell · Guess The Emoji · Regions

Alaska

74 Apple employees

1,000 App Store ecosystem jobs

11 Suppliers

1 Retail store

Since the Apple Store in Anchorage opened in 2011, it has welcomed 2.2 million customers.

Apps created in AK

Cruise Cam · SuperBall 3 · StatMan

Arizona

1,010 Apple employees

21,800 App Store ecosystem jobs

168 Suppliers with 5 mfg. facilities

6 Retail stores

Mesa is home to Apple's Global Data Command Center.

Apps created in AZ

2X SX Lite · The Executive · Hooked On

Arkansas

119 Apple employees

3,200 App Store ecosystem jobs

19 Suppliers

1 Retail store

Last year our Little Rock store helped nearly 1,000 businesses get up and running with Apple devices.

Apps created in AR

Sam's Club · Field Agent · Land Nav Assistant

California

36,786 Apple employees

370,800 App Store ecosystem jobs

3,970 Suppliers with 38 mfg. facilities

53 Retail stores

California has the highest concentration of Apple suppliers and app economy jobs of any state.

Apps created in CA

Instagram · Creative Cloud · OpenTable

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Colorado

1,114 Apple employees

28,100 App Store ecosystem jobs

205 Suppliers with 4 mfg. facilities

6 Retail stores

Apple works with Avago Technologies in Ft. Collins to make radio frequency components.

Apps created in CO

Sling · STARZ · DragonVale

Connecticut

729 Apple employees

13,400 App Store ecosystem jobs

97 Suppliers with 3 mfg. facilities

7 Retail stores

Connecticut is among 23 states with 500 or more Apple employees.

Apps created in CT

ESPN · KAYAK · WWE

Delaware

235 Apple employees

4,400 App Store ecosystem jobs

32 Suppliers

1 Retail store

The Christiana Mall store has helped over 1,000 businesses get running with Apple devices.

Apps created in DE

RWT · Trading Cards · Barclaycard

D.C.

168 Apple employees

21,400 App Store ecosystem jobs

140 Suppliers

1 Retail store

Apple is working on an exciting new store opportunity with the historic Carnegie Library.

Apps created in DC

NPR One · WWF Together · Quartz

Florida

3,868 Apple employees

58,200 App Store ecosystem jobs

245 Suppliers with 4 mfg. facilities

18 Retail stores

The equipment used to do advanced testing of the MacBook Pro display and Touch Bar is made in Florida.

Apps created in FL

Nearpod · VR Roller Coaster · MyRadar

2

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Georgia

1,516 Apple employees

45,100 App Store ecosystem jobs

186 Suppliers with 3 mfg. facilities

6 Retail stores

Turner Broadcasting entertainment apps — Comedy Network, Adult Swim, TBS, and more — come from Atlanta.

Apps created in GA

FlyDelta · CNN · MailChimp

Hawaii

328 Apple employees

3,600 App Store ecosystem jobs

26 Suppliers

3 Retail stores

The Apple Honolulu store is a global tourist destination and had over 2 million visitors in 2016.

Apps created in HI

Filterstorm Neue · iWatermark · Tetris Battle Drop

Idaho

145 Apple employees

3,500 App Store ecosystem jobs

27 Suppliers with 2 mfg. facilities

1 Retail store

In 2016 the Boise Towne Square store participated in over 350 hours of volunteer time with local organizations.

Apps created in ID

ComicBook! · DEVONthink · Krazy Cou...

Illinois

1,422 Apple employees

64,000 App Store ecosystem jobs

493 Suppliers with 6 mfg. facilities

9 Retail stores

Illinois is a top 10 state for number of suppliers, direct Apple employment, and app economy jobs.

Apps created in IL

United · WolframAlpha · Waterminder

Indiana

381 Apple employees

15,100 App Store ecosystem jobs

84 Suppliers with 8 mfg. facilities

2 Retail stores

Polymer Science's adhesives bond components inside iOS enclosures to ensure their reliability and durability.

Apps created in IN

Steak 'n Shake · Artboard · DoubleMap

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Iowa

129 Apple employees

10,400 App Store ecosystem jobs

30 Suppliers with 1 mfg. facility

1 Retail store

Materials that help form the display modules of iPhone and iPad come from the 3M plant in Knoxville.

Apps created in IA

10 Frame Fill · TaxACT · Line 'em Up

Kansas

177 Apple employees

6,300 App Store ecosystem jobs

36 Suppliers

1 Retail store

Since Apple's store in Leawood opened in 2008, the store has welcomed more than 3.7 million customers.

Apps created in KS

Letterpress · Garmin Connect · Sprint Zone

Kentucky

298 Apple employees

10,200 App Store ecosystem jobs

43 Suppliers with 2 mfg. facilities

2 Retail stores

The glass in every iPhone since its launch was developed by Corning and is still produced at the Harrodsburg plant.

Apps created in KY

Hanx Writer · Pictophile · MyHumana

Louisiana

302 Apple employees

6,500 App Store ecosystem jobs

86 Suppliers

2 Retail stores

Six Louisiana schools take part in Apple's ConnectED program.

Apps created in LA

Numberlys · Notion · Waitr

Maine

126 Apple employees

2,300 App Store ecosystem jobs

31 Suppliers with 1 mfg. facility

1 Retail store

The Texas Instruments plant in Portland makes electrical components that go into Apple products.

Apps created in ME

National Parks · 7 Little Words · WEX Connect

4

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Maryland

602 Apple employees

32,300 App Store ecosystem jobs

111 Suppliers with 3 mfg. facilities

5 Retail stores

Maryland is a top 20 state for app economy job creation.

Apps created in MD

Marriott · Fallout Shelter · WeatherBug

Massachusetts

1,265 Apple employees

65,100 App Store ecosystem jobs

379 Suppliers with 9 mfg. facilities

11 Retail stores

A partner for over 8 years, Analog Devices based in Norwood supplies chips that enable iOS touch displays.

Apps created in MA

TripAdvisor · Lose It! · Fidelity Investments

Michigan

949 Apple employees

34,700 App Store ecosystem jobs

188 Suppliers with 4 mfg. facilities

6 Retail stores

Dow Corning processes raw materials so they can be used to produce Apple products.

Apps created in MI

Deliveries · Domino's · Duo Mobile

Minnesota

595 Apple employees

33,400 App Store ecosystem jobs

198 Suppliers with 7 mfg. facilities

5 Retail stores

Headquartered in St. Paul, 3M produces display materials at several U.S. locations, including its Hutchinson plant.

Apps created in MN

Cartwheel · US Bank · PRI

Mississippi

111 Apple employees

3,800 App Store ecosystem jobs

14 Suppliers

1 Retail store

In 2016, Apple Renaissance at Colony Park hosted nearly 500 events and workshops for the local community.

Apps created in MS

myBlue · SkyGolf 360 · My C Spire

5

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Missouri

517 Apple employees

16,400 App Store ecosystem jobs

64 Suppliers with 2 mfg. facilities

3 Retail stores

Missouri is one of 23 states where Apple has 500 or more employees.

Apps created in MO

Enterprise · Panera · Grammar Snob

Montana

21 Apple employees

1,500 App Store ecosystem jobs

12 Suppliers with 1 mfg. facility

Schools from Browning, Pablo, and Box Elder take part in Apple's ConnectED program.

Apps created in MT

Goomzee · Schedulicity · Coconut Keno

Nebraska

123 Apple employees

4,700 App Store ecosystem jobs

19 Suppliers with 1 mfg. facility

1 Retail store

Vishay Intertechnology provides electrical components for many Apple products.

Apps created in NE

Hudl · Omaha Steaks · StuffFinder

Nevada

717 Apple employees

7,500 App Store ecosystem jobs

65 Suppliers with 1 mfg. facility

5 Retail stores

Apple operates a data center in Reno. With NV Energy, we recently announced our largest solar investment to date.

Apps created in NV

Zappos · Photo Vault · UFC

New Hampshire

335 Apple employees

4,400 App Store ecosystem jobs

55 Suppliers with 4 mfg. facilities

3 Retail stores

Apple has welcomed nearly 12 million visitors to our New Hampshire stores since the first one opened in Dec. 2001.

