

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VICOR CORPORATION,

Petitioner,

v.

DELTA ELECTRONICS, INC.,

Patent Owner.

PTAB Case No. IPR2024-00706

U.S. Patent No. 10,877,534

PATENT OWNER'S PRELIMINARY RESPONSE

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EXHIBIT LIST

Exhibit No.	Description
2001	Declaration of Dr. Joshua Phinney (“Phinney”)
2002	Curriculum Vitae of Dr. Joshua Phinney
2003	U.S. Pat. App. Pub. No. 2012/0014069 to Zeng et al.
2004	U.S. Pat. App. Pub. No. 2012/0327604 to Yang et al.
2005	J. Phinney, <i>Multi-resonant Passive Components for Power Conversion</i> (Doctoral Thesis, Massachusetts Institute of Technology, Oct. 2005) (“Phinney Thesis”)
2006	U.S. Pat. App. Pub. No. 2014/0167897 to Choi (“Choi”)

I. INTRODUCTION

Vicor Corp. (“Vicor” or “Petitioner”) challenges claims 1-8 and 10-12 of U.S. Patent No. 10,877,534 (“the ’534 Patent”) (VICOR-1001) under eight grounds in its petition for *inter partes* review (“Petition”). Delta Electronics, Inc. (“Delta” or “Patent Owner”) hereby submits its preliminary response to the Petition.

Ground	Claims	Statutory Basis	Applied References
1	1-8, 10-12	Obvious	Vinciarelli-218 and Zeng-014
2	1-8, 10-12	Anticipation	Zeng-014
3	1-8, 10-12	Obvious	Zeng-014 and Zeng-014 in combination with Jun
4	1-3, 5-8	Anticipation	Park
5	1-3, 5-8	Obvious	Park and Park in combination with Jun
6	4, 10-12	Obvious	Park, Zeng-014, and Jun
7	1-8, 10-12	Obvious	Vinciarelli-218 and Park
8	4, 10-12	Obvious	Vinciarelli-218, Park, and Zeng-014

Petitioner presents an excessive number of cumulative grounds. Each ground is defective as described below.

Ground 1 fails for several reasons. Principally, Petitioner’s combination takes

two references (Vinciarelli-218 ¹ and Zeng-014 ²) that have incompatible manufacturing processes and mashes them together to create a device having conductive pins on both the top and bottom surface of the encapsulant. In other words, Petitioner transforms Vinciarelli-218's direct mounted device and makes it one that can be stackable (i.e., can have multiple devices on top of each other). But, this changes the nature of Vinciarelli-218 and goes against its teachings regarding heat dissipation and device footprint. Moreover, Petitioner's combination requires applying destructive manufacturing processes to the Vinciarelli-218 device; its encapsulant would need to be drilled to provide conductors or conductive pillars would need to be formed (and encapsulant thereafter filled). Both are error prone operations. Petitioner's combination is hindsight bias and fails to arrive at the claims; Ground 1 should thusly be denied.

Ground 1 nonetheless fails at an element level. The claims require "insulation material" and "a plurality of pins ... allocated along lateral sides of the insulation material." Petitioner's combination, however, does not result in pins being on the

¹ United States Patent Application Publication No. 2014/0355218 to Vinciarelli et al. ("Vinciarelli-218") (VICOR-1006).

² United States Patent Application Publication No. 2009/0175014 to Zeng et al. ("Zeng-014") (VICOR-1007).

lateral sides of the insulator. Instead, they would be made integrally with the insulator. Thusly, even assuming that there was a motivation to combine, Ground 1 still fails for not meeting various limitations.

Ground 2 fails because its cited reference (Zeng-014) does not anticipate the claims. Petitioner identifies Zeng-014's inductor's non-conductive magnetic substrate as being both the "bearing plate" and the "insulation material." This analysis is contradictory. A bearing plate bears components (i.e., have some conductive element), but the magnetic substrate is non-conductive (as demonstrated by Petitioner also identifying it as an insulator). Nonetheless, a single structure cannot satisfy multiple different elements, and Ground 2 fails.

Ground 3 relies on Zeng-014 and Jun³, but does not cure any of its above-mentioned deficiencies.

Ground 4 presents Park⁴ (another inductor reference) in a maze of alternative (and failed) reads. Principally, Park is just an inductor, so it fails to teach a "power supply apparatus," "bearing plate," and "insulation material." Petitioner argues that

³ United States Patent Application Publication No. US2005/0098874 to Jun et al. ("Jun") (VICOR-1012).

⁴ United States Patent Application Publication No. 2015/0116891 to Park et al. ("Park") (VICOR-1009).

Park's inductor (or its internal substrate) is a "bearing plate," but this fails because the bearing plate bears components (it is not the component itself). Moreover, Petitioner argues that the inductor's magnet is an insulation material, but this does not comport with the claims which require that the insulation material is formed on the substrate. Park does not anticipate the claims and Ground 4 fails.

Ground 5 relies on Park and Jun and does not cure the above-described deficiencies.

Ground 6 relies on Park, Jun, and Vinciarelli-218 but does not cure any of the above-described deficiencies.

Ground 7 relies on Vinciarelli-218 and Park in combination. There is, however, no motivation to combine. They have entirely different manufacturing processes that are incompatible with each other given that one is a panel-molded power-converter assembly and another is a component. In Park, paste is used for its conductor that must undergo a sintering or curing process. Sintering would melt Vinciarelli-218, while curing would lessen Vinciarelli-218's conductivity. Further, like Ground 1, Petitioner modifies Vinciarelli-218 to be a stacked device. A POSITA would not have made this combination.

Ground 8 restates arguments presented in Ground 7, and fails for the same reasons.

Finally, as can be seen from the above, there is a large number of grounds that

are weak, each trying an alternative angle to hit the independent claims. Propounding the numerosity is Petitioner's parallel IPR against the '534 Patent which recycles the same art against a substantively similar independent claim. There is no reason to allow any Petitioner to provide 14 grounds across two petitions on related (or closely related patented inventions or embodiments). This is a waste of Board resources, and the PTAB should exercise its discretion to not institute.

Provided below is further detail.

II. THE '534 PATENT

The '534 Patent is directed to improvements to the design and manufacture of internal structures of a power supply apparatus. *See generally* '534 Patent. At the time of the invention, long-felt need existed for improving data processing performance by higher power pressure and efficiency. '534 Patent, 3:15-23.⁵ In light of this need, the Inventor developed a cost-effective solution - by increasing the number of power units that can fit in the power supply apparatus. *Id.*, 3:15-23. This inventive stack structure ensures high power pressure and efficiency, thereby enhancing data processing performance. Phinney, ¶40.

The '534 Patent recognized the growing need of data processing that relies on

⁵ "The power pressure (Pp) equals to PO/S" where Po is the power supplies power and S is the horizontal area. '534 Patent at 1:63-2:2.

the support of large-scale data centers. '534 Patent, 1:21-28. A key component of the data center is the server, which includes data processing chips and power supply mounted on the same main board. *Id.*, 1:29-43. Along with the ever-improving processing capability of the data processing chips, their power consumption and footprint within the server also increase. *Id.* As a result, the main board power supplies are “expected to exhibit greater efficiency, higher power density and more compact volume, so as to realize the energy-saving of the whole server.” *Id.* Power density is quantified as “power pressure,” which is the power provided by power supply over unit horizontal area. *Id.*, 1:60-62. In other words, power density is directly proportional to the amount of power provided and inversely proportional to the area occupied by the power supply. Phinney, ¶41.

“The following relationship between the power pressure (Pp) and the height (H) could be derived: the greater the H, the greater the Pp.” *Id.*, 2:4-7. It was noted that “the space above the main board power supply” for certain servers “is not adequately utilized.” *Id.*, 19-22. Conventionally there were two general ways of manufacturing main board power supplies but both present difficulties of utilizing the full height. Phinney, ¶¶42-45; *see* '534 Patent, 2:23-32 (implementing individual power supply components with uneven heights on main board degrades heat handling), 2:33-47 (implementing packaging technique that improves power density but requires the lowering the height of the main board).

The '534 Patent addresses the deficiencies of existing power supplies and presents a solution that “deals with both the power pressure and the efficiency” by developing “a stacked structure so that the height of the power supply can be properly utilize[d].” '534 Patent, 3:10-22. As shown in Fig. 1 of the '534 Patent, the stacked power supply includes multiple power units and a control unit stacked on a main board. '534 Patent, 4:8-36. Each power unit includes pins for electrically coupling to an adjacent power and/or control unit. Specifically, as shown in annotated Fig. 1 of the '534 Patent reproduced below, a control unit 130 is mounted on mainboard 110, and two power units 120 are stacked and mounted on the top surface of control unit 130. The height of the package is fully or optimally utilized, as indicated by the respective heights H and h of the stacked power supply and the power supply package. See '534 Patent, 4:1-7, 4:66-5:5, 17:63-67, Figs. 1, 4, 7-10, 17-20, 23-24, 26-27. Phinney, ¶46.

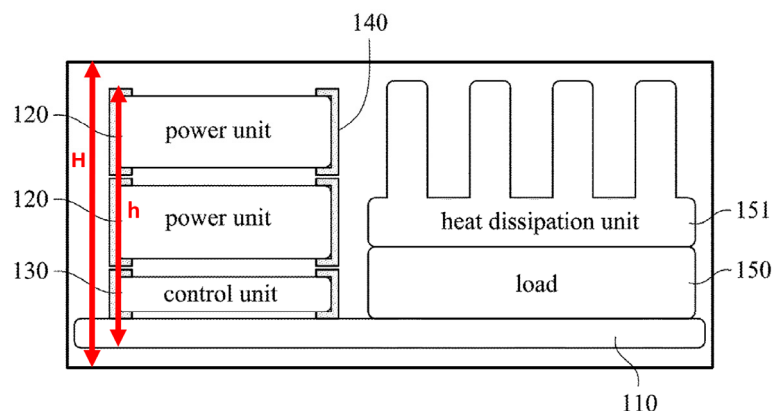
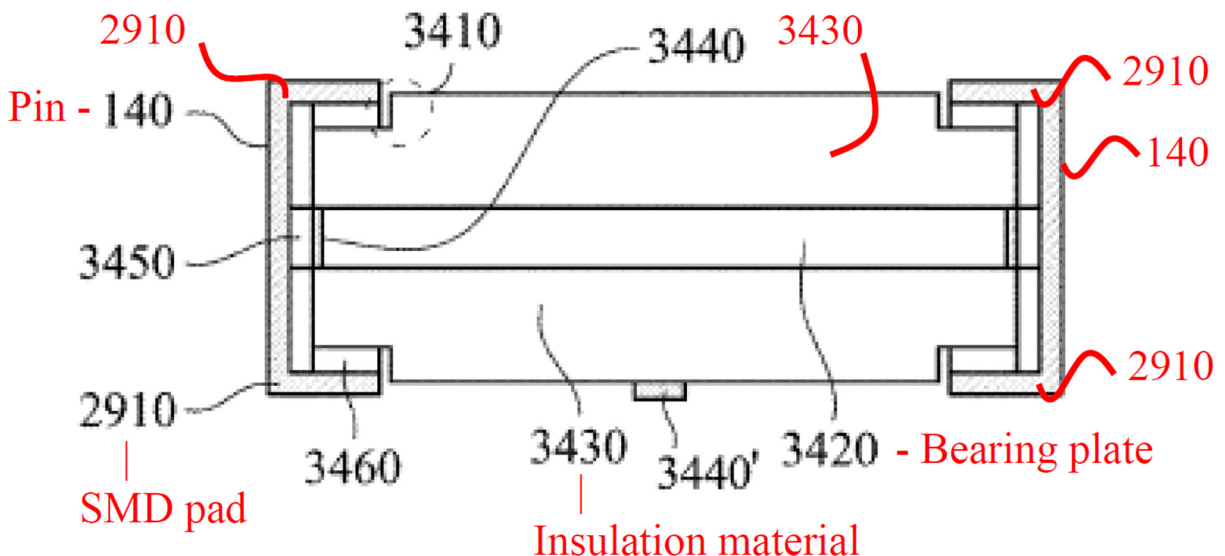


Fig. 1

Annotated '534 Patent Fig. 1

The novel stacked structure in the '534 Patent “accomplishes both the high power pressure and high efficiency” and advances the field of power supply design and manufacture. Phinney, ¶47. The '534 invention demonstrated that “the height of the power supply can be properly utilized so that a smaller floor space can be realized when the volume is fixed.” '534 Patent, 4:1-7.

As discussed below in §IV, Petitioner’s proposed invalidity grounds failed to appreciate these aspects of the claimed solutions in the '534 Patent. The structural features of the above designs are recited in the exemplary claims and figures (e.g., Fig. 25 with annotations). Phinney, ¶¶48-52.



Annotated '534 Patent Fig. 25

Claim 1 is provided below, with Petitioner’s organization of clauses, i.e., [1pre]-[1c]:

[1pre] A power supply apparatus, comprising:

[1a] a bearing plate;

[1b] insulation material formed on two opposite surfaces of the bearing plate; and

[1c] a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material, wherein two terminals of each of the pins have two SMD pads, wherein the two SMD pads of each of the pins are extending to an upper surface and a lower surface of the insulation material, respectively.

Exemplary claim 10 is also provided below, with Petitioner's organization of clauses, i.e., [10pre]-[10c]:

[10pre] A power supply apparatus, comprising:

[10a] a bearing plate;

[10b] insulation material formed on two opposite surfaces of the bearing plate; and

[10c] a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material, wherein the bearing plate is embedded in the insulation material to form a cuboid body, edges of an upper surface and a lower surface of the cuboid body have recesses, and two terminals of each of the pins have SMD pads extending to the recesses at the upper surface and the lower surface of the cuboid body.

III. CLAIM CONSTRUCTION

In IPR proceedings, the Board construes claims in accordance with their ordinary and customary meaning as understood by one of ordinary skill in the art. *See* 37 C.F.R. § 42.100; *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir.

2005). At this preliminary stage and because inadequacies of the Petition can be described without construction, Patent Owner offers no construction. Patent Owner reserves the right to offer construction should the Board institute review.

A person of ordinary skill in the art (“POSITA”) in September 2014 would have had Bachelor’s degree in electrical engineering or a related field, and two or more years of work experience or research related to power engineering, or equivalent training and work experience in the field. Formal education can substitute for work experience and relevant work experience could substitute for formal education.

Dr. Phinney was at least a POSITA in the field of technology of the ’534 Patent, is familiar with U.S. patent law, and is therefore qualified to opine on what POSITAs would have known and understood as of September 2014 to form the basis of his analysis and opinions. Phinney, ¶¶1-16, 35-39, 53-54.

IV. THE CHALLENGED CLAIMS ARE PATENTABLE

A. Ground 1: Petitioner’s Combination of Vinciarelli-218 and Zeng-014 Fails

Petitioner’s combination for Ground 1 fails because: (1) there is no motivation to combine Vinciarelli-218 and Zeng-014; and (2) the combination nonetheless fails to teach [1b] (“insulation material formed on two opposite surfaces of the bearing plate”) and [1c] (“pins ... allocated along lateral sides of the insulation material”). Phinney, ¶55.

Petitioner's combination of Vinciarelli-218 and Zeng-014 fails to present a motivation to combine (and demonstrates hindsight bias) for multiple reasons. First, Petitioner's combination transforms Vinciarelli-218 to a stacked module; a POSITA would not have had any motivation to change Vinciarelli-218's module in this manner because doing so would go against Vinciarelli-218's teachings. Second, modifying Vinciarelli-218 results in a device that will have manufacturing errors, resulting in a high error rate and low yield; a POSITA would not make that change. Third, Petitioner ignores the differences in manufacturing processes in Vinciarelli-218 and Zeng-014 which makes their combination incompatible. Ground 1 fails at a motivation level.

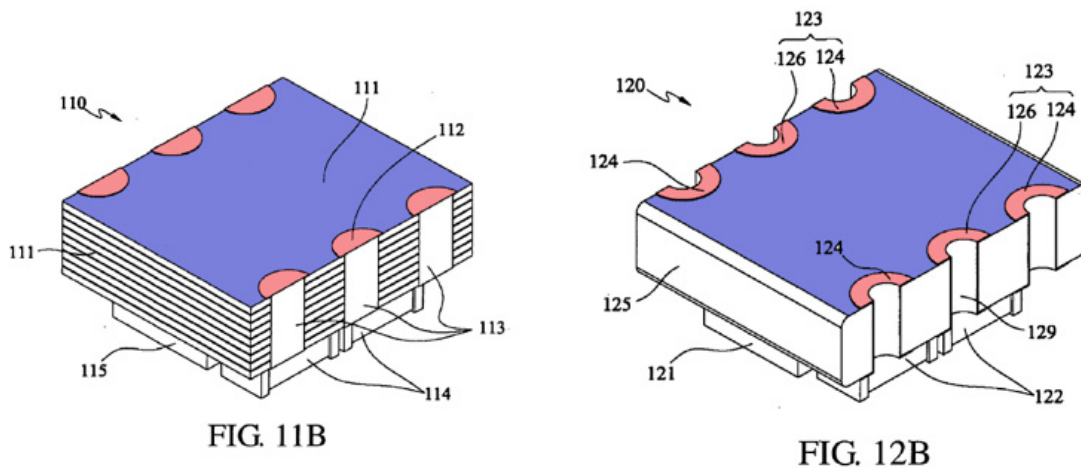
Finally, even if there was motivation to combine, Petitioner's combination does not arrive at the claims. The following claim limitations would still be missing: "insulation material formed on two opposite surfaces of the bearing plate" and "a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material [with] each of the pins [] extending to an upper surface and a lower surface of the insulation material."

Ground 1 thusly fails.

1. Petitioner's Combination of Vinciarelli-218 and Zeng-014 Does Not Result in Limitations [1c] and [10c] Being Met

Petitioner's combination of Vinciarelli-218 and Zeng-014 fails to meet at least the limitations of [1c] (and substantively similar [10c]) for the following reasons.

Phinney, ¶56. Limitation [1c] (and substantively similar [10c]) requires SMD pads extending “to an upper surface and a lower surface of the insulation material, respectively.” Vinciarelli-218 does not teach or suggest that its interconnect portions 808A are “SMD pads,” and instead uses terminals that extend in a single, downwardly direction. Zeng-014 is similarly silent regarding this issue and does not cure the deficiency of Vinciarelli-218. Phinney, ¶56. As shown, for example in Fig. 11B and Fig. 12B of Zeng-014 below, the conductive layer 112/123 (red) does not extend over or onto a lower surface (purple) of the magnetic material substrate 111/125. For similar reasons, conductive layers 113, 117, and 118 do not extend over or onto a top surface of the substrates. Phinney, ¶56. Therefore, the combination of Vinciarelli-218 and Zeng-014 cannot teach or suggest any SMD pads extending “to an upper surface and a lower surface” at the least, let alone to “an upper surface and a lower surface of the insulation material” (even if present).



Annotated Zeng-014 Fig. 11B and Fig. 12B

As such, both [1c] and [10c] are not taught by Petitioner's combinations. Ground 1 fails to present a reasonable likelihood of success.

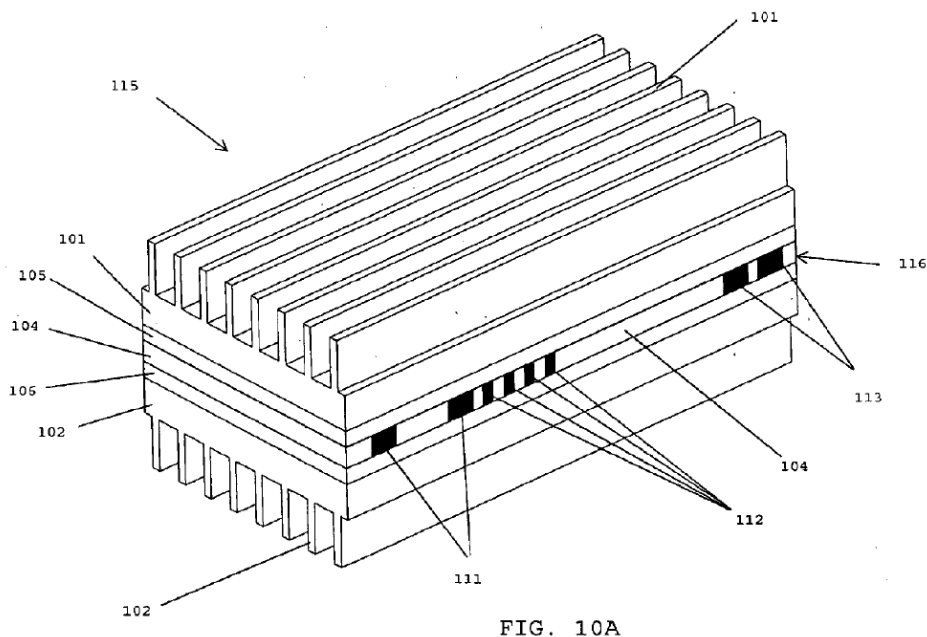
2. A POSITA Would Not Have Been Motivated to Make Vinciarelli-218 a Stacked Module

A POSITA would not have been motivated to modify Vinciarelli-218 to be a stacked module (i.e., a module with connectors on the upper lower surface of its encapsulant) as opposed to a device as only having downward pin connectors. Petitioner presents no valid rationale to change the entire nature of Vinciarelli-218's device (and ignores the drawbacks of such a device). Petitioner's modification is hindsight bias. Phinney, ¶57.

Petitioner contends that a POSITA would have been motivated to modify Vinciarelli-218 to use Zeng-014's interconnect scheme for "enabling additional electronic components to be stacked on." Petition at 16. However, not all electronic components are suitable for being stacked for reasons such as package height constraints and poor heat dissipation. Phinney, ¶58. Indeed, Vinciarelli-218's modules are restricted by these factors as directed to singulated module having heatsinks on its top and bottom, and a POSITA would not have been motivated to stack electronic components on Vinciarelli-218's encapsulated power converter or module. Petitioner did not provide a plausible rationale (other than using the claims as a guide). Phinney, ¶59.

Vinciarelli-218 dissuades a POSITA to look at Petitioner's proposed

combination. Vinciarelli-218's embodiments require heat sink panels, such as flat heat sink surfaces, finned heat sinks, or pinned heat sink. Vinciarelli-218, ¶¶82-83, 87-105, 119-123, 128, 131-139, 153-157, Figs. 1, 10, 12, 15-16, 17-26; Phinney, ¶¶60-61. Having heat-sinks on the upper surface makes it so that the devices cannot be stacked.



Vinciarelli-218 Fig. 10A

Vinciarelli-218 does teach heatsink-less modules, but their purpose was to reduce height (while Petitioner's stacking combination increases height). Vinciarelli-218, ¶159 (“[i]n some applications it may be desirable to use the panel-molding process to produce components, such as power converters, without the flat heat sink surfaces.”); Vinciarelli-218, ¶135 (“[a]s internal components are reduced in height, *e.g.* reducing the thickness of the magnetic core, the depth of the interior

cavity may be decreased bringing the heat sink panels closer together, reducing the encapsulant thickness and the resulting module thickness.”). Phinney, ¶¶62-63. Petitioner’s suggestion to stack the heatsink-less modules increases their height, defeating the purpose of providing the heatsink-less modules. Again, a POSITA would not have done this.

In addition, stacking singulated modules 815 would have exacerbated heat dissipation, demonstrating further lack of motivation to arrive at a stacked module. Vinciarelli-218 does not state that its heat-sinkless singulated module 815 is modified to produce less heat than the other modules in the heat-sink embodiments. Phinney, ¶64. Rather, removing the heat-sink from singulated module 815 makes it more susceptible to problems caused by poor heat dissipation. Phinney, ¶65. Stacking additional electronic components, or even singulated modules 815 on top of a singulated module 815 would further block air flow (e.g., hot air will be trapped between opposing surfaces of two stacked modules), reduce thermal transmittance, and exacerbate the heat dissipation problem, which in turn leads to poor device performance and even hazardous conditions. *Id.* A POSITA would not have provided this stacking modification which exacerbates heat problems when Vinciarelli-218’s disclosure is focused on heat dissipation with heat sinks.

Petitioner’s rationale for having stacked modules falls short. The Petition alleges that “[s]ince Vinciarelli-218 discloses a component that is a DC-DC power

converter module,” “a skilled artisan would have been motivated to stack input or output capacitors onto the power converter module to save space.” Petition at 21-22. Simply having more electronic components instead of a singular package does not increase power density as more elements could be fitted into a singular package (as opposed to stacked package). Phinney, ¶66. The purpose of putting electronic elements into one package to form a power module is to improve integration and power density, and reduce device footprint. Vinciarelli-218 already discloses putting input and output capacitors *inside* the module. Vinciarelli-218, ¶¶82, 143, 145, 148, 150, 153. Phinney, ¶66. These input/output capacitors are the exact same “input or output capacitors” the Petitioner suggested to stack on top of Vinciarelli-218’s module. A POSITA would not put some elements in the package but leave some outside when Vinciarelli-218 teaches placing such elements within the package. A POSITA would not have stacked capacitors on Vinciarelli-218’s modules because doing so would decrease the power density and increase the overall dimensions of an apparatus. Phinney, ¶66.

In contrast to Vinciarelli-218, a stacked device is required by the challenged claims because they require an SMD pad on both the bottom and top surfaces. ’534 Patent at 21:28-29, 22:12-14. If a POSITA had no motivation to make a stackable device (which it does not as described above), there would be no reason to add an SMD pad on both the top and bottom surfaces of Vinciarelli-218. Phinney, ¶67.

This is moreover true when providing a stacked device requires difficult manufacturing processes that result in errors and lower yields, as described in the sections that follow.