Apps created in NH

Video Star · My Russound · Planet Fitness

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

New Jersey

1,391 Apple employees

42,200 App Store ecosystem jobs

261 Suppliers with 1 mfg. facility

12 Retail stores

New Jersey has one of the highest concentrations of Apple Store locations of any state.

Apps created in NJ

Jet · Path to Luma · My Verizon

New Mexico

187 Apple employees

2,700 App Store ecosystem jobs

22 Suppliers with 8 mfg. facilities

1 Retail store

Intel provides processors for Mac in its Rio Rancho manufacturing facility.

Apps created in NM

SkyView · LANL · Lobster Diver

New York

4,291 Apple employees

120,000 App Store ecosystem jobs

804 Suppliers with 9 mfg. facilities

21 Retail stores

New York City is one of five U.S. cities with more than 1,000 Apple employees.

Apps created in NY

Venmo · Bloomberg · MLB

North Carolina

1,148 Apple employees

33,500 App Store ecosystem jobs

173 Suppliers with 7 mfg. facilities

5 Retail stores

Greensboro-based Qorvo works with Apple to design and manufacture components that enable our devices to connect with cellular networks.

Apps created in NC

Temple Run 2 · U by BB&T · BofA

North Dakota

4 Apple employees

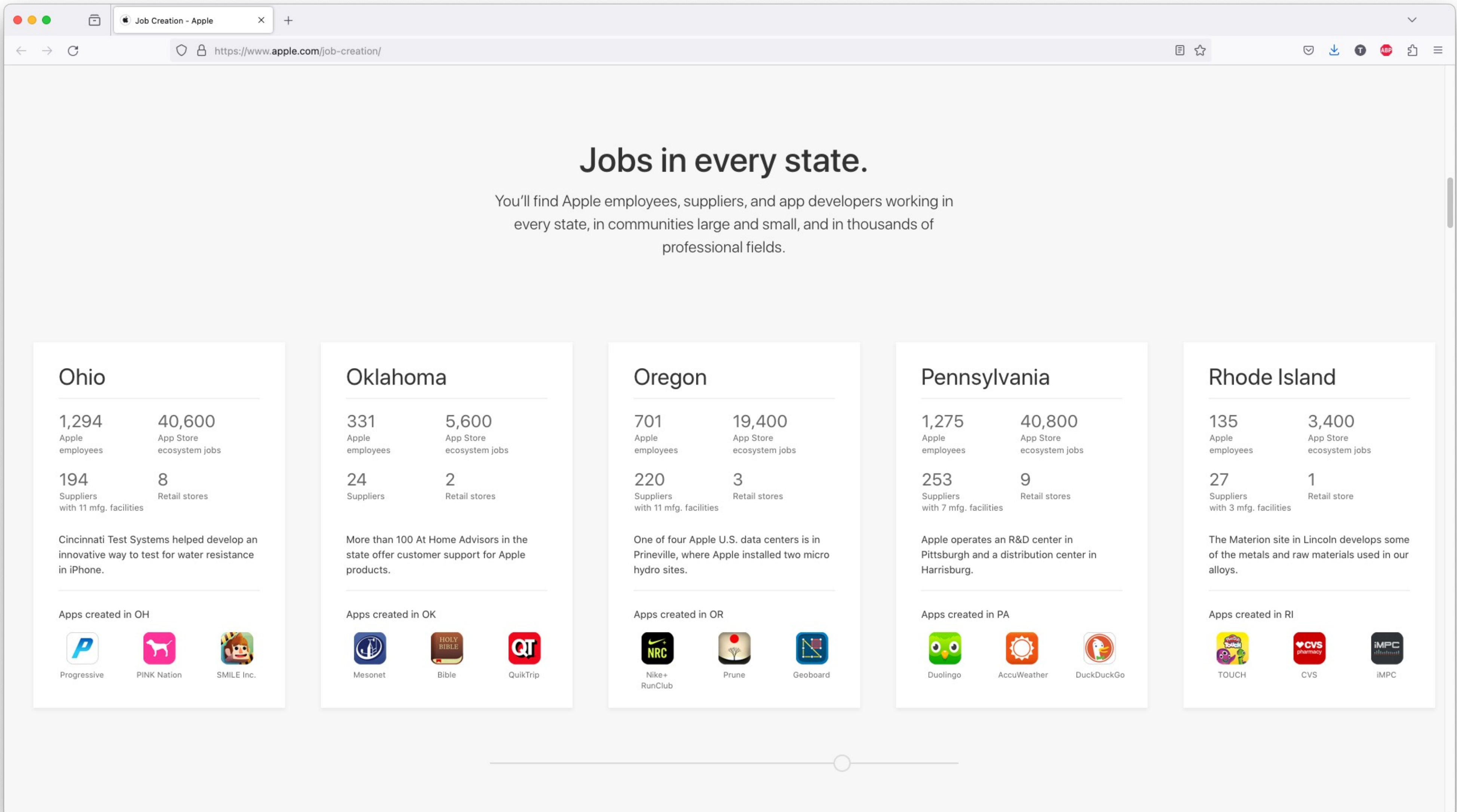
1,800 App Store ecosystem jobs

5 Suppliers

Cannon Ball Elementary School is a participant in Apple's ConnectED program.

Apps created in ND

Inforum Now · WSK · Stratus



Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Ohio

1,294 Apple employees

40,600 App Store ecosystem jobs

194 Suppliers with 11 mfg. facilities

8 Retail stores

Cincinnati Test Systems helped develop an innovative way to test for water resistance in iPhone.

Apps created in OH

Progressive · PINK Nation · SMILE Inc.

Oklahoma

331 Apple employees

5,600 App Store ecosystem jobs

24 Suppliers

2 Retail stores

More than 100 At Home Advisors in the state offer customer support for Apple products.

Apps created in OK

Mesonet · Bible · QuikTrip

Oregon

701 Apple employees

19,400 App Store ecosystem jobs

220 Suppliers with 11 mfg. facilities

3 Retail stores

One of four Apple U.S. data centers is in Prineville, where Apple installed two micro hydro sites.

Apps created in OR

Nike+ RunClub · Prune · Geoboard

Pennsylvania

1,275 Apple employees

40,800 App Store ecosystem jobs

253 Suppliers with 7 mfg. facilities

9 Retail stores

Apple operates an R&D center in Pittsburgh and a distribution center in Harrisburg.

Apps created in PA

Duolingo · AccuWeather · DuckDuckGo

Rhode Island

135 Apple employees

3,400 App Store ecosystem jobs

27 Suppliers with 3 mfg. facilities

1 Retail store

The Materion site in Lincoln develops some of the metals and raw materials used in our alloys.

Apps created in RI

TOUCH · CVS · iMPC

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

South Carolina

348 Apple employees

12,300 App Store ecosystem jobs

62 Suppliers with 2 mfg. facilities

2 Retail stores

Over the past two years, Apple employment in South Carolina has grown by 25 percent.

Apps created in SC

TerraStride Pro · Comic Life 3 · X-Plane 10

South Dakota

17 Apple employees

2,200 App Store ecosystem jobs

8 Suppliers with 1 mfg. facility

At Home Advisors based in South Dakota offer technical support to customers across the Americas.

Apps created in SD

Intro to Colors · FAL Free · StayConnect

Tennessee

689 Apple employees

16,000 App Store ecosystem jobs

82 Suppliers

4 Retail stores

Tennessee is a major logistics and shipping hub, distributing Apple products across the Americas.

Apps created in TN

FedEx · Utility · Regal

Texas

8,407 Apple employees

105,000 App Store ecosystem jobs

515 Suppliers with 13 mfg. facilities

18 Retail stores

Apple's second-largest corporate presence in the world is in Austin, with 6,000 employees from the local area.

Apps created in TX

American · Match · USAA

Utah

393 Apple employees

13,800 App Store ecosystem jobs

76 Suppliers with 2 mfg. facilities

3 Retail stores

For nearly 20 years, family-run Fetzer Woodworking has crafted tables and fixtures for our stores worldwide.