Petitioner fails to demonstrate that a POSITA would have been motivated to combine the teachings of Vinciarelli-218 and Zeng-014 to realize a device that achieved all of the features of independent claims 1 and 10. Petitioner's disregard of fundamental differences between Vinciarelli-218 and Zeng-014's devices render Ground 1 fatally deficient, and institution should be denied. Phinney, ¶68.

The below provides additional reasons why Petitioner's Ground 1 lacks a motivation to combine. Phinney, ¶69.

3. Petitioner's Combination Creates a Device that No POSITA Would Have Been Motivated to Create

a. Petitioner Proposes Combination Through Hindsight

Beyond lacking motivation to provide a stacked module, the teachings of Vinciarelli-218 and Zeng-014 results in a device that would have been difficult to or impractical to manufacture. Petitioner's combination results in a manufacturing process where the encapsulant is drilled, or where pins are formed as pillars then the encapsulant applied and cured; both of which are error-prone. A POSITA would not have (with no reason) made a device that was difficult to manufacture and Petitioner's combination is the result of pure hindsight bias. *Metalcraft of Mayville, Inc. v. The Toro Co.*, 848 F.3d 1358, 1367 (Fed. Cir. 2017) (“[W]e cannot allow

hindsight bias to be the thread that stitches together prior art patches into something that is the claimed invention.”). Phinney, ¶70.

Vinciarelli-218 provides a device that has several components (e.g., several inductors) that are encapsulated but provides no terminals that reach to the top and bottom of the encapsulant. Zeng-014 teaches multi-layer substrate of an inductor where its conductor is pre-formed or pre-fabricated on each layer of the substrate or by drilling holes directly into the component itself and filling the holes with conductive material. Phinney, ¶71.

Petitioner contends that Vinciarelli-218’s device could be modified with Zeng-014’s conductors. A POSITA, however, would not have pre-formed or pre-fabricated an encapsulant with conductors. Phinney, ¶71. It would not be technically feasible to pre-form conductors (as series of pillars onto an unknown material layer) then encapsulate the structure; nor would it be feasible to drill holes into the encapsulant to reach the unknown material layer. *Id.*

The differences in the devices (and the inapplicability of the manufacturing processes) is apparent when each is viewed in turn. First, Vinciarelli-218 teaches a device having several components that are encapsulated into a larger unit. The relied-upon embodiment of Vinciarelli-218 (Vinciarelli-218, ¶¶159-160) is a device having encapsulant (yellow) surrounding an unknown/undefined layer labeled as 804 (green) which is disposed within module 815. Vinciarelli-218, ¶¶159-160.

Vinciarelli-218 provides exposed interconnects 811/812 that the interconnect portions 808A are connected to. *Id.* Phinney, ¶71.

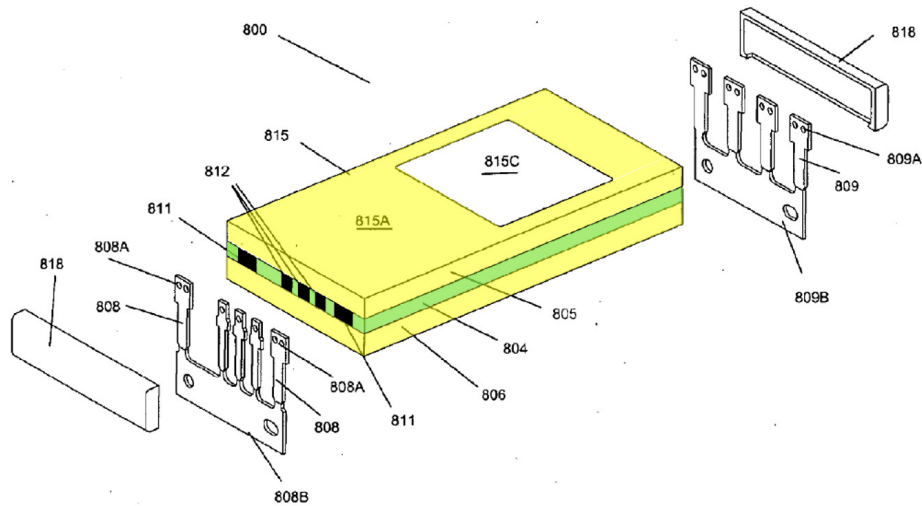


FIG. 35

Annotated Vinciarelli-218 Fig. 35

Another view of Fig. 35 is shown in Fig. 34 below. As can be seen below, interconnect portions 808A are attached to the side of the layer 804 (green) and extend downwards through terminal portions 808 for connection.

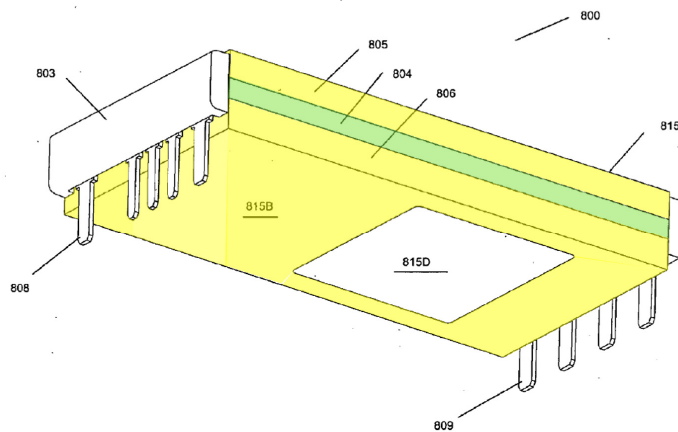


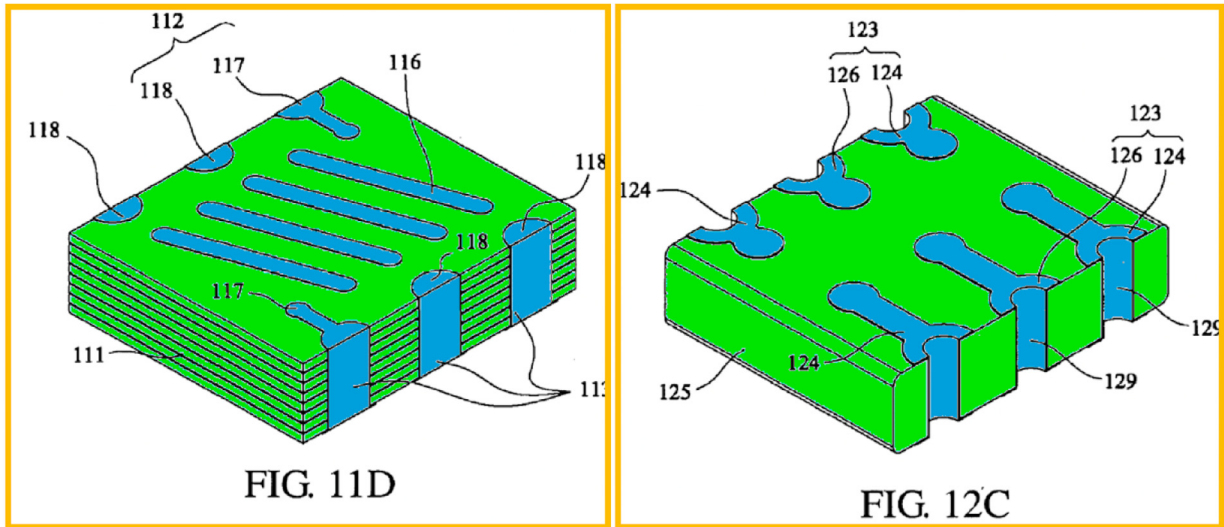
FIG. 34

Annotated Vinciarelli-218 Fig. 34

As can be seen from the above, terminal portions 808 (including interconnect portions 808A, shown in Fig. 35 but not visible in Fig. 34) do not extend to the top and bottom surfaces of the encapsulant (moreover, terminal portions 808 are not SMD pads).

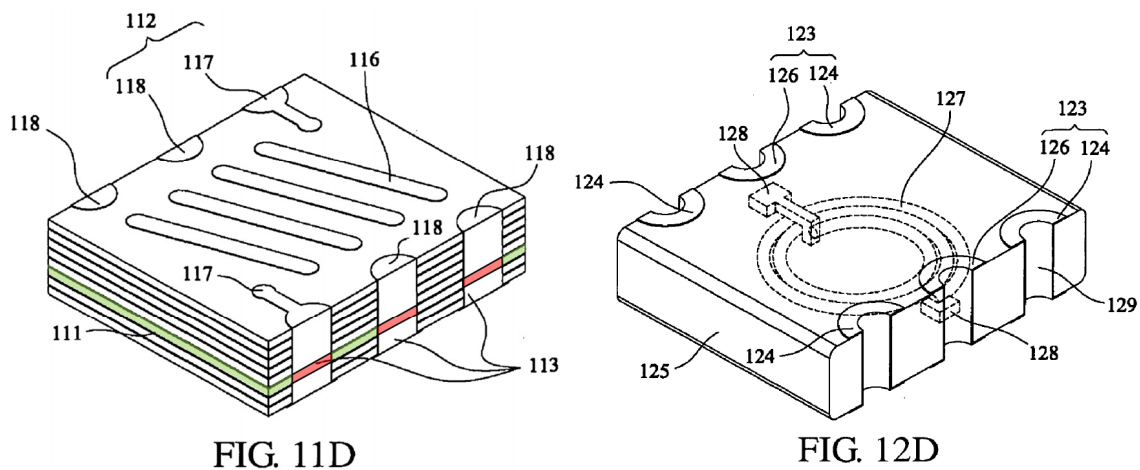
Petitioner acknowledges that Vinciarelli-218 lacks the claimed structure of [1c] (“pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material ... [the] pins have two SMD pads ... extending to an upper surface and a lower surface of the insulation material”) and argues that a POSITA would have arrived at [1c] by “modify[ing] Vinciarelli-218 to use Zeng-014 pin’s scheme” where “pins are similar to Zeng-014’s pin conductors.” Petition at 16. Zeng-014’s manufacturing processes, however, are inapplicable to Vinciarelli-218’s encapsulated device. Phinney, ¶¶72-84.

Zeng-014 teaches fabricating an inductor (within the orange boxes, below) utilizing multi-layer magnetic material substrates 111 or magnetic material substrate 125 (both shown in green in Fig. 11D and Fig. 12C below). In both magnetic material substrates 111 or 125 pins 117/118/123/129 are formed integrally with the device. Phinney, ¶¶73-78. Zeng-014 teaches forming pins integrally with the device.



Annotated Zeng-014 Figs. 11D and 12C

Zeng-014 provides detail in forming its pins integrally with the magnetic substrate. Zeng-014 pins (red, below) are formed as part of the magnetic substrate (green) (e.g., Fig. 11D, and other Fig. 11 embodiments) or drilled through the magnetic substrate 125 (e.g., Fig. 12D) (further detail follows the below figures). Phinney, ¶79.



Annotated Zeng-014 Figs. 11D and 12D

Figs. 11A-11G are made by forming pins integrally with the substrate. They describe “a POL DC to DC converter.” Zeng-014, ¶73. The first fabrication step includes forming “a number of semi-circular through-holes” “at two opposite sides of each magnetic material layer [111]” and filling the semi-circular through-holes “with a metal material” to form the pins 117 and 118. Zeng-014, ¶74. Multiple layers of substrates 111 are then stacked by “sintering multiple layers of magnetic material together, which is a process similar to the low temperature co-fired ceramic (LTCC) process.” Zeng-014, ¶74. The layers of each conductor (e.g., pins 117 and 118) are aligned and stacked at the same time when substrates 111 are stacked, and the stacked layers of pins 117 and 118 form conductor 113. *Id.* Phinney, ¶80. Figs. 11D and 11G of Zeng-014 reproduced below show the substrate stack which includes multiple single substrate 111 (green) and embedded pins 117 and 118 (red) stacked on top of each other. Zeng-014, ¶¶73-75; Phinney, ¶¶80-81. Only one layer of substrate 111 and embedded pins 117 and 118 are annotated for clarity; as can be seen below, the pins are made integral with the substrate.

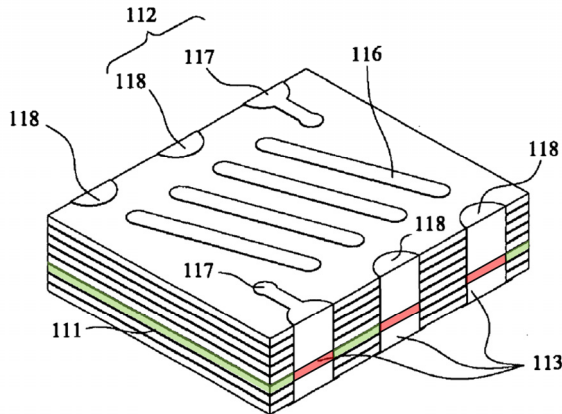


FIG. 11D

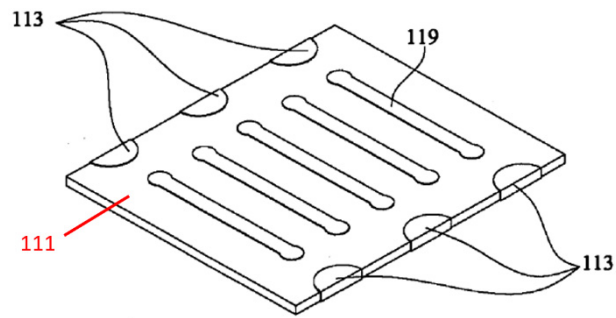


FIG. 11G

Annotated Zeng-014 Figs. 11D and 11G

Zeng-014's other embodiments (e.g., FIG. 12) also demonstrate the pins being integral with the substrate, but this time by drilling it to form pins. Zeng-014's DC to DC converter 120 includes a "first conductive layer 123 [that] comprises a connecting conductor having four pins 124 and a pin conductor having two pins 126." *Id.* Each of the pins 124 and 126 contains a conductor 129 which is "formed in a through-hole form through the top and the bottom surfaces of the magnetic material substrate 125." Zeng-014, ¶77. Phinney, ¶82. The through-holes are drilled in the magnetic material substrate and electro-plated to form conductors 129. *See* Zeng-014, ¶¶77. Conductor 129 is "electrically connected with the flat coil pins 128 at both ends of the inductance coil 127 inside the magnetic material substrate 125." Zeng-014, ¶77. Zeng-014's Fig. 12D is reproduced below.

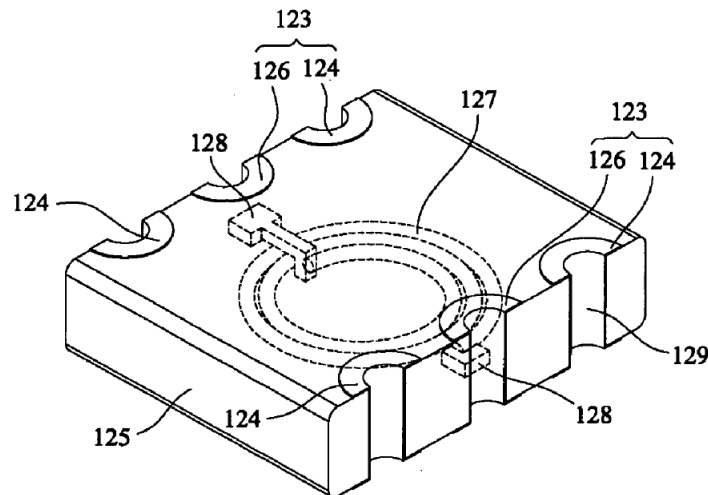


FIG. 12D

Zeng-014 Fig. 12D

The substrate 125 is drilled to form semi-circular through-holes and electroplated to form conductors 129. Zeng-014, ¶77. Conductors 129 are “electrically connected with the flat coil pins 128 at both ends of the inductance coil 127 *inside* the magnetic material substrate 125.” Zeng-014, ¶77. As shown in Fig. 12D above, the sidewall surfaces of substrate 125 contains multiple semi-circular through-holes extending into magnetic material substrate 125 in which flat coil pins 128 are embedded. Zeng-014, Fig. 12D. Phinney, ¶83.

Embodiments in Zeng-014’s Figs. 11D and 12D thusly pre-form pins integrally with the substrates, and Petitioner’s combination using Zeng-014’s manufacturing processes would result with pins being formed integrally with the encapsulant. Petitioner, however, does not describe how this could possibly be accomplished on Vinciarelli-218’s device (excerpted again below).

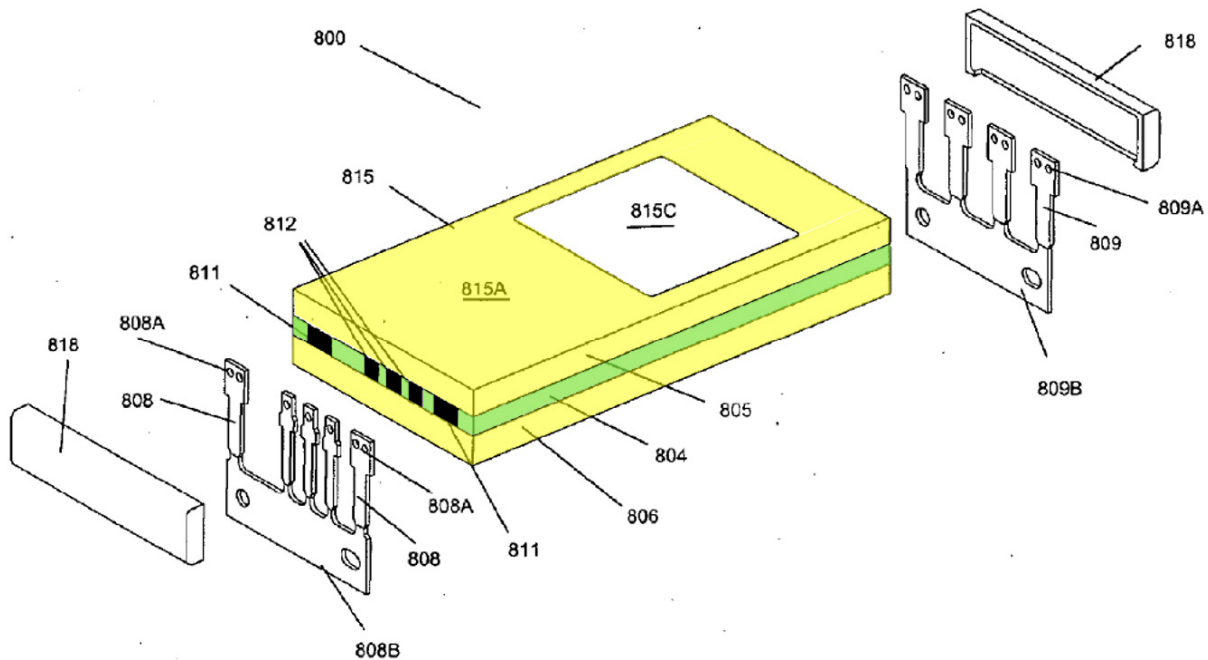


FIG. 35

Annotated Vinciarelli-218 Fig. 35

A POSITA would have no reason to modify the assembly-based solution of Vinciarelli-218, and would not have integrally formed pins in an encapsulant. Phinney, ¶¶84-85. Vinciarelli-218 does not stack laminations that extend the full height of the device, this process would require forming pins on the PCB upwards like pillars and then pouring and curing an encapsulant. Phinney, ¶¶85-86.

A POSITA would have understood this operation to be error prone, since the conductors are unprotected by encapsulants. Phinney, ¶86. These conductors would be prone to damage without the protection of encapsulant layers. *Id.* A POSITA would not have been motivated to make the purported modifications to Vinciarelli-

218's device using a method which the Petitioner fails to elucidate and is not disclosed in Vinciarelli-218 or Zeng-014. A POSITA would have no reason to deviate from Vinciarelli-218's post-singulation assembly of an unbent lead frame and exposed "bar codes" 811, or expectation of success in doing that. *Id.*

A POSITA would also not have drilled holes into the encapsulant to provide conductive pins (Zeng-014's other relied upon embodiment). Phinney, ¶87. This process requires extra manufacturing steps that would result in possibly breakage / or weaken or destroy the protection of the encapsulant. *Id.* Again, this would be an error prone manufacturing step that introduces unwanted stress that could lead to device mechanical failure such as delamination. A POSITA would not have made or be motivated to make a combination that resulted in lower yields and more costs. *Id.*

Petitioner's combination ignores the technical details of Vinciarelli-218 and Zeng-014, and arrives at its combination through hindsight. Phinney, ¶88. The source to arrive at the '534 Patent's claims is not found in Vinciarelli-218 or Zeng-014; instead, the source to piece together everything is the '534 Patent's claims. The Petition "use[s] the challenged patent as a roadmap to reconstruct the claimed invention using disparate elements from the prior art—i.e., the impermissible *ex post* reasoning and hindsight bias that KSR warned against." *TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1361 (Fed. Cir. 2019). By doing so, Petitioner goes

headlong “into the tempting but forbidden zone of hindsight.” *In re Dembiczak*, 175 F.3d 994, 998 (Fed. Cir. 1999).

As such, there is no motivation to arrive at [1c] (and substantively similar [10c]).

b. The Combination Still Fails to Meet Limitations [1c] and [10c]

Put the absence of motivation aside, Petitioner’s combination fails to meet at least the limitations of [1c] and [10c] for the following reasons. Phinney, ¶89. Limitation [1c] requires that SMD pads extending “to an upper surface and a lower surface of the insulation material, respectively.” As an initial matter, Vinciarelli-218 does not teach or suggest that its interconnect portions 808A are “SMD pads.” Zeng-014 is similarly silent regarding this issue and does not cure the deficiency of Vinciarelli-218. Phinney, ¶89.

A POSITA would have understood that the top and bottom surfaces of pins 117, 118, and top bottom surfaces of each layer of conductors 113, are *coplanar* with top and bottom surfaces of their respective magnetic material substrate 111. This is because if pins 117, 118, or conductors 113 protrude from top and bottom surfaces of magnetic material substrate 111, gaps would form between substrates 111 during lamination which in turn leads to mechanical failure. Phinney, ¶89. Therefore, after lamination, bottom surfaces of pins 117, 118 and conductors 113 are coplanar with bottom surfaces of substrate 111. In other words, bottom surfaces of the pins,

conductors, and substrate 111 are on the *same plane*. *Id.* As such, there is no disclosure or motivation in Zeng-014 that teaches [1c]. Phinney, ¶89.

Moreover, [10c] requires that the “SMD pads extending to the recesses at the upper surface and the lower surface of the cuboid.” The Petitioner’s combination does not demonstrate recesses at the upper/lower surfaces, as Zeng-014 teaches integrally forming (or drilling) conductive pins. Phinney, ¶89. The rest of [10c] is similar to [1c].

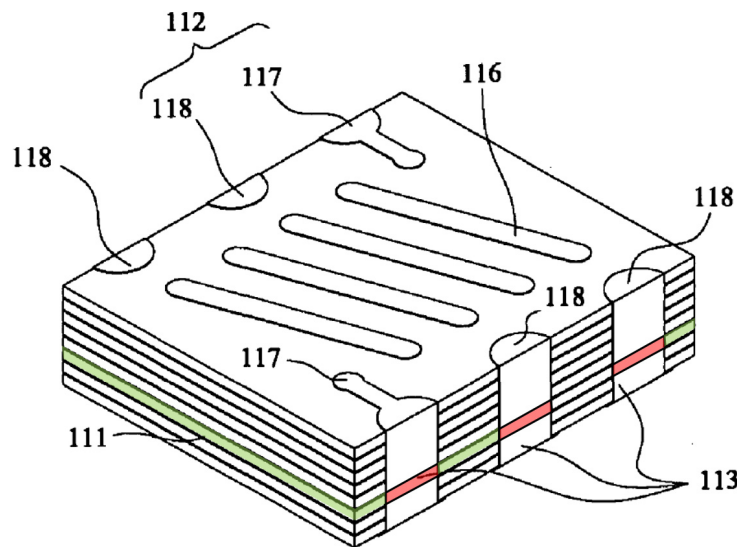


FIG. 11D

Annotated Zeng-014 Fig. 11D

As such, both [1c] and [10c] are not taught by Petitioner’s combinations.

Phinney, ¶89. Ground 1 thus fails to present a reasonable likelihood of success.

4. Petitioner Ignores the Differences in Interconnection Formation Between Vinciarelli-218 and Zeng-014

In addition to the above, Petitioner’s motivation fails because it ignores the

differences between Vinciarelli-218 and Zeng-014. Phinney, ¶90.

Petitioner's combination takes Vinciarelli-218's singulated module 815 and adds Zeng-014's pins and conductors formed in a non-singulated structure (described in Fig. 11D and Fig. 12C of Zeng-014). Petition at 16-18. While acknowledging that Vinciarelli-218 needs to be modified by Zeng-014 to make its proposed combination work (Petition at 16), Petitioner fails to explain why a POSITA would use Zeng-014's pin scheme on Vinciarelli-218's singulated module 815. Petition at 16-18. Phinney, ¶91.

Petitioner's proposed combination ignores the differences between the fabrication processes of Vinciarelli-218 and Zeng-014, and provides no benefits prompting a POSITA to make the change. Phinney, ¶92. Faced with feasibility challenges in incorporating conductors in Zeng-014 into Vinciarelli-218' structure, a POSITA would not have been motivated to do so. *Id.* This is described in detail below.

Vinciarelli-218 describes a singulated module 815 and two adaptors 803 (803A and 803B)⁶ that are "suitable for through-hole mounting to a motherboard."