Apps created in UT

Journal · Ancestry · InstaSize

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Vermont

6 Apple employees

2,300 App Store ecosystem jobs

22 Suppliers with 6 mfg. facilities

Radio frequency components for Apple products are manufactured in Vermont and we also do packaging research and design in the state.

Apps created in VT

Ello, Banktivity, ShopRite

Virginia

1,101 Apple employees

59,300 App Store ecosystem jobs

156 Suppliers with 2 mfg. facilities

9 Retail stores

Since 2010 App Store payments to developers in Virginia have grown 40 percent.

Apps created in VA

Capital One, PBS KIDS, Languages

Washington

1,131 Apple employees

81,100 App Store ecosystem jobs

189 Suppliers with 10 mfg. facilities

6 Retail stores

Seattle is an R&D center for artificial intelligence and machine learning.

Apps created in WA

Starbucks, Zillow, Omni Group

West Virginia

39 Apple employees

9,700 App Store ecosystem jobs

7 Suppliers with 1 mfg. facility

Many school districts use iPad as a learning tool, including Kanawha County, the state's largest district.

Apps created in WV

WSAZ Weather, HelpWELL, WesBanco

Wisconsin

410 Apple employees

15,500 App Store ecosystem jobs

69 Suppliers with 2 mfg. facilities

3 Retail stores

The beautiful card stock Apple uses in its packaging comes from Wisconsin.

Apps created in WI

Kohl's, Ultrapic, GoodMeeting

Job Creation - Apple

https://www.apple.com/job-creation/

Jobs in every state.

You'll find Apple employees, suppliers, and app developers working in every state, in communities large and small, and in thousands of professional fields.

Virginia

1,101 Apple employees

59,300 App Store ecosystem jobs

156 Suppliers with 2 mfg. facilities

9 Retail stores

Since 2010 App Store payments to developers in Virginia have grown 40 percent.

Apps created in VA

Capital One · PBS KIDS · Languages

Washington

1,131 Apple employees

81,100 App Store ecosystem jobs

189 Suppliers with 10 mfg. facilities

6 Retail stores

Seattle is an R&D center for artificial intelligence and machine learning.

Apps created in WA

Starbucks · Zillow · Omni Group

West Virginia

39 Apple employees

9,700 App Store ecosystem jobs

7 Suppliers with 1 mfg. facility

Many school districts use iPad as a learning tool, including Kanawha County, the state's largest district.

Apps created in WV

WSAZ Weather · HelpWELL · WesBanco

Wisconsin

410 Apple employees

15,500 App Store ecosystem jobs

69 Suppliers with 2 mfg. facilities

3 Retail stores

The beautiful card stock Apple uses in its packaging comes from Wisconsin.

Apps created in WI

Kohl's · Ultrapic · GoodMeeting

Wyoming

7 Apple employees

900 App Store ecosystem jobs

4 Suppliers

At Home Advisors based in Wyoming offer technical support to customers all across the Americas.

Apps created in WY

Park My Yacht · Sierra Tradi... · TimeLapse

Exhibit 10

State	Closer to	Employees	Suppliers
Alabama	WDTX	355	163
Alaska	NDCA	74	11
Arizona	Neither	1010	168
Arkansas	WDTX	119	19
California	NDCA	36786	3970
Colorado	Neither	1114	205
Connecticut	WDTX	729	97
Delaware	WDTX	235	32
D.C.	WDTX	168	140
Florida	WDTX	3868	245
Georgia	WDTX	1516	186
Hawaii	NDCA	328	26
Idaho	NDCA	145	27
Illinois	WDTX	1422	493
Indiana	WDTX	381	84
Iowa	WDTX	129	30
Kansas	WDTX	177	36
Kentucky	WDTX	298	43
Louisiana	WDTX	302	86
Maine	WDTX	126	31
Maryland	WDTX	602	111
Massachusetts	WDTX	1265	379
Michigan	WDTX	949	188
Minnesota	WDTX	595	198
Mississippi	WDTX	111	14
Missouri	WDTX	517	64
Montana	NDCA	21	12
Nebraska	WDTX	123	19
Nevada	NDCA	717	65
New Hampshire	WDTX	335	55
New Jersey	WDTX	1391	261
New Mexico	Neither	187	22
New York	WDTX	4291	804
North Carolina	WDTX	1148	173
North Dakota	Neither	4	5
Ohio	WDTX	1294	194
Oklahoma	WDTX	331	24
Oregon	NDCA	701	220
Pennsylvania	WDTX	1275	253
Rhode Island	WDTX	135	27
South Carolina	WDTX	348	62
South Dakota	WDTX	17	8
Tennessee	WDTX	689	82
Texas	WDTX	8407	515

Total Employees closer to WDTX	35204
Total Employees closer to NDCA	40296
Total Suppliers closer to WDTX	5370
Total Suppliers closer to NDCA	4596

Utah	NDCA	393	76
Vermont	WDTX	6	22
Virginia	WDTX	1101	156
Washington	NDCA	1131	189
West Virginia	WDTX	39	7
Wisconsin	WDTX	410	69
Wyoming	Neither	7	4

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UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
MIDLAND-ODESSA DIVISION

RESONANT SYSTEMS, INC. d/b/a RevelHMI, *Plaintiff,* v. APPLE INC., *Defendant*.	Case No. 7:23-cv-00077-DC JURY TRIAL DEMANDED

DEFENDANT APPLE INC.'S OPPOSED MOTION TO STAY PENDING RESOLUTION OF APPLE'S MOTION TO TRANSFER

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I. INTRODUCTION

Defendant Apple Inc. ("Apple") respectfully moves to stay all case activity pending resolution of its Motion to Transfer to the Northern District of California ("NDCA"). As the Fifth Circuit and the Federal Circuit have repeatedly emphasized, resolving a pending motion to transfer should take top priority, ahead of addressing underlying substantive issues. Apple's Motion to Transfer is pending and venue discovery is complete. A stay is necessary as substantive deadlines are quickly approaching. Apple's opening *Markman* brief is due in two weeks, fact discovery opens in April, and other major deadlines—such as the submission of technology tutorials, the *Markman* hearing, and the exchange of final contentions—follow soon thereafter.

All relevant factors favor a stay. First, Resonant will not be prejudiced by a stay, as it does not make any products and is not seeking injunctive relief. Second, Apple will be harmed without a stay, as it will need to invest significant resources to litigate in an inconvenient venue that has no relevant witnesses or evidence. Finally, without a stay, judicial resources will be wasted if this case is later transferred to NDCA, as it should be, given that it is clearly the more convenient venue. Thus, further proceedings should be stayed pending a decision on transfer.

II. FACTUAL BACKGROUND

Resonant filed this suit in the Western District of Texas ("WDTX") on June 1, 2023. Dkts. 1 (Complaint), 20 (First Amended Complaint, filed August 14, 2023, "FAC"). Apple filed its answer on August 28, 2023, Dkt. 24, and timely filed a motion to transfer on October 10, 2023, Dkts. 36–37. After a three-month venue discovery period—which was extended from the 10-week maximum in the Court's Standing Order, per Resonant's request, *see* Ex. 1 (2023-12-11 to 12-12 Email)—the motion to transfer was fully briefed by February 16, 2024. *See* Dkts. 43–48.

Per the Court's Scheduling Order, Dkt. 40, the parties and the Court face several imminent deadlines that will require significant work. For example, Apple's opening *Markman* brief is due on March 7, 2024; fact discovery opens on April 12, 2024; technology tutorials are due May 9, 2024; the *Markman* hearing is scheduled for May 16, 2024; and final infringement/invalidity contentions are due on June 6, 2024. These upcoming deadlines, especially those relating to claim construction, are expected to require significant time and resources from the parties and the Court. Granting a stay now will avoid incurring unnecessary inconvenience and expense.

The parties met and conferred on February 23, 2024, to discuss Resonant's position on this motion for a stay. Resonant's counsel acknowledged that the Court should resolve Apple's transfer motion prior to the *Markman* hearing but stated that it opposes this motion. In addition, Resonant's counsel stated that it intends to re-open the transfer briefing by seeking leave to file a sur-reply to Apple's transfer motion. Ex. 2 (2024-02-16 to 2-20 Email). Resonant did not identify any new fact or issue that would warrant additional briefing and, as it would needlessly delay resolution of Apple's motion to transfer, Apple would oppose such a request.