⁶ Adapters 803A and 803B are only mentioned once in Vinciarelli-218's specification at ¶159 and are not shown in Figs. 33-36 of Vinciarelli-218. Patent Owner presumes in its analysis that this is an error and that adapters 803A and 803B

Vinciarelli-218, ¶159. Phinney, ¶93. Vinciarelli-218’s Fig. 33 shows that singulated module 815 includes cured encapsulant 805 and 806 with a layer 804⁷ in between. *Id.*, ¶159, Fig. 33. Adaptors 803 are attached to side surfaces of singulated module 815. *Id.*

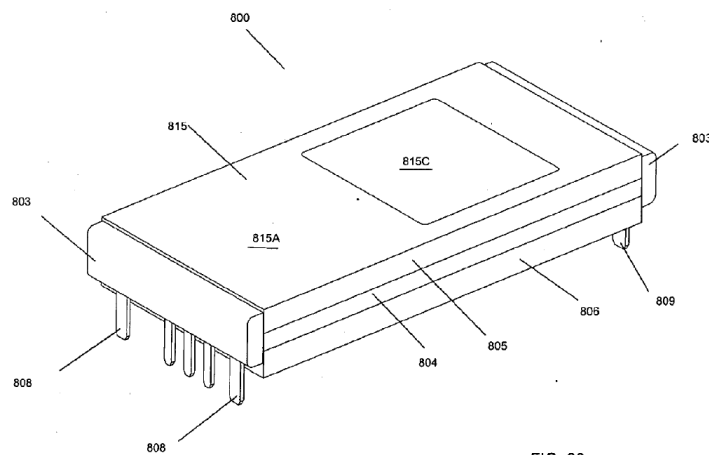


FIG. 33

Vinciarelli-218 Fig. 33

Fig. 35 of Vinciarelli-218 is an exploded view showing “terminal portions 808 and interconnect portions 808A [that] may be formed for example by a precision metal stamping process.” Vinciarelli-218, ¶160. Interconnect portions 808A “may be soldered to the exposed interconnects 811, 812.” *Id.* After interconnect portions

refer to the pair of adaptors 803 (having protective caps 818 shown in Fig. 35) depicted in Figs. 33 and 34 of Vinciarelli-218.

⁷ Layer 804 is only marked in Figs. 33-36 of Vinciarelli-218 but not described in the specification.

808A (blue in annotated Fig. 35 below) “are attached to the exposed contacts” of singulated module 815, the “lead frame 808B may be separated from the terminals 808.” *Id.* Therefore, singulated module 815 and terminals 808 are fabricated separately and then joined together to form a connection in between. Phinney, ¶¶94. In addition, Vinciarelli-218 discloses attaching protective caps 818 to interconnect portions 808A after they are attached to singulated module 815 “to provide structural integrity,” and protective caps are depicted in drawings where adaptors are used. Vinciarelli-218, ¶160, Figs. 15-18, 25, 26, 33-36; Phinney, ¶¶94. Petitioner intentionally omitted protective caps from the purported combination and failed to explain how Zeng-014’s terminal can be incorporated with protective caps 818 as required by 218 patent to provide the necessary “structure integrity.” Phinney, ¶¶94.

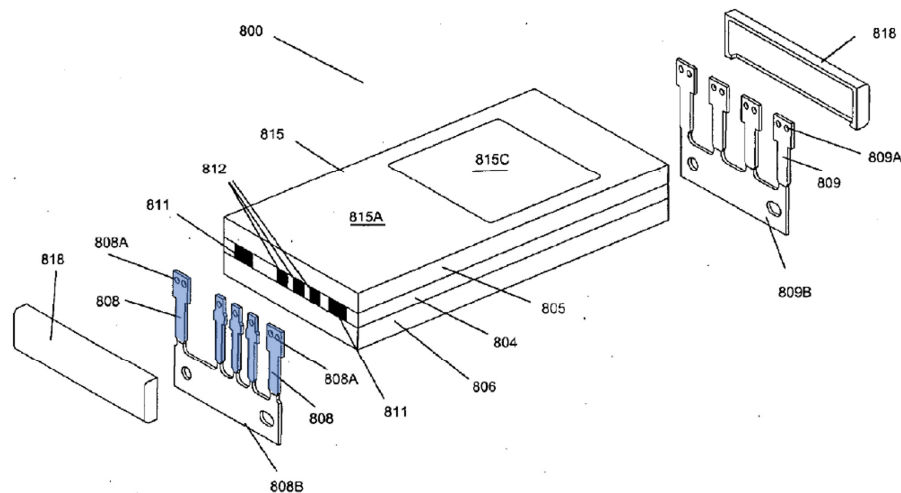


FIG. 35

Annotated Vinciarelli-218 Fig. 35

As can further seen above, Vinciarelli-218's interconnects 811 and 812 are exposed and formed in flush with the sidewall surface of singulated module 815. Phinney, ¶94.

Different from Vinciarelli-218, in which singulated module 815 is fabricated *separately from* interconnect portions 808A, the conductors of Zeng-014 are pre-formed on *each substrate 111*. Phinney, ¶¶95-97. In other words, Zeng-014's conductors 113 are formed *during* the formation of stacked substrates 111, rather than after substrates 111 are completely formed or after the components of a power supply module has been encapsulated. *Id.*

Zeng-014 describes “a POL DC to DC converter” and Petitioner relies on two of its embodiments. Zeng-014, ¶73. For the first embodiment, the first fabrication step includes forming “a number of semi-circular through-holes” “at two opposite sides of each magnetic material layer [111]” and filling the semi-circular through-holes “with a metal material” to form the pins 117 and 118. Zeng-014, ¶74. Multiple layers of substrates 111 are then stacked by “sintering multiple layers of magnetic material together, which is a process similar to the low temperature co-fired ceramic (LTCC) process.” Zeng-014, ¶74. The layers of each conductor (e.g., pins 117 and 118) are aligned and stacked at the same time when substrates 111 are stacked, and the stacked layers of pins 117 and 118 form conductor 113. *Id.* Phinney, ¶¶98. Fig. 11D of Zeng-014 reproduced below shows the substrate stack which includes

multiple single substrate 111 (green) and embedded pins 117 and 118 (red) stacked on top of each other. Zeng-014, ¶¶73-75; Phinney, ¶¶99-101. Only one layer of substrate 111 and embedded pins 117 and 118 are annotated for clarity.

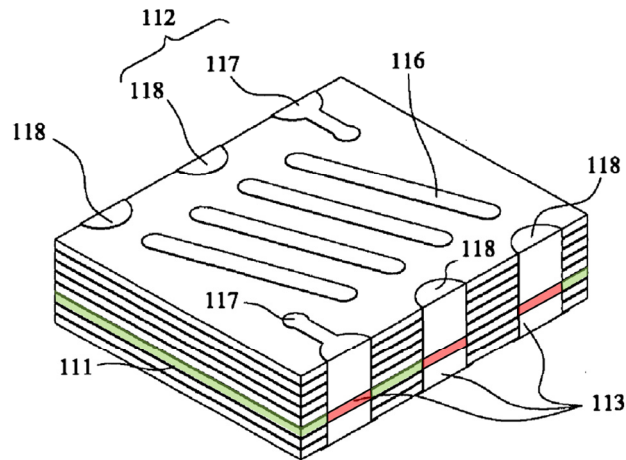


FIG. 11D

Annotated Zeng-014 Fig. 11D

The second relied-upon embodiment likewise shows the integrally formed device. Phinney, ¶102. Zeng-014’s DC to DC converter 120 includes a “first conductive layer 123 [that] comprises a connecting conductor having four pins 124 and a pin conductor having two pins 126.” *Id.* Each of the pins 124 and 126 contains a conductor 129 which is “formed in a through-hole form through the top and the bottom surfaces of the magnetic material substrate 125.” Zeng-014, ¶77. Phinney, ¶103. The through-holes are drilled in sides of the magnetic material substrate and electro-plated to form conductors 129. *See* Zeng-014, ¶¶77. Conductor 129 is “electrically connected with the flat coil pins 128 at both ends of

the inductance coil 127 inside the magnetic material substrate 125.” Zeng-014, ¶77.

Zeng-014’s Fig. 12D is reproduced below.

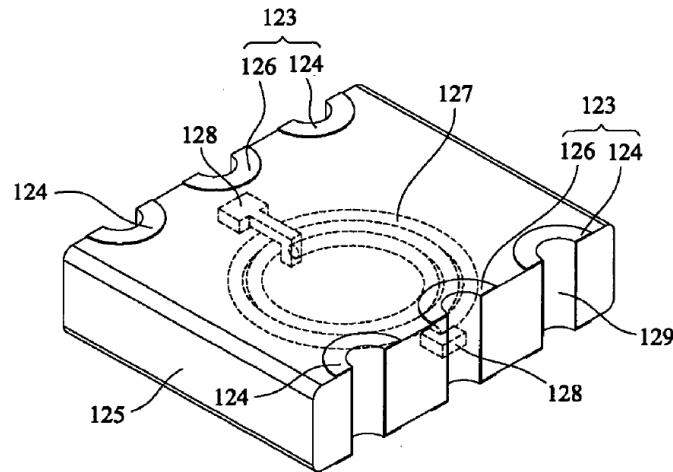


FIG. 12D

Zeng-014 Fig. 12D

Given the difference in interconnect formation, a POSITA would have recognized that Petitioner’s modification requires Vinciarelli-218 to *fabricate the external interconnect (e.g., interconnect 808A) within singulated module 815*. Phinney, ¶¶104-105. A POSITA would not have been motivated to modify Vinciarelli-218 and incorporate Zeng-014’s conductors 129 because doing so would have required the formation of semi-circular through-holes at the sidewall surface of Vinciarelli-218. Phinney, ¶106. According to Dr. Phinney, creating semi-circular holes at sidewall locations would require additional processing steps. In addition to drilling, masking or stop-off is required to form Zeng-014’s conductors 129 only where needed, e.g., in a plating process. *Id.*

In addition, Vinciarelli-218's terminal portions 808 and interconnect portions 808A are designed to mount singulated module 815 onto a motherboard using a "through-hole mounting" method. Vinciarelli-218, ¶¶159-160. This mounting method requires the ends of the interconnect portions to be "constructed and arranged to be inserted into conductive holes in the circuit board" by having interconnect portions protruding vertically down into the circuit board. Vinciarelli-218, ¶18; Phinney, ¶107. In contrast, Zeng-014's conductors 113 and 129 extend horizontally and do not have the capability of being inserted into conductive holes in the circuit board. *Id.*

Moreover, Vinciarelli-218 requires that the terminals (e.g., 808) be connected to a lead frame, which is then broken off from the terminals after the terminals are joined to the singulated module. The fabrication processes of Vinciarelli-218 and Zeng-014 are incompatible and Petitioner's rationale is derived from hindsight. Phinney, ¶108.

Petitioner considers none of this while asserting that a POSITA would have been motivated to combine the references. Rather, Petitioner stated that "Zeng-014's pin scheme would be used in place of Vinciarelli-218's connectors" and came to the conclusion that the "pins in the combination" would have the same structure as taught by Zeng-014. Petition at 19-20. Petitioner's expert merely repeats the attorney's argument—and ignores the same details—without adding anything

substantial beyond conclusory statements from the petition. *See, e.g., Harmonic, Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (“[Petitioner’s] expert testimony in support of this theory is equally unavailing, adding nothing beyond the conclusory statements in [the] petition.”); *Smartmatic USA Corp. v. Election Sys. & Software, LLC*, IPR2019-00527, Paper 32 at 34 (Aug. 5, 2020) (giving no weight to an expert declaration that “merely parrots the language in the Petition”).

Faced with feasibility challenges and differences between the interconnect designs, a POSITA would not have been motivated to incorporate Zeng-014’s conductors into Vinciarelli-218’s structure. Phinney, ¶109.

5. Petitioner’s Combination Does Not Result in Other Limitations of [1b], [1c], [10b], and [10c]

In addition to the above, Petitioner’s combination would not result in a device that satisfies the limitations of [1b] and [1c] (and substantively similar [10b]/[10c]). Phinney, ¶110.

The ’534 Patent claims require “insulation material formed on two opposite surfaces of the bearing plate” and “a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material [with] each of the pins [] extending to an upper surface and a lower surface of the insulation material.” ’534 Patent, at 21:26-33. This is shown in Fig. 25, where pin 140 (blue) is located on lateral sides of the insulation material 3430 (which is formed on the bearing plate 3420). *Id.* at 19:34-40. As can be seen below, the conductor wraps

around the insulator (and is on its lateral side). Phinney, ¶111.

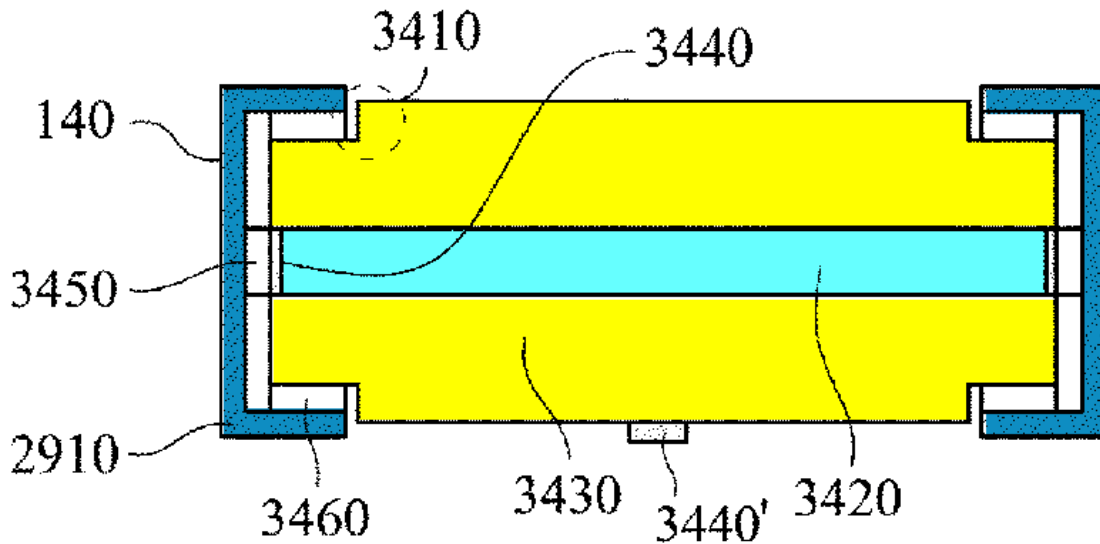


Fig. 25

Annotated '534 Patent Fig. 25

As described above in §§IV.A.3-IV.A.4, Petitioner's combination results in pins being made into the encapsulant and not on its lateral sides. As a consequence, Petitioner's combination does not result in a device with "insulation material formed on two opposite surfaces of the bearing plate" (limitation [1b]) and "a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material" (limitation [1c]). Petitioner's combination (even if a motivation were found) thusly fails to teach the limitations. Phinney, ¶112.

As such, both [1b]/[1c] and [10b]/[10c] are not taught by Petitioner's combinations. Phinney, ¶113.

B. Ground 2: Zeng-014 Does Not Anticipate Claims 1-8 and 10-12 because it fails to teach [1a], [1b], and [1c]

1. Zeng-014 Does Not Teach [1a], [10a]

Petitioner has failed to show that Zeng-014 anticipates [1a], “a bearing plate.” [10a] is substantively similar. Phinney, ¶114.

Petitioner identifies Zeng-014’s magnetic substrates 111 / magnetic material substrate 125 as being the “bearing plate.” These are, however, are not bearing plates. A “bearing plate” bears mountable components (e.g., ’534 Patent at 8:25-29 describing bearing plate as a PCB) and is not the part of a component. Petitioner’s identified elements (magnetic substrates 111 / magnetic material substrate 125) are not a bearing plate because they are internal structures that create an inductor, and are not where components are mounted onto (e.g., like a PCB.) Phinney, ¶115.

The Petition alleges that magnetic substrates 111 and magnetic material substrate 125 are bearing plates because they are used for integrated circuits 115 and 121, and others. *See* Petition at 36. However, FIGs. 11A and 12A show that these components in fact are mounted on conductive layers 112 and 123 and are not even in direct contact with magnetic substrates 111 or magnetic material substrate 125. *See* Zeng-014, Figs. 11A and 12A. Phinney, ¶116.

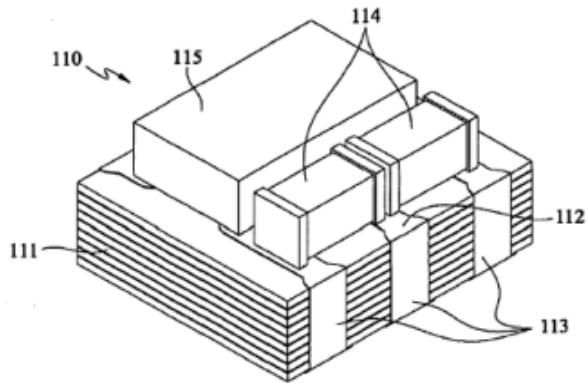


FIG. 11A

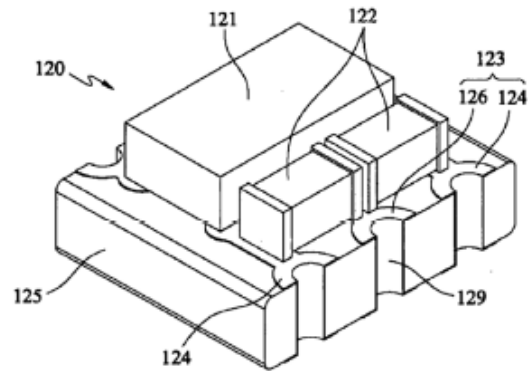


FIG. 12A

Zeng-014 Figs. 11A and 12A

Petitioner has not, however, identified the conductive pins as part of the bearing plate. This is because the claims separately require another set of pins connected to the bearing plate (and Petitioner identifies the pins of Zeng-014 as the claimed pins of [1c]). Petitioner's identification of the substrate, which lacks any conductive element, thusly fails. Phinney, ¶116.

Therefore, magnetic substrates 111 and magnetic material substrate 125 are not a “bearing plate” as recited by limitations [1a] and [10a]. Phinney, ¶117.

2. Zeng-014 Does Not Teach [1b], [10b]

Petitioner has failed to show that Zeng-014 anticipates [1b], “insulation material formed on two opposite surfaces of the bearing plate.” [10b] is substantively similar. Phinney, ¶118.

Petitioner identifies Zeng-014's magnetic material substrate 125 as being both the “bearing plate” and the “insulation material.” Petitioner argues that its

identification is appropriate because the magnetic substrate has insulative properties. Petition at 37-39. Phinney, ¶119.

Petitioner’s argument is not consistent with the claims and specification of the ’534 Patent. The claims do not define the property; they describe an entirely separate component, the “insulation material” in addition to the “bearing plate.” To state that the “insulation material” can be the “bearing plate” itself because it is non-conductive renders the “insulation material” wholly superfluous. Phinney, ¶120. Each limitation must be given meaning, and Petitioner’s attempt to identify a single component as satisfying multiple different structural limitations fails. The Federal Circuit has repeatedly held that “[w]here a claim lists elements separately, as done here, there is ‘a presumption that those components are distinct.’” *Barrday, Inc. v. Lincoln Fabrics Inc.*, No. 2022-1903, 2023 WL 7871688, at *4 (Fed. Cir. Nov. 16, 2023) (quoting *Kyocera Senco Indus. Tools Inc. v. Int’l Trade Comm’n*, 22 F.4th 1369, 1382 (Fed. Cir. 2022)); see *Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1254 (Fed. Cir. 2010) (“Where a claim lists elements separately, ‘the clear implication of the claim language’ is that those elements are ‘distinct component[s]’ of the patented invention.”) (quoting *Gaus v. Conair Corp.*, 363 F.3d 1284, 1288 (Fed. Cir. 2004)); see *Engel Indus., Inc. v. Lockformer Co.*, 96 F.3d 1398, 1404-05 (Fed. Cir. 1996) (Concluding that when a claim provides for two separate elements, “they logically cannot be one and the same.”).

The problem in Petitioner's read is pronounced because it stretches the magnetic material substrates of Zeng-014 to describe too much. Phinney, ¶121. As noted in [1a], the magnetic material substrates alone cannot be a bearing plate because they cannot bear components. Moreover, Petitioner identifies those substrates as being both bearing plates and insulators (which are contradictory because an insulator insulates components and does not mount them).

Petitioner thusly failed to demonstrate that [1b] (both the bearing plate and insulating material) is taught. [10b] is substantively similar and Petitioner's argument fail for similar reasons. Phinney, ¶122.

3. Zeng-014 Does Not Teach [1c], [10c]

Petitioner has failed to show that Zeng-014 anticipates [1c], which requires “a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material.” [10c] is substantively similar but provides additional limitation. Phinney, ¶123.

In Ground 2, Petitioner again relies on the embodiments of Zeng-014 described above (Figs. 11A-11G and 12A-12D). However, Petitioner fails for the same reason. Phinney, ¶124. As described in Ground 1, §§IV.A.3-IV.A.5, Zeng-014's conductors are formed integrally with or pre-formed in each of its substrates. Zeng-014 fails to anticipate because it does not teach [1c] for the same reasons described in §§IV.A.3-IV.A.5.

As described above in §§IV.A.3-IV.A.5, pins 117 of Zeng-014's Figs. 11A-11G are integral parts of substrates 111 because they are embedded therein and not on the lateral side of the insulating material. Phinney, ¶125. Zeng-014's pins 117 and 118 are formed "at two opposite sides of each magnetic material layer, and are filled with a metal material...to form the connecting conductive elements 119 and pins 117, 118 of the inductance coil 116." Zeng-014, ¶74. Magnetic material substrate 111 with pre-formed pins 117, 118, and conductors 113 are "laminated together to form the inductance coil 116." *Id.* A POSITA would have understood that the top and bottom surfaces of pins 117, 118, and each layer of conductors 113 are coplanar with top and bottom surfaces of their respective magnetic material substrate 111. This is because if pins 117, 118, or conductors 113 protrude from top and bottom surfaces of magnetic material substrate 111, gaps will form between the substrates during lamination which in turn leads to mechanical failure. Phinney, ¶126. Therefore, after lamination, bottom surfaces of pins 117, 118, and stack of conductors 113 are coplanar with both top and bottom surfaces of substrate 111. In other words, top and bottom surfaces of the conductors and top and bottom surfaces of substrate 111 are being on the *same plane*, respectively. *Id.* As such, there is no disclosure or motivation in Zeng-014 that teaches [1c], which recites "two SMD pads of each of the pins are extending to an upper surface and a lower surface of the insulation material, respectively." *Id.*

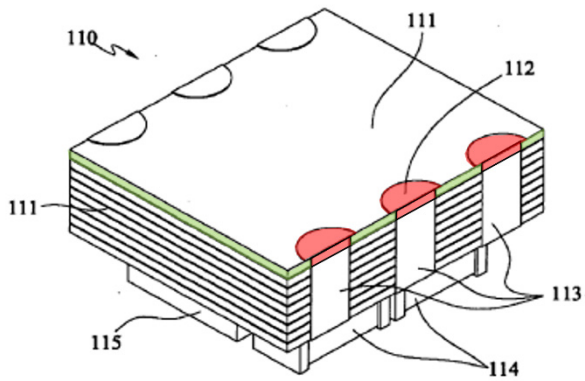


FIG. 11B

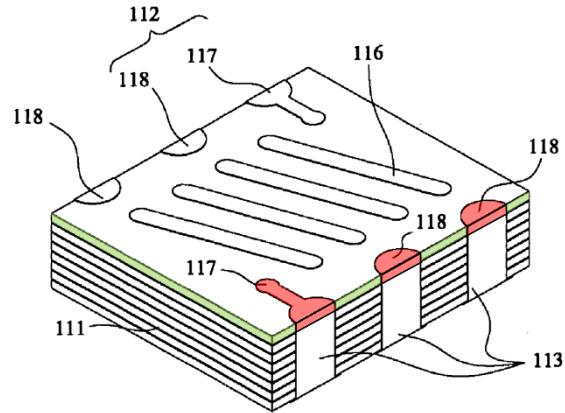


FIG. 11D

Annotated Zeng-014 Figs. 11B and 11D

The contrast can be seen in the figures of the '534 Patent whose claims require “insulation material formed on two opposite surfaces of the bearing plate” and “a plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material [with] each of the pins [] extending to an upper surface and a lower surface of the insulation material.” '534 Patent, 21:26-33. This is shown in Fig. 25, where pin 140 (blue) is located on lateral sides of the insulation material 3430 (which is formed on the bearing plate 3420). *Id.*, 19:34-40. As can be seen below, the conductor wraps around the insulator (and is on its lateral side). Phinney, ¶127.

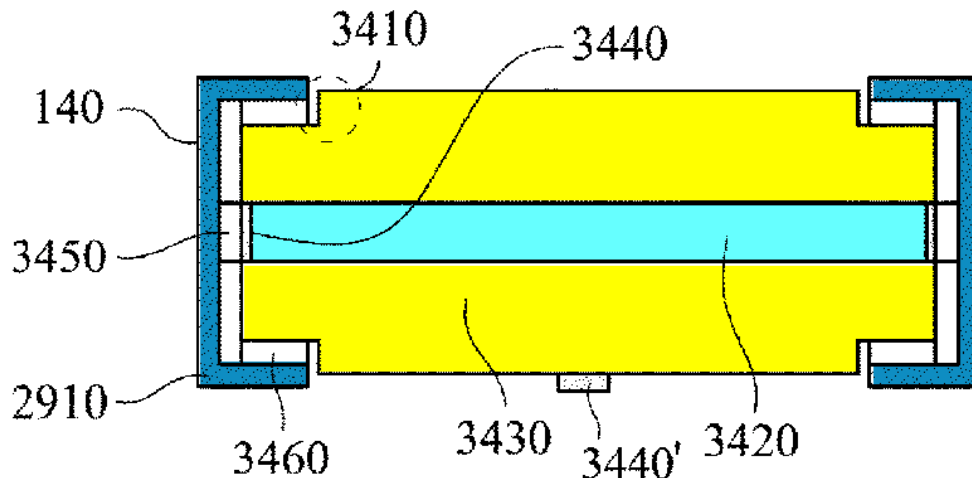


Fig. 25

Annotated '534 Patent Fig. 25

As described previously in §§IV.A.3-IV.A.5 **Error! Reference source not found.**, Petitioner's argument on its second relied upon embodiment of Zeng-014 (Fig. 12) likewise fail. Phinney, ¶128. These embodiments are formed via drilling, they similarly do not provide "plurality of pins electrically connected to the bearing plate and allocated along lateral sides of the insulation material" as required by [1c]. Shown in Fig. 12, each of the pins 124 and 126 contains a conductor 129 which is "formed in a through-hole form through the top and the bottom surfaces of the magnetic material substrate 125." Zeng-014, ¶77. The through-holes are drilled in the magnetic material substrate and electro-plated to form conductors 129. *See* Zeng-014, ¶¶77. Conductor 129 is "electrically connected with the flat coil pins 128 at both ends of the inductance coil 127 inside the magnetic material substrate 125." Zeng-014, ¶77. Zeng-014's Fig. 12D is reproduced below. Therefore, Zeng-014's

Fig. 12 embodiment fails to disclose [1c] because Zeng-014 only discloses conductors 129 being electrically to flat coil pins 128. Phinney, ¶129.