In any event, regardless of whether the Court grants Resonant's attempt to rehash the same arguments it made in its opposition to transfer, the Court should stay all substantive deadlines, not just the *Markman* hearing, pending resolution of Apple's transfer motion.

III. THIS CASE SHOULD BE STAYED PENDING THE TRANSFER DECISION

A. The Resolution of Apple's Motion to Transfer Should Take "Top Priority"

Appellate courts' precedent, this District's standard practice, and recent mandamus law all require this case to be stayed pending Apple's transfer motion. "[O]nce a party files a transfer motion, disposing of that motion should unquestionably take top priority." *In re Apple Inc.*, 979 F.3d 1332, 1337 (Fed. Cir. 2020) (making clear that transfer should be handled before other substantive tasks, including *Markman*); *In re TikTok, Inc.*, 85 F.4th 352, 362 (5th Cir. 2023) ("[D]isposition of a [§ 1404(a)] motion should [take] a top priority in the handling of a case." (quoting *In re Horseshoe Ent.*, 337 F.3d 429, 433 (5th Cir. 2003))). Thus, a district court should "timely decide the transfer motion before proceeding to further substantive matters." *In re Apple Inc.*, No. 2023-120, 2023 WL 2359699, at *2 (Fed. Cir. Mar. 6, 2023) (granting petition for mandamus); *In re Apple, Inc.*, 52 F.4th 1360, 1363 (Fed. Cir. 2022) (directing the district court to "postpone fact discovery and other substantive proceedings until after consideration of Apple's motion for transfer"); *In re TracFone Wireless, Inc.*, 848 F. App'x 899, 900–01 (Fed. Cir. 2021) (similar); *In re SK hynix Inc.*, 835 F. App'x 600, 600–01 (Fed. Cir. 2021) (similar).

It is therefore this District's well-established practice to stay proceedings pending resolution of a transfer motion. *See, e.g.*, Text Order Granting Motion to Stay Case, *KOSS Corp. v. Plantronics, Inc.*, No. 6:20-cv-00663-ADA (W.D. Tex. Apr. 8, 2021); Text Order Granting Motion to Stay Case, *NewFlux v. Best Buy Co.*, No. 6:20-cv-00732-ADA (W.D. Tex. Apr. 13, 2021); Order Staying Case, *Red Rock Analytics, LLC v. Apple Inc. et al.*, No. 6:21-cv-00346-ADA (W.D. Tex. June 13, 2022), Dkt. 130. After all, the fundamental purpose of the transfer statute—"to protect litigants, witnesses and the public against unnecessary inconvenience and expense"—is "thwarted" if protracted litigation occurs in an inconvenient venue before transfer is resolved. *Cont'l Grain Co. v. The Barge FBL-585*, 364 U.S. 19, 27 (1960); *Apple*, 52 F.4th at 1361; *see also In re Google Inc.*, No. 2015-138, 2015 WL 5294800, at *1–2 (Fed. Cir. 2015) (explaining that lengthy delays in deciding transfer motions can "frustrate 28 U.S.C. § 1404(a)'s intent" when "a motion to transfer lingers unnecessarily on the docket" (internal citation omitted)).

In three recent cases filed against Apple in this District, the Federal Circuit directed the district court to "postpone fact discovery and other substantive proceedings until after consideration of Apple's motion for transfer[,]" explaining that "precedent entitles parties to have their venue motions prioritized" and that "decision of a transfer motion must proceed expeditiously as the first order of business[.]" *Apple*, 52 F.4th at 1362–63; *In re Apple Inc.*, No. 2022-163, 2022

WL 16754376, at *1 (Fed. Cir. Nov. 8, 2022); *In re Apple Inc.*, No. 2022-164, 2022 WL 16754153, at *1 (Fed. Cir. Nov. 8, 2022). Orders subsequently issued in each underlying case, staying all deadlines. *See Aire Tech. Ltd., v. Apple Inc.*, No. 6:21-cv-01101-ADA (W.D. Tex. Nov. 8, 2022), Dkt. 71; *Scramoge Tech. Ltd. v. Apple Inc.*, No. 6:21-cv-01071-ADA (W.D. Tex. Nov. 8, 2022), Dkt. 68; *XR Commc'ns LLC v. Apple Inc.*, No. 6:21-cv-00620-ADA (W.D. Tex. Nov. 8, 2022), Dkt. 83.

With fact discovery about to open and the fast-approaching deadlines for *Markman* briefings, technology tutorials, the *Markman* hearing, and final contentions, the Appellate courts' directives require prioritizing the resolution of the pending transfer motion and staying this case to avoid undue and unnecessary burdens on the parties and this Court.

B. All Relevant Factors Favor a Stay Pending a Decision on Transfer

Courts in this District typically consider three factors to determine whether a stay is warranted: (1) any potential prejudice to the non-moving party; (2) the hardship and inequity to the moving party if the action is not stayed; and (3) the judicial resources saved if a stay is granted. *Yeti Coolers, LLC v. Home Depot U.S.A., Inc.*, No. 1:17-CV-342-RP, 2018 WL 2122868, at *1 (W.D. Tex. Jan. 8, 2018). Here, all three factors favor a stay.

1. A Stay Will Not Prejudice Resonant

A stay pending resolution of Apple's Motion to Transfer will not prejudice Resonant. Where a party, like Resonant, "does not make or sell any product that practices the claimed invention[,]" a short stay does not prejudice it. *In re Morgan Stanley*, 417 F. App'x 947, 950 (Fed. Cir. 2011); *see In re Google LLC*, 58 F.4th 1379, 1383 (Fed. Cir. 2023) (noting that a non-competing party "is not threatened in the market in a way that . . . might add urgency to case resolution"). Nor does Resonant request any injunctive relief, Dkt. 20 (FAC), so a "mere delay in collecting [any alleged] damages does not constitute undue prejudice." *Crossroads Sys., Inc. v.*

Dot Hill Sys. Corp., No. A-13-CA-1025-SS, 2015 WL 3773014, at *2 (W.D. Tex. June 16, 2015); *Kirsch Rsch. & Dev., LLC v. Tarco Specialty Prods., Inc.*, No. 6:20-CV-00318-ADA, 2021 WL 4555804, at *2 (W.D. Tex. Oct. 4, 2021) ("[T]he weight of Plaintiff's interest in timely enforcement is diminished here where a stay would merely delay Plaintiff's potential monetary recovery.").

Even if Resonant could, arguendo, show that it would suffer some economic disadvantage from a stay, there would be a simple remedy in the form of pre-judgment interest. *See, e.g.*, *Underwater Devices Inc. v. Morrison-Knudsen Co., Inc.*, 717 F.2d 1380, 1389 (Fed. Cir. 1983), *overruled on other grounds by In re Seagate Tech., LLC*, 497 F.3d 1360 (Fed. Cir. 2007); *see also Transmatic, Inc. v. Gulton Indus., Inc.*, 180 F.3d 1343, 1347–48 (Fed. Cir. 1999). And although "delay in the vindication of patent rights . . . is present in every case in which a patentee resists a stay," it is "not sufficient, standing alone, to defeat a stay motion." *NFC Tech. LLC v. HTC Am., Inc.*, No. 2:13-CV-1058-WCB, 2015 WL 1069111, at *2 (E.D. Tex. Mar. 11, 2015).

2. Apple Will Suffer Undue Hardship Absent a Stay

Absent a stay, this case will progress into substantial merits proceedings in less than two weeks, which will impose significant hardship on Apple and the Court. Apple's opening *Markman* brief is due March 7, 2024, and there are currently 21 terms at issue. Exs. 3–4 (Parties' Proposed Constructions). This District has stayed cases even when the *Markman*-related burdens were much lower. *See Scramoge*, No. 6:21-cv-01071-ADA (W.D. Tex. 2022) Dkts. 41, 68 (staying the case pending transfer where only four terms were presented for construction).[1]

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[1] To the extent Resonant requests further briefing on the transfer motion, and if the Court grants such request (which it should not), it will further support the need for a stay to avoid burdening the Court and the parties, since work on such additional briefing would overlap with existing *Markman* briefing deadlines (March 7 to April 25, Dkt. 40).