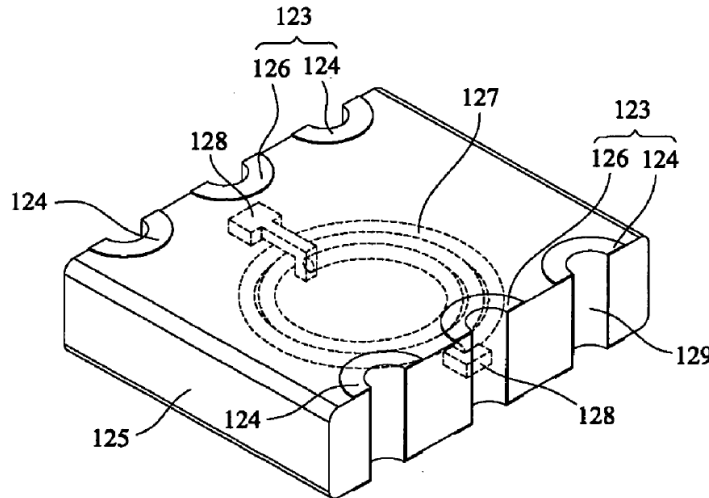


FIG. 12D

Zeng-014 Fig. 12D

Petitioner’s analysis here fails for another reason. Phinney, ¶¶130-131. It first contends that Zeng-014’s magnetic material substrate discloses the claimed “bearing plate” and concedes that “Zeng-014 does not expressly describe insulation material formed on opposite surfaces of the bearing plate in DC to DC converter 120.” Petition at 36. Petitioner continues to argue that because conductor pins 124 and 126 need to be insulated, “a skilled artisan would have at once envisaged the use of an insulation material layer in DC to DC converter 120.” Petition at 39.

As explained by Dr. Phinney, Petitioner’s arguments are incorrect and Zeng-014’s magnetic material substrate 125 is a non-conductive material, otherwise pins 124 and 126 and any conductive structures formed within magnetic material

substrate 125 would all be electrically connected, rendering the device inoperable. Phinney, ¶132. Therefore, Zeng-014's third embodiment does not disclose or teach an insulating material between magnetic substrate 125 and pins 124 or 126. *Id.*

Zeng-014 thusly does not anticipate, and Ground 2 fails to present a reasonable likelihood. Phinney, ¶133.

C. Ground 3: Zeng-014 and Zeng-014 in Combination with Jun Does Not Render Obvious Claims 1-8 and 10-12

1. The Zeng-014-Jun Combination Does Not Teach [1a], [1b], [1c], [10a], [10b], [10c]

Petitioner relies on Zeng-014 to teach the features of [1a], [1b], and [1c] which are deficient as described above in §IV.B. Petition at 49-50. Limitations [10a], [10b], and [10c] are substantively similar. Ground 3 fails for the same reasons. Phinney, ¶134.

2. A POSITA Would Not Have Been Motivated to Add Additional Insulation Material to Zeng-014

Petitioner relies only on Jun for dependent claim limitations and not independent claim limitations. Thusly, its Jun combination does not affect whether it has presented a reasonable likelihood of success of the base independent claims. Phinney, ¶135.

Petitioner nonetheless fails to present a viable motivation to combine Zeng-014 and Jun, and Petitioner's numerous failed grounds should weigh in favor of non-institution. Petitioner concedes that Zeng-014 does not teach a separate insulation

layer for substrate 125 of Zeng-014's fourth embodiment. Petition at 50. Petitioner further contends that "it would have been obvious to insulate the upper and lower surfaces of Zeng-014's substrate 125 to prevent short circuits between pins 124 and 126 disposed on the surface of the substrate." Petition at 50. As shown in Zeng-014's Fig. 12D is reproduced below, the only structure between pins 124 and 126 is substrate 125. If substrate 125 is conductive, an electrical path would have existed between not only adjacent pins 124 and 126, but also between all other conductive elements such as pins 124 and 126 formed on the opposite side surface of substrate 125, and even between pins 124 and 126 and inductive coil 127. Phinney, ¶136. This renders the entire structure depicted in Fig. 12D a conductive brick and defeats its purpose as a DC-to-DC converter. *Id.*

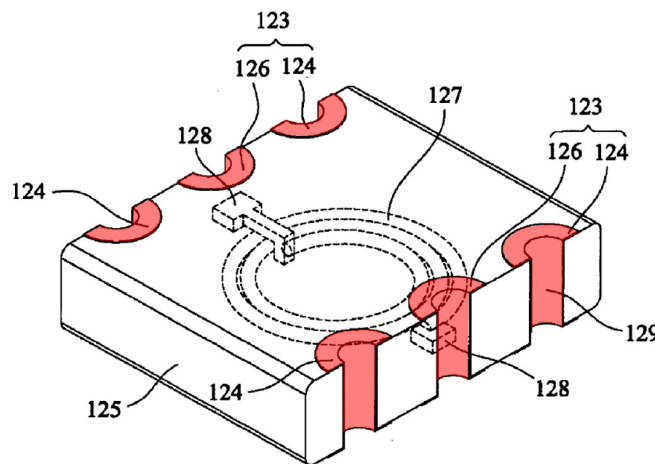


FIG. 12D

Annotated Zeng-014 Fig. 12D

3. A POSITA Would Not Have Been Motivated to Modify Zeng-014 With the Teachings of Jun

For Ground 3 of Zeng-014 over Jun, Petitioner relied on impermissible hindsight to argue that it would have been obvious to modify Zeng-014 with the connection pad of Jun. For at least these reasons, Ground 3 should be rejected. *Phinney*, ¶137.

Petitioner contends that pins 128 of Zeng-014 “are disposed on lateral sides of the bearing plate and are exposed from the insulation material and whose ends are contacting and electrically connecting the adjacent pins.” Petition at 50. This feature is not found in Zeng-014. Zeng-014 merely discloses that “conductor 129 in the two pins 126 of the pin conductor are electrically connected with the flat coil pins 128 at both ends of the inductance coil 127 inside the magnetic material substrate 125.” Zeng-014, ¶77. Petitioner failed to provide any argument that pins 128 are formed on the lateral sides of substrate 125. *Phinney*, ¶138. However, nowhere does Zeng-014 teach or suggest that conductor 129 and flat coil pins 128 are also physically connected. Indeed, flat coil pins 128 within substrate 125 could have been electrically connected to conductor 129 through pins 124 and 126. *Id.* Therefore, Petitioner’s following argument that it would have been obvious for a POSITA to use connection pads on the lateral sides of Zeng-014 fails. *Id.*; Petition at 51-52.

Petitioner’s arguments on Jun regarding limitation of [1c] “a plurality of pins...allocated along lateral sides of the insulation material” fail and do not address

the deficiencies of Zeng-014 described above. Therefore, Zeng-014 alone or Zeng-014 and Jun do not render claims 1-8 and 10-12 unpatentable. Phinney, ¶139.

In short, Petitioner’s analysis of the Zeng-014 and the proposed combination in Grounds 2-3 suffers from multiple defects and should be rejected. Petitioner has failed to demonstrate a reasonable likelihood of prevailing on Grounds 2-3, and institution should be denied. Phinney, ¶140.

D. Ground 4: Petitioner Fails to Establish a Reasonable Likelihood that Park Anticipates Claims 1-3 and 5-8

As illustrated below, Park fails to teach several elements of the claims, and it should be denied. Phinney, ¶141.

1. Park Fails to Teach “a power supply apparatus” of [1pre] and [10pre]

As an initial matter, Petitioner has failed to show that Park teaches a power supply apparatus. The petition points to a composite electronic component 100 that is a combined inductor 120 (red) and capacitor 110 (blue) to satisfy [1pre]. Petition at 57 (citing to Park, ¶68). An inductor and capacitor are passive components, and alone are not a power supply apparatus. Phinney, ¶¶142-143 (citing to Park, ¶¶34, 55, 61, 68).

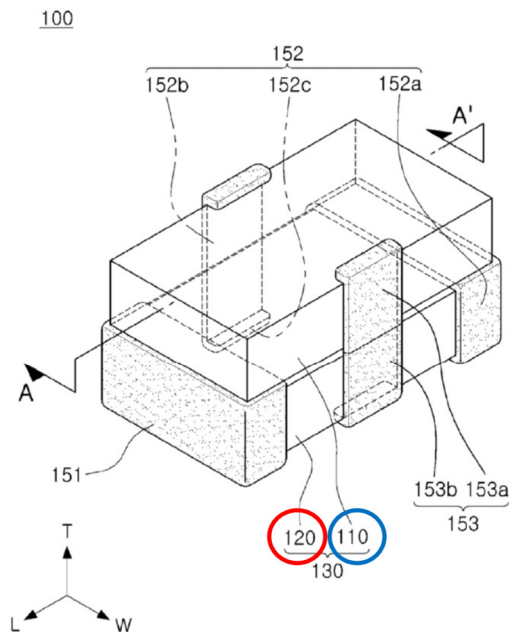


FIG. 1

Annotated Park Fig. 1

Petitioner's other citations to a PMIC (power management integrated circuit) appear to be directed to general background. Petition at 57 (citing Park, ¶5, Fig. 1). Petitioner did not identify any PMIC as satisfying the claims, and only identified the inductor/capacitor pair. This fails to teach [1pre] and substantively similar [10pre]. Phinney, ¶144.

2. Park Fails to Teach “a bearing plate” of [1a] and [10a]

Park does not teach a bearing plate. Phinney, ¶145.

Petitioner presents alternatives 1-3 for satisfying this limitation, namely (1) Inductor 120, (2) combination of substrate 123 and coil 140, and (3) substrate 123.) Each fails. Phinney, ¶146.

1: Petitioner contends that an inductor is a bearing plate. Petition at 58. This is incorrect. An inductor is a component; and components are placed onto bearing plates. Phinney, ¶147. To state that any component can be a bearing plate because it can connect to another component, effectively erases any meaning from “bearing plate.” A term cannot be rendered wholly superfluous. *Stumbo v. Eastman Outdoors, Inc.*, 508 F.3d 1358, 1362 (Fed. Cir. 2007) (denouncing claim constructions which render terms or phrases in claims superfluous).

2: Petitioner’s argument that the substrate 123 and coil 140 together are a bearing plate also fail. A bearing plate needs to be mountable by components (e.g., a PCB). A substrate surrounded by an insulated coil, which is what Park teaches, cannot have any additional components mounted on it. This thusly fails to satisfy [1a]. Phinney, ¶148.

3: Alternatively, Petitioner argues that the substrate 123 is a bearing plate. Petition at 58. Petitioner’s argument breaks down when substrate 123 is analyzed in combination with [1b] and [10b], as explained in §IV.D.3 below. Phinney, ¶149.

Again, an inductor is not a “bearing plate” and to argue it is renders the term “bearing plate” effectively meaningless. *Id.*

As such, Park fails to teach [1a] and [10a] and Ground 4 fails. Phinney, ¶150.

3. Park Fails to Teach “insulation material formed on two opposite surfaces of the bearing plate” of [1b], [10b]

Petitioner’s analysis here fails for many reasons. Phinney, ¶151.

First, the claims require that the “insulation material” be “formed” on opposite surfaces of the bearing plate. Petitioner’s identification of the magnet as an insulator and the substrate 123 (or substrate with coil) as the bearing plate (in its alternative read) is inconsistent with the claim language. Here, the magnet 122 is a device that has the coil wrapped around it (i.e., the substrate 123 with coil); magnet 122 is consequently not formed onto the substrate 123 (or onto the substrate 123 with the coil). Thusly, Petitioner’s alternative read of the substrate 123 / substrate 123 + coil 140 as the bearing plate fails with respect to [1b]. Phinney, ¶152.