After the *Markman* briefings, technology tutorials are due on May 9 and the *Markman* hearing is scheduled for May 16. These "are not merely rote, ministerial tasks"; instead, "a *Markman* hearing and claim construction order are two of the most important and time-intensive substantive tasks a district court undertakes in a patent case." *Apple*, 979 F.3d at 1338. Additionally, fact discovery opens on April 12 and the parties' final contentions are due on June 6. Thus, moving forward now will risk a "waste 'of time, energy, and money'" that § 1404(a) is intended to prevent. *Google*, 2015 WL 5294800, at *1–2; *accord In re EMC Corp.*, 501 F. App'x 973, 975–76 (Fed. Cir. 2013); *Apple*, 52 F.4th at 1361–63. Such prejudice "cannot be put back in the bottle" and remedied after the fact. *In re Volkswagen of Am., Inc.*, 545 F.3d 304, 319 (5th Cir. 2008) (*en banc*). But it can be minimized, if not completely prevented, by a short stay.

3. A Stay Will Conserve Judicial Resources

Finally, a stay will conserve judicial resources by minimizing the need for duplicative proceedings in the transferor and transferee courts. "'[J]udicial economy requires that another district court should not burden itself with the merits of the action until it is decided that a transfer should be effected and such consideration additionally requires that the court which ultimately decides the merits of the action should also decide the various questions which arise during the pendency of the suit instead of considering it in two courts.'" *Apple*, 52 F.4th at 1362–63 (quoting *McDonnell Douglas Corp. v. Polin*, 429 F.2d 30, 30 (3d Cir. 1970)). Where, as here, the Court has not made any substantive rulings, but the *Markman* hearing and preceding briefing deadlines are quickly approaching, a stay will preserve judicial resources and prevent any duplicative efforts.

IV. CONCLUSION

For the foregoing reasons, Apple respectfully request that the Court stay all case activity until it issues a decision and written opinion on Apple's Motion for Transfer.

Date: February 23, 2024

Respectfully submitted,

/s/ Ryan O'Connor

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CERTIFICATE OF CONFERENCE

Pursuant to Local Rules CV-7(G), counsel for the parties met and conferred telephonically on February 23, 2024. Peter Tong and Kristopher Davis attended for Plaintiff. Joy Kete, Ryan O'Connor, and James Yang attended for Defendant. The parties discussed their positions on this motion. Plaintiff indicated that it opposes this motion. The discussions ended in an impasse, leaving an open issue for the court to resolve.

/s/ James Yang
James Yang

CERTIFICATE OF SERVICE

Pursuant to the Federal Rules of Civil Procedure and Local Rule CV-5, I hereby certify that, on February 23, 2024, all counsel of record who have appeared in this case are being served with a copy of the foregoing via the Court's CM/ECF system.

/s/ Katherine Root
Katherine Root

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UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
MIDLAND-ODESSA DIVISION

RESONANT SYSTEMS, INC., d/b/a RevelHMI, Plaintiff, v. APPLE, INC., Defendant.	Case No. 7:23-cv-00077-DC **JURY TRIAL DEMANDED**

PLAINTIFF REVELHMI'S OPPOSED MOTION TO STRIKE DECLARATION OF CIRRUS LOGIC

[redacted]

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I. INTRODUCTION

After repeatedly refusing to produce its communications with third-party supplier of accused components, Cirrus Logic, Inc. during venue discovery, Apple worked with Cirrus Logic employee [redacted] to procure a declaration to file with its Reply. Neither Apple nor Cirrus produced this declaration or any related communications to RevelHMI during the venue discovery period. RevelHMI was thus deprived of the opportunity to depose [redacted] and obtain further discovery regarding the contents of his declaration. Allowing the declaration would thus unduly prejudice RevelHMI and given Apple an unfair advantage, and the declaration should be struck pursuant to Rule 37(c)(1).

If the Court does not grant this motion, then it should, in the alternative, grant RevelHMI's motion for leave to file a sur-reply, filed herewith.

II. FACTS

On June 1, 2023, Plaintiff RevelHMI filed this patent infringement suit concerning Apple's infringement of several patents related to vibration technology. Dkt. 12. The "Accused Products" include various iPhones, MacBooks, and Apple Watches. *Id.* ¶ 22. On October 10, 2023, Apple filed a motion to transfer venue to the NDCA. Dkt. 37.

RevelHMI diligently pursued venue discovery from Apple and third-party Cirrus Logic, which is headquartered in Austin, Texas, and supplies amplifier components for the Accused Products. As explained in RevelHMI's opposition to Apple's transfer motion, RevelHMI expects that the trial in this case will focus on the claimed driving component and control component, and RevelHMI Plaintiff intends to prove that amplifier components supplied by Cirrus Logic contribute to infringement of the claimed driving component and/or control component. Dkt. 43-12 at 1, 3.

RevelHMI's discovery requests sought, *inter alia*, "the quantity of your Documents related to the structure, operation, function, features, source code or use of any capability of the Cirrus Logic Products," "to Identify which of the Cirrus Logic Products . . . you have as physical inventory or physical prototypes of in Texas," and "to Identify, by names, ten Cirrus employees in Texas most knowledgeable about the operation, marketing, and/or accounting of the Cirrus Logic Products." Ex. 43-1 at 1–2. RevelHMI also served a request for production to Apple seeking communications between Apple and Cirrus Logic related to this case. Dkt. 43-6 at 3.

Cirrus and Apple essentially stiffed RevelHMI on the requested discovery, serving only objections to nearly all requests, including the aforementioned requests relating to Cirrus's communications with Apple in connection with this litigation. *E.g., id.* The parties met and conferred extensively but reached an impasse. Cirrus failed to provide meaningful responses to the vast majority of RevelHMI's requests. Accordingly, RevelHMI filed a motion to compel in Case No. 6:23-mc-00870-ADA, and as a result, Cirrus Logic eventually provided limited discovery. Apple still refuses to produce its communications with Cirrus.

The court-ordered deadline for venue discovery cutoff was January 19, 2024. Dkt. 40 at 1 RevelHMI filed its opposition to Apple's motion to transfer on February 2, 2024. Dkt. 44. On February 16, 2024, Apple filed its reply. Dkt. 47. With its reply, Apple filed the declaration of [redacted] at Cirrus Logic. Dkt. 48-2. The declaration attempts to downplay Cirrus's Austin connections with respect to the accused products by providing new information responsive to discovery requests that Cirrus previously objected to producing. [redacted]. *Id.* ¶ 8. Neither Apple nor Cirrus produced this declaration or any related communications to RevelHMI during the venue discovery period, despite it clearly being responsive to at least the above-mentioned requests. Instead, Apple and Cirrus waited to violate the court-ordered deadline for venue discovery cutoff. Dkt. 40 at 1.

III. LEGAL STANDARD

Rule 37(c)(1) provides that "[i]f a party fails to provide information or identify a witness as required by Rule 26(a) or (e), the party is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless." Fed. R. Civ. P. 37(c)(1). The court is also authorized to impose additional sanctions, including striking pleadings in whole or in part. Fed. R. Civ. P. 37(c)(1)(C), (b)(2)(A)(iii). For less severe sanctions (i.e., those that will not result in a default judgment or the dismissal of any claims or defenses), the sanction need only be "just and fair" and have a "'substantial relationship'" to the facts sought to be established by the discovery." *Arigna Tech. Ltd. v. Samsung Elecs. Co.*, No. 6:21-CV-00943-ADA, 2022 WL 2835862, at *2 (W.D. Tex. July 20, 2022). "In determining whether a sanction is just and fair, the Court considers whether: (1) the sanctioned party was warned of the impending sanctions, (2) the party made empty promises to comply with its discovery obligations, (3) the sanctioned party bore some culpability, (4) the claim being pursued through discovery was not so frivolous so as to amount to an abused of judicial process, and (5) the court previously sanctioned the same party." *Id.* at *3 (citing *Alexsam, Inc. v. IDT Corp.*, 715 F.3d 1336, 1344 (Fed. Cir. 2013) (applying Fifth Circuit law)).

IV. ARGUMENT

Both Apple and Cirrus withheld relevant, responsive discovery regarding their communications relating to this litigation, including the [redacted] Declaration. Indeed, Apple did not produce the [redacted] Declaration until *after* RevelHMI filed its opposition to the transfer motion, and after the venue discovery cutoff. RevelHMI thus had no opportunity to depose Mr. [redacted] or obtain any other further discovery regarding the contents of the declaration, putting it at a significant disadvantage.

For example, the declaration purports to [redacted]. Dkt. 46-3 ¶ 8. He identifies [redacted], but now RevelHMI has no opportunity to depose or test this new employee's purported relevance to this case. *Id.* ¶ 5. He purports to know that Cirrus Logic provides [redacted]. *Id.* ¶ 6. RevelHMI was also denied the opportunity to obtain discovery regarding [redacted] investigation and the basis of his knowledge of the facts provided in his declaration. For example, how does he—[redacted]? Dkt. 43-3 at 3.

[redacted] may not be telling the truth because he contradicts Cirrus Logic's counsel. During venue discovery, Cirrus Logic's in-house counsel responded that "[redacted]." Dkt. 43-1 at 2. Mr. Marijanovic declared that [redacted]." Dkt. 46-3 ¶ 3.

There is no question that Apple's failure to produce the Marijanovic Declaration violated its duties under Rules 26 and 37 and violated the Court's order for venue discovery cutoff.

Accordingly, Apple "is not allowed to use that information" in support of its motion to transfer. Fed. R. Civ. P. 37 (b)(2)(A) and (c)(1). Striking the declaration and Apple's reliance thereon is just and fair, as this is expressly authorized by Rule 37. This sanction is also proportional to the offense because Apple's reply relies heavily on the [redacted] Declaration to rebut RevelHMI's arguments regarding Cirrus Logic's connections to this District in opposing transfer to the NDCA. Indeed, in *Arigna*, the Court struck Apple's *entire transfer motion* for failing to put a declarant up for deposition, explaining that without a deposition, plaintiff "cannot determine the scope of Apple's connections to the Western District of Texas and will lack the information needed to oppose Apple's Motion to Transfer." *Arigna*, 2022 WL 2835862, at *3. The same is true here: venue discovery is closed, and RevelHMI can no longer depose Mr. [redacted]. Apple's late disclosure prevented RevelHMI from determining the full scope of Cirrus Logic's connections to WDTX and from testing the credibility of Mr. [redacted] testimony. This information is highly relevant to Apple's motion to transfer. Allowing the declaration would unduly prejudice RevelHMI and give Apple an improper advantage.

The factors set forth in *Alexsam*, *supra*, further support that striking the declaration is just and fair. As to the first factor (warnings), RevelHMI repeatedly met and conferred with Apple and Cirrus regarding the RevelHMI's discovery requests and its need to obtain information regarding Cirrus's connections to this case and WDTX in order to support its opposition to transfer. RevelHMI even filed a motion to compel Cirrus to produce venue discovery. As to the second (empty promises), Cirrus Logic repeatedly promised to supplement its discovery and did supplement to a limited extent, but Cirrus Logic withheld the information in the [redacted] Declaration until after venue discovery closed. For the third factor (culpability), Apple is clearly working behind the scenes with Cirrus to produce additional venue discovery in violation of the

Court's deadline for venue discovery cutoff. Dkt. 40 at 1. There is no reason why they could not have produced the declaration during the venue discovery period. As to factor 4 (whether the discovery is frivolous), the discovery sought was not frivolous because Cirrus is a third-party supplier of accused components, and Apple relied on Mr. [redacted] declaration to support its motion to transfer. RevelHMI "had a right to depose him about [Cirrus]'s ties to this District and to question [the Declarant] about the accuracy of and basis for statements in his venue declaration." *Arigna*, 2022 WL 2835862, at *3. And as to factor 5, while the court has not previously sanctioned Apple in this case, Apple has been warned by this Court multiple times in other cases regarding its "venue discovery tactics." *Id.* In any event, RevelHMI is not requesting the more severe sanction of striking Apple's entire motion. It is seeking the proportional sanction of having the declaration struck and all references to it in Apple's Reply.

V. CONCLUSION

For the foregoing reasons, the Court should strike the [redacted] Declaration and all references thereto in Apple's briefing for its motion to transfer venue.

Dated: March 1, 2024 Respectfully submitted,

<u>/s/ *Reza Mirzaie*</u>

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CERTIFICATE OF SERVICE

The undersigned certifies that all counsel of record who are deemed to have consented to electronic service are being served with a copy of this document on March 1, 2024.

/s/ *Reza Mirzaie*
Reza Mirzaie

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
MIDLAND-ODESSA DIVISION

RESONANT SYSTEMS, INC., d/b/a RevelHMI, Plaintiff, v. APPLE INC., Defendants.	Case No. 7:23-cv-000077-DC

PLAINTIFF RESONANT'S OPPOSITION TO DEFENDANT APPLE'S MOTION TO STAY PENDING APPLE'S MOTION TO TRANSFER VENUE

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I. INTRODUCTION

Apple's requested stay is gamesmanship that would unfairly prejudice Resonant by needlessly delaying the case. This Court need only decide Apple's transfer motion before holding the *Markman* ***hearing*** and before issuing the *Markman* ***order***. But in the meantime, the parties should begin briefing claim construction so that the Court will be ready to hold the *Markman* hearing as scheduled if the Court does not transfer the case. The parties should also begin both discovery and claim construction because both will need to occur regardless of whether this Court transfers this case. Thus, the motion to stay amounts to a transparent effort to delay routine briefing and discovery. The standard practice of other Courts in this District is to delay the *Markman* hearing if additional time is needed to rule on the transfer motion, but not to delay fact discovery or *Markman* briefing.[1] Ex. A (Waco Division OGP) at 6 ("If a motion to transfer remains pending, the Court will either promptly resolve the pending motion before the *Markman* hearing, or postpone the *Markman* hearing. . . . Fact Discovery will begin one day after the originally scheduled *Markman* date.").

All of the stay factors weigh against Apple's request. Resonant's business has been unfairly harmed by Apple's infringement and will only suffer longer if a months-long stay is entered. In contrast, Apple will suffer no prejudice from beginning the briefing or discovery process in this case—routine tasks that Apple will undertake regardless of whether this action proceeds here or is transferred. And no judicial resources will be wasted by denying Apple's stay request, because this Court will not decide any substantive issue before Apple's transfer motion.

Apple's stay request is an unnecessary delay tactic and should be rejected.

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[1] This Court can confirm this by contacting the Waco Division to ensure uniform applicability of rules across the Western District.

II. ARGUMENT

A. The Court regularly makes transfer motions a "top priority" by continuing the *Markman* hearing, not by staying cases

While the Federal Circuit and Fifth Circuit hold that resolving a transfer motion should take "top priority," their cases notably do not hold or even suggest that **all** case activities must be stayed until such a decision is made. *See* Dkt. No. 49 at 2-3 (citing cases). So long as this Court decides Apple's transfer motion before holding a *Markman* hearing—as is common practice in this District—this "top priority" standard will be met. Ex. A[2] at 6. Nothing about that standard requires an immediate stay of **all** routine briefing and discovery, as Apple suggests.

The Waco OGP disproves Apple's assertion that the "well-established practice [is] to stay proceedings pending resolution of a transfer motion" because the Waco OGP made it the standard rule to ***not*** delay discovery or the *Markman* briefing. Dkt. No. 49 at 3; Ex. A at 6. Thus, the Waco OGP sets fact discovery to open one day after the default *Markman* hearing, regardless of whether the defendant manages to cause delay in the case. Ex. A at 6, 15. This rule was put into place specifically to avoid the very type of gamesmanship that Apple now attempts. *Scramoge Tech. Ltd. v. Apple Inc.*, No. 6:21-CV-00620-ADA, 2022 WL 4595069, at *2 (W.D. Tex. Sept. 30, 2022) ("Indeed, the Court revised its OGP because so many defendants delayed filing a transfer motion to delay *Markman* hearings and the subsequent fact discovery."). This Court's OGP similarly has fact discovery open the day after the *Markman* hearing, apparently under the same logic. *See* Midland/Odessa OGP at Appendix A.

The District's dockets are replete with examples of how claim construction and discovery proceed while the venue ruling is pending. As one example, in *Mobile Data Technologies LLC v. Meta Platforms, Inc.*, the parties ***fully completed claim construction briefing*** by September 8,

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[2] Exhibits A-E attached to the Declaration of Peter Tong, filed herewith.

2023 while the Motion to Transfer was pending. No. 7:22-cv-00244-ADA-DTG (W.D. Tex. Nov. 23, 2023); Ex. B (*Mobile Data* Docket) at Dkt. Nos. 20, 33, 40, 46, 56. The initial *Markman* hearing was set for August 31, 2023 and extended to November 14, 2023. *Id.* at Dkt. Nos. 16, 64. But because Judge Gilliland had not yet ruled on the transfer motion by November, he *sua sponte* continued the *Markman* hearing until December 21, 2023, consistent with the Waco OGP (Ex. A) at 6 to give the venue motion top priority. *Id.* at Dkt. Nos. 70, 71. In that case, he granted transfer on December 18, so he canceled the December 21 *Markman* hearing. Similarly, in *Lone Star SCM Systems, Ltd. v. Honeywell International Inc*., Judge Albright set the *Markman* hearing for June 2, 2023, with fact discovery opening the next business day. No. 6:21-cv-00843-ADA (W.D. Tex. Aug. 12, 2021); Ex. C (*Lone Star* Scheduling Order) at 2. The parties would proceed to fully brief **both** the venue motion and claim construction in parallel, even after fact discovery opened. Ex. D (*Lone Star* Docket) at Dkts. 77, 83. Judge Albright routinely continued the *Markman* hearing, but not fact discovery, to accommodate briefing. *Id.* at Dkts. 71, 80, 81. It is simply not the case that this Court must grant Apple a stay because it has requested one. *E.g.*, *10Tales, Inc. v. TikTok, Inc.*, No. 6:20-cv-00810-ADA, Dkt. No. 57 (W.D. Tex. Mar. 8, 2021) (denying "Defendant's Motion to Stay Pending Resolution of the Motion to Transfer Venue").

This approach makes sense because any claim construction briefs the parties prepare will eventually be considered by a court, regardless of whether this case is transferred. Claim construction determinations are based on intrinsic and extrinsic evidence that are in no way dependent on the jurisdiction deciding the parties' disputes. Thus, there can be no wasted effort by having the parties brief their claim arguments now, regardless of whether this Court or another ultimately decides the parties' disputes.

The same is true for any optional technical tutorials. If either party elects to submit a tutorial, that would be considered by the Court in conjunction with the *Markman* hearing, which presumably will be held after the transfer motion is decided. And just as this Court permits parties to submit optional technical tutorials, the NDCA courts do as well, such that any tutorial a party prepares here can just as easily be submitted to an NDCA court if the case were transferred.

Likewise, there is no reason that fact discovery should not proceed while the Court considers Apple's transfer motion. The Scheduling Order calls for fact discovery to open on April 12, 2024. Dkt. No. 35 at 2. Should the transfer motion remain pending at that time, it is minimally burdensome for the parties to prepare and exchange initial disclosures and initial written discovery requests.[3] Whether this case proceeds here or in the NDCA, the parties will exchange such discovery, such that no party efforts would be wasted or duplicated even if the case were transferred. Apple does not and cannot establish otherwise; it merely seeks to cause delay.

B. *Markman* briefing and early fact discovery need not be delayed to make Apple's transfer motion a "top priority."

In the cases Apple references, the Federal Circuit and Fifth Circuit merely held that resolving a transfer motion should take "top priority" ahead of "substantive" parts of the case. *See* Dkt. No. 49 at 2-3 (citing cases). While a Court's *Markman* **ruling** is "substantive," the routine discovery and briefing that Appple seeks to stay are not. So long as this Court decides Apple's transfer motion before holding the *Markman* hearing—as is common practice in this District—this "top priority" standard will be met. Ex. A at 6; *In re Apple Inc.*, 979 F.3d 1332, 1338 (Fed. Cir. 2020) (faulting the District for barrelling ahead with "substantive" parts of the case by holding the *Markman* hearing and issuing a claim construction order). Nothing about that standard requires an immediate stay of **all** routine briefing and discovery, as Apple suggests.

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[3] A reputable patent firm like Fish & Richardson should have a library of default discovery templates at its disposal that it can cost-effectively adapt for its client.

Apple also cites three of its own Federal Circuit cases in which stays of fact discovery and other deadlines were entered. Dkt. No. 49 at 3-4. However, those decisions stem from an overpunishing of Apple's unique misconduct, a fact Apple omits. A consolidated opinion issued in each case explains:

> Apple moved for transfer relying on the same 30(b)(6) venue declarant, Mr. Mark Rollins, that Apple repeatedly used in so many cases that the Court no longer believes that he does any substantive investigation when preparing his declarations or when preparing for his depositions. *Scramoge Tech. Ltd. v. Apple Inc.*, No. 6:21-CV-00579-ADA, 2022 WL 1667561, at *2 (W.D. Tex. May 25, 2022) (explaining history of problems with Mark Rollins). Thus, in these three cases, the Court has modified the schedule to open discovery before having the parties re-brief the transfer motion. Fact discovery will allow the parties to find the relevant evidence and witnesses that bear on the transfer factors rather than speculate about them. The Court has decided not to rule on the transfer motions supported by such an unreliable venue declarant. In these three cases, Apple petitioned for a writ of mandamus and petitioned to stay these cases pending mandamus review.

Scramoge, 2022 WL 4595069, at *1. In other words, Apple habitually supplied that court with such unreliable transfer evidence that Judge Albright *departed from* the District's usual practice. He reworked the case schedule, requiring rebriefing on venue *32-36 weeks* later after full fact discovery *closes* (not merely opens) because then the parties would know, rather than speculate about, which evidence and witnesses would be needed at trial. *E.g.,* Ex. E (order from *Aire Tech. Ltd. v. Apple Inc.*, No. 62:21-cv-01101-ADA, Dkt. No. 54 (W.D. Tex. Aug. 22, 2022)) at 1–2, 5–6. The Federal Circuit found that approach—delaying the venue ruling for *the entirety* of fact discovery—too extreme, but nobody is suggesting here that this Court is unable to rule on the transfer motion during early fact discovery, or within anywhere near 32 weeks.[4] To the contrary, Resonant merely submits that there is no reason to delay the parties' exchange of initial disclosures and initial discovery requests once fact discovery opens on April 12 (about 4 weeks from now), if

[4] In fact, Resonant would not oppose Apple refiling its motion to stay if the Court takes more than a few months to rule on the transfer motion. Apple's motion is, at minimum, premature.

the transfer motion is even pending at that time.

Notably, Apple offers no reason why this Court is unable to rule on the transfer motion or the parties' claim construction disputes within a reasonable time. If the Court has concerns about the technical nature of the claim construction issues here, it can enlist the assistance of a technical advisor or special master, as other courts, including the Waco Division and the Marshall Division, frequently do. And even if the Court permits supplemental venue briefing to address recent new authority, this would require only about 2-3 weeks of extra briefing, and the Court can continue the *Markman* hearing if necessary. There is no reason to waste time with a stay while the Court considers Apple's transfer motion. Instead, it makes far more sense for the parties to continue their claim construction breifing and exchange initial discovery when the Scheduling Order permits—all of which will be applicable no matter where this case is adjudicated, such that there will be no wasted effort regardless of the transfer decision.

C. All three (wrongly articulated) factors weigh against the requested stay.

As explained in Subsection C below, Apple fails to correctly articulate the factors considered for a stay. But even the three factors articulated by Apple (prejudice to Resonant, hardship to Apple, and judicial resoures saved) weigh against a stay.

First, the requested stay would unfairly prejudice Resonant. Apple wrongly suggests that RevelHMI is merely a patent assertion entity (Dkt. No. 49 at 4-5), but Resonant's founder and sole remaining employee, Robin Elenga, has explained that other employees of the company were laid off during the COVID pandemic due to companies like Apple infringing Resonant's patents. *See* Dkt. No. 44-20 (Elenga Decl.) ¶¶ 3–4. Before that, Resonant developed and sold vibrating/resonating products, and Resonant is the original assignee of all asserted patents. *See id.* ¶ 4. Apple is wrong to argue that a months-long stay of this case will not prejudice Resonant because the sooner Resonant can have its day in court and seek compensation for Apple's infringement, the sooner the company can restore what it has lost from infringement of its patents.

Also, a stay would unfairly prejudice Resonant because it would effectively allow Apple to backtrack on a joint motion that does not move the opening of discovery. During venue discovery, Apple initially failed to provide meaningful responses. *See* Dkt. No. 43-9 at 2, 8–10 (initially objecting to discovery requests without meaningful responses). During the meet and confer process, Resonant agreed to give Apple additional time to supplement its venue production, so the parties ***jointly*** moved to extend venue discovery. Dkt. No. 34; Dkt. No. 34-1. Apple agreed to Resonant's requirement that the opening of fact discovery remain unchanged. Dkt. No. 35 at 2 (setting fact discovery to open April 12, 2024); Dkt. No. 34-1 (keeping fact discovery on April 12, 2024). Granting a stay would effectively allow Apple to backtrack on this earlier agreement. Had Resonant known Apple would later move to stay as a tactic for delaying this case, Resonant would not have agreed to the joint extention and instead would have moved to compel seeking an adverse inference for failure to provide venue discovery during the original venue discovery period.

Second, Apple would suffer zero hardship from denial of its motion. If this case is not stayed, the parties will merely prepare claim construction briefs, optional technical tutorials, and initial discovery disclosures and requests. These typical costs of litigation do not weigh against a stay. *Kaneka Corp. v. JBS Hair, Inc.*, No. 3:10-CV-1430, 2011 WL 13167931, at *1 (N.D. Tex. Mar. 30, 2011) ("ordinary discovery deadlines, without more, does not give rise to an undue burden"). Merely having to participate in discovery and other ordinary pre-trial proceedings does not constitute irreparable harm. *M.D. v. Perry*, No. C-11-84, 2011 WL 7047039, at *2 (S.D. Tex. July 21, 2011) (denying stay as "[t]he prospect of burdensome or expensive discovery alone is not sufficient to demonstrate 'irreparable injury.'"). Discovery and briefing will happen whether the case remains here or is transferred to the NDCA, such that no efforts by the parties would be wasted even if the case were transferred. Notably, Resonant also already agreed to postpone *Markman* proceedings in this case by two weeks, which alleviates Apple's concerns and will allow the Court additional time to decide the transfer motion and consider any supplemental briefing. *See* Dkt. No. 54.

As to the sur-reply,[5] Apple incorrectly suggests that it will unfairly delay the Court's venue decision. Dkt. No. 49 at 2. To the contrary, Apple violated the Court's Scheduling Order by submitting a new third-party declaration with its Reply, long after extended venue discovery concluded, necessitating Resonant's motion to strike and motion for a sur-reply. Apple caused this delay, and its gamesmanship should not be rewarded.

Third, a stay will not conserve any judicial resources because, consistent with case law and the normal practice of this District, this Court will presumably decide the transfer motion before holding a *Markman* hearing. Assuming that is the case, the Court will not expend any significant judicial resources on this case before deciding the transfer motion (and the instant motion to stay). In fact, a stay would waste resources. If the Court keeps the case, it would need to issue a new schedule for *Markman* briefing, fact discovery, and trial.[6] Also, if the Court denies the transfer motion, it will not have the *Markman* briefs ready for ruling. If the Court decides to transfer this case, the Court can merely cancel the *Markman* hearing without doing any duplicative work, as Judge Gilliland did in the *Mobile Data* case. *See* Ex. B at Dkt. Nos. 83, 81.

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[5] Resonant will withdraw its sur-reply (Dkt. No. 51-1) and file a new one addressing the the Fifth Circuit case *In re Kevin Clarke*, No. 24-50079, --- F.4th ---, 2024 WL 886953, at *1 (5th Cir. Mar. 1, 2024), which issued the next business day. This authority heavily favors denying the transfer motion and should be considered.

[6] Additionally, Apple creates duplicative work by filing this meritless motion for the reasons in Section D below. To evaluate the likelihood of success factor, the Court needs to effectively decide the transfer motion.

D. The correct four factors weigh more heavily against a stay.

In determining whether to issue a stay of proceedings, courts are to consider four factors: (1) whether the movant has made a showing of likelihood of success on the merits; (2) whether the movant has made a showing of irreparable injury if the stay is not granted; (3) whether granting of the stay would substantially harm the other parties; and (4) whether granting of the stay would serve the public interest. *U.S. v. McKenzie*, 697 F.2d 1225, 1226 (5th Cir. 1983); *see also Weaver v. Stroman*, 1:16-cv-01195, 2020 WL 3545655, *3 (W.D. Tex. June 30, 2020) (citing *Nken v. Holder*, 556 U.S. 418, 434 (2009)). The analysis for factors (2) and (3) are similar to the factors articulated by Apple and are covered in preceding section C. Apple did not, and cannot, articulate a coherent argument for (1) its likelihood of success on the merits and (4) the public interest.

As to the likelihood of success on the merits of the transfer motion,[7] Apple as the movant had the burden of proof. After Apple filed its motion to transfer on October 10, 2023, the Fifth Circuit issued two decisions that changed the requirements for transfer. *In re TikTok, Inc.*, 85 F.4th 352 at 361 (5th Cir. Oct. 31, 2023) (requiring strict application of 100-mile rule); *In re Kevin Clarke*, No. 24-50079, --- F.4th ---, 2024 WL 886953 (5th Cir. Mar. 1, 2024) (enhancing burden of proof, rejecting time-to-trial statistics, and excluding parties from consideration for local interest). Apple's original transfer evidence does not satisfy the revised legal standards that Apple did not foresee when it filed its motion. Additionally, Apple is unlikely to succeed on the merits for the reasons described in Resonant's Opposition to Transfer. Dkt Nos. 43–44.

The public interest factor weighs heavily against a stay. Apple has effectively admitted that there is no public interest supporting its stay request. Its opening brief argues that a stay would allow *Apple* to avoid the costs of litigation, not the general public, and Apple is not permitted to

[7] As noted above, Apple's meritless Motion to Stay duplicates the Court's workload by requiring the Court evaluate the merits of the Motion to Transfer as part of ruling on the Motion to Stay.

raise new arguments on reply. Dkt. No. 49 at 6; *Kaneka*, 2011 WL 13167931, at *1 ("ordinary discovery deadlines, without more, does not give rise to an undue burden"). In addition, Samsung and Sony have similarly been sued by Resonant in the Eastern District of Texas for infringing at least some of the same patents asserted against Apple. *Resonant Sys., Inc. v. Samsung Elec. Co., Ltd.*, No. 2:22-cv-00423-JRG (E.D. Tex.); *Resonant Sys., Inc. v. Sony Group Corp.*, No. 2:22-cv-00424-JRG (E.D. Tex.). Samsung and Sony have great interest in the Court's *Markman* rulings in this case, to see how it may or may not affect their cases. A stay unfairly hurts Samsung and Sony.

III. CONCLUSION

After being warned against submitting unreliable venue evidence and scheduling gamesmanship in Waco, Apple now seeks to deply those same tactics before this Court, seeking a different outcome. For the foregoing reasons, Apple's motion to stay should be denied.

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Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that on March 6, 2024, I electronically filed the foregoing document with the Clerk of the Court for the Western District of Texas using the ECF System which will send notification to the registered participants of the ECF System as listed on the Court's Notice of Electronic Filing.

/s/ *Reza Mirzaie*

CERTIFICATE OF COMPLIANCE

This brief complies with the type-volume limitation of Federal Circuit Rule 28.1(b). This brief contains 7,685 words excluding the parts of the brief exempted under Federal Rule of Appellate Procedure 32(f) and Federal Circuit Rule 32(b).

This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type-style requirements of Federal Rule of Appellate Procedure 32(a)(6). This brief has been prepared in a proportionally spaced typeface using Microsoft Word in 14-point Times New Roman font.

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