Second, Petitioner’s mapping between [1a] and [1b] cannot be reconciled with the claim language “formed on two opposite surfaces of the bearing plate” and the specification. In [1a], Petitioner argues that the inductor 120 is a “bearing plate.” And, for [1b], Petitioner argues that the magnet is the insulating material. As a consequence, Petitioner argues that the magnet (an internal component of the inductor) is a separate insulating material in addition to that inductor. Phinney, ¶153. This effectively vitiates the meaning of separate limitations. *See Stumbo v. Eastman Outdoors, Inc.*, 508 F.3d at 1362.

Park teaches that magnet 122 is an internal component of inductor 120 and even points to the same structure in Fig. 3 below. Park states that an inductor is created by wrapping a coil around a magnetic core. Shown below, the coil 140 (orange) is wrapped around a magnet 122 (blue). *See Park*, ¶90. The coil is on

substrate 123 (green). By wrapping a coil around a magnet, an inductor is formed. Phinney, ¶154. Fig. 3 effectively points to the inductor 120 being made out of the magnet 122. *Id.*

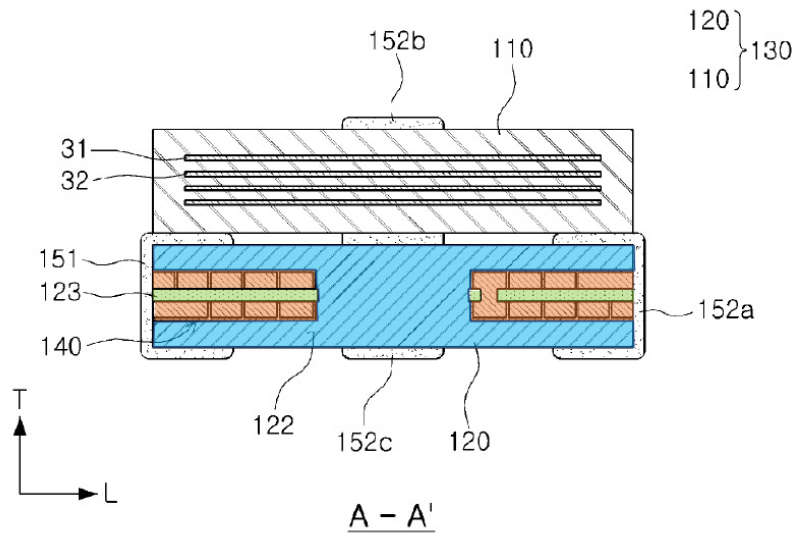


FIG. 3

Annotated Fig. 3 of Park

Moreover, Petitioner's analysis also fails to consider that the inductor already has an insulator. This can be seen below, where the insulator is in purple. Phinney, ¶155. A POSITA would understand that the insulator is provided so that conduction does not occur in other parts (i.e., the magnet). Indeed, in U.S. Pat. App. Pub. No. 2014/0167897 to Choi ("Choi") that was submitted by the same applicant as Park (Samsung Electro Mechanics Co. Ltd.), disclosed an insulator and coil structure in Fig. 2 (annotated and reproduced below). Choi teaches an insulating film 50 formed along circumferences of coils 30. Petitioner relies on the magnet being wholly non-

conductive, but fails to consider that Park has an insulator between the coil and magnet.

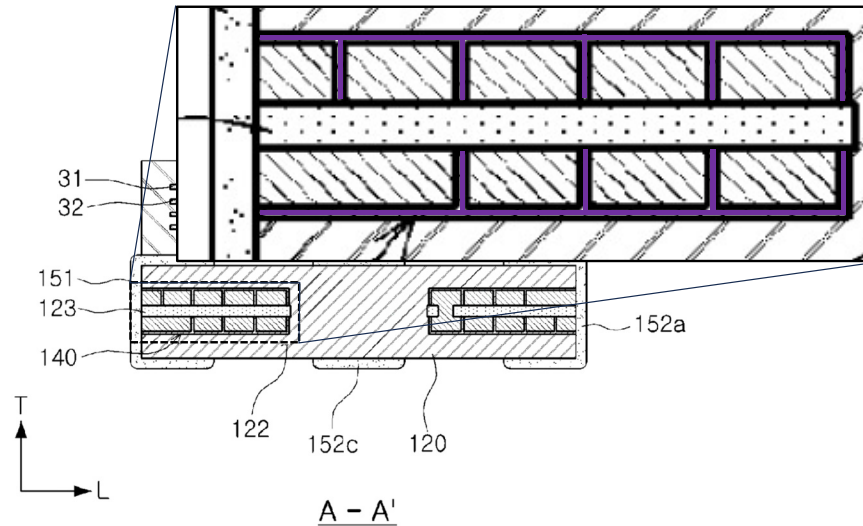


FIG. 3

Annotated and enlarged Park Fig. 3

Ground 4 accordingly fails because Park further fails to teach [1b] and its substantively similar [10b]. Phinney, ¶156.

4. Park Fails to Teach [1c] and [10c]

As described in [1a] analysis, Petitioner presents the substrate 123 as the bearing plate. This reading does not comport with the requirements of [1c] which requires that “a plurality of pins electrically connected to the bearing plate.” Park’s substrate is an insulating substrate (i.e., non-conductive). *See* Park, ¶86. A POSITA would understand that pins cannot electrically connect to an insulator. Petitioner’s read involving the substrate 123 thusly fails. Phinney, ¶¶157-158.

E. Ground 5 Fails to Present a Reasonable Likelihood of Success

Petitioner relies on Park and Jun to remedy perceived deficiencies of Ground 4. Petitioner, however, does not address any of the deficiencies addressed above with respect to each of [1pre], [1a], [1b].⁸ For the same reasons discussed with respect to Park and the additional reasons below, Ground 5 fails. Phinney, ¶¶159-161.

In addition, Ground 5 does not purport to cure any claim 1 deficiencies with Jun. It only addresses dependent claims. This ground's failure however leads towards non-institution because of the numerosity of failed grounds, as explained below. Phinney, ¶162.

Petitioner does argue that a POSITA would have found it obvious to make ferrite magnet 122 to be an insulating material. This, however, fails to cure the deficiencies of Park. Phinney, ¶163. Park fails because the magnet 122, even assuming it is insulation material is not “formed on two opposite surfaces of the bearing plate.” Magnet 122 has the coil 140 and substrate 123 wrapped around it as

⁸ Petitioner does appear to discuss the deficiency of [1c], but its rationale on how [1a] and [1b] are met at a level to understand [1c] is too ambiguous and uncertain to address in this preliminary response, especially when its other limitations are plainly absent.

described in Ground 4, [1b]. It moreover fails when considering the inductor itself as the bearing plate (which Petitioner does in element [1a]) because the magnet 122 is a component of the inductor (and not its insulator).

Finally, Ground 5 fails to present the requisite clarity required. Phinney, ¶164. Petitioner is simply picking-and-choosing random elements, while making only a high-level tie to specific claim language. The lack of clarity here is compounded by the lack of clarity in Ground 4, which this ground inherits most of its arguments from. This is a threshold issue warranting denial of Ground 5. Phinney, ¶165.

Ground 5 fails for the reasons described above. Phinney, ¶166.

F. Ground 6 Fails to Present a Reasonable Likelihood of Success

Ground 6 address substantively similar independent claim 10. Petitioner relies on the same analysis of Park for Ground 4, and its analysis fails for the same reasons described above with respect to each of [1pre], [1a], [1b], [1c]⁹, and [10pre], [10a], [10b], and [10c] have substantively similar limitations. For the same reasons discussed with respect to Park, Ground 6 fails. Phinney, ¶167.

⁹ Like in Ground 5, Petitioner in Ground 6 does appear to discuss the deficiency of [1c], but its rationale on how [1a] and [1b] are met at a level to understand [1c] is too ambiguous and uncertain to address in this preliminary response, especially when it other limitations are plainly absent.

Finally, Ground 6 fails to present the requisite clarity required. Phinney, ¶168. Petitioner is simply picking-and-choosing random elements, while making only a high-level tie to specific claim language and providing back-referencing language. The lack of clarity here is compounded by the lack of clarity in Ground 4, which this ground inherits most of its arguments from. This is a threshold issue warranting denial of Ground 6. Phinney, ¶¶168-169.

Ground 6 fails for the reasons described above. Phinney, ¶170.

G. Ground 7 Fails to Present a Reasonable Likelihood of Success

Petitioner relies on Park and Vinciarelli-218, and relies on Vinciarelli-218's discussion in Ground 1. The Park and Vinciarelli-218 combination fails for similar reasons. Phinney, ¶171.

Here, there is further no motivation to make the suggested combination. Petitioner presumes that a POSITA would have been motivated, looking at Park, to apply entirely different connection structures than those discussed in Vinciarelli-218. Petitioner's combination, however, does not lead to the result it seeks, and is hindsight bias. Park plainly teaches a component, (e.g., a capacitor 110/inductor 120) with separate electrodes. Vinciarelli-218, on the other hand, encapsulates all its components within the encapsulant materials. In a power converter example, the "electronic components may include power transistors, control ICs, and discrete resistors and capacitors." Vinciarelli-218, ¶82, 143, Fig. 27. These components are

mounted on a board and encapsulated. *Id.* Petitioner presents no reasonable motivation to take a component teaching to modify the device. Phinney, ¶172.

A POSITA would not have been motivated to take a component level teaching (of the inductor) and applied it to an entire device to arrive at e.g., the claimed structure of a stacked device. Petitioner is applying hindsight bias. Phinney, ¶173.

Furthermore, Vinciarelli-218 and Park have entirely different manufacturing processes that are incompatible with each other given that one is a panel-molded power-converter assembly and another is a component. A POSITA would not apply Park's conductors to Vinciarelli-218. Phinney, ¶174. Park teaches that its terminals are formed of conductive paste, including conductive metal. *Id.* In Park, the paste must undergo a sintering or curing process to evaporate the solvent and harden the binder. Phinney, ¶175.

Both these processes are incompatible with Vinciarelli-218. Phinney, ¶175-177. Sintering is a high heat process, and it would cause Vinciarelli-218's encapsulant to potentially melt and would most certainly cause any solder connections within the Vinciarelli-218 device to melt. Phinney, ¶176. A POSITA would not expose the Vinciarelli-218 device to high heat to attach pins because it would cause significant damage. *Id.* Curing, on the other hand, is a lower temperature process. *Id.* However, curing causes a significant amount of insulating material to remain in the joint between device and the conductors. *Id.* A POSITA

would not have added this process to Vinciarelli-218 because it would lessen conductivity. *Id.* Vinciarelli-218 provides soldering metal to metal, which is a high conductive device or connection. As a result, a POSITA would not have modified or substituted the device of Vinciarelli-218 with low conductive material when high conductivity is required. *Id.*

Park also discloses that pins can be formed via electroplating. Park, ¶138. Phinney, ¶177. Plating is suitable for smaller scale components with a few surfaces that require metal deposition, such as Park’s inductor, because a larger device like those described in Vinciarelli-218 contains many exposed metal surfaces could include a high number of exposed metal surfaces where plating is not desired. *Id.* The manual application of “stop-offs” is required on every metal surface where plating is not desired. *Id.* Vinciarelli-218 discloses modules that can contain as high as more than 20 exposed interconnects per module. Vinciarelli-218, Fig. 10B; Phinney, ¶177. Therefore, a POSITA would not have been motivated, and in some cases not feasible, to apply electroplating in Vinciarelli-218. Phinney, ¶177.

Moreover, Petitioner contends that a POSITA would have been motivated to modify Vinciarelli-218 to use Park’s electrodes with Vinciarelli-218. Not all electronic components are suitable for being stacked for reasons such as package height constraints and poor heat dissipation. Phinney, ¶178. Indeed, Vinciarelli-218’s modules are restricted by these factors as directed to singulated module having

heatsinks on its top and bottom and a POSITA would not have been motivated to stack Vinciarelli-218's modules. Neither did Petitioner and its expert provide any reason to. Phinney, ¶¶178-179.

Vinciarelli-218's embodiments dissuade a POSITA from looking at Petitioner's proposed combination as Vinciarelli-218's embodiments require heat sink panels, such as flat heat sink surfaces, finned heat sinks, or pinned heat sink. *Vinciarelli-218*, ¶¶82-83, 87-105, 119-123, 128, 131-139, 153-157, Figs. 1, 10, 12, 15-16, 17-26; Phinney, ¶179. Having heat-sinks on the upper surface makes it so that the devices cannot be stacked, and Petitioner's combination defeats the heat dissipation aspect of Vinciarelli-218. Vinciarelli-218 states that "[i]n some applications it may be desirable to use the panel-molding process to produce components, such as power converters, without the flat heat sink surfaces." Vinciarelli-218, ¶159. As explained by Dr. Phinney, however, since heat sinks add considerable thickness to the power converter (e.g., finned heat sink illustrated in Fig. 10A, reproduced below) one of those applications would be reducing the height of the internal components to accommodate encapsulating the power converter in a package having a height restriction. Phinney, ¶179.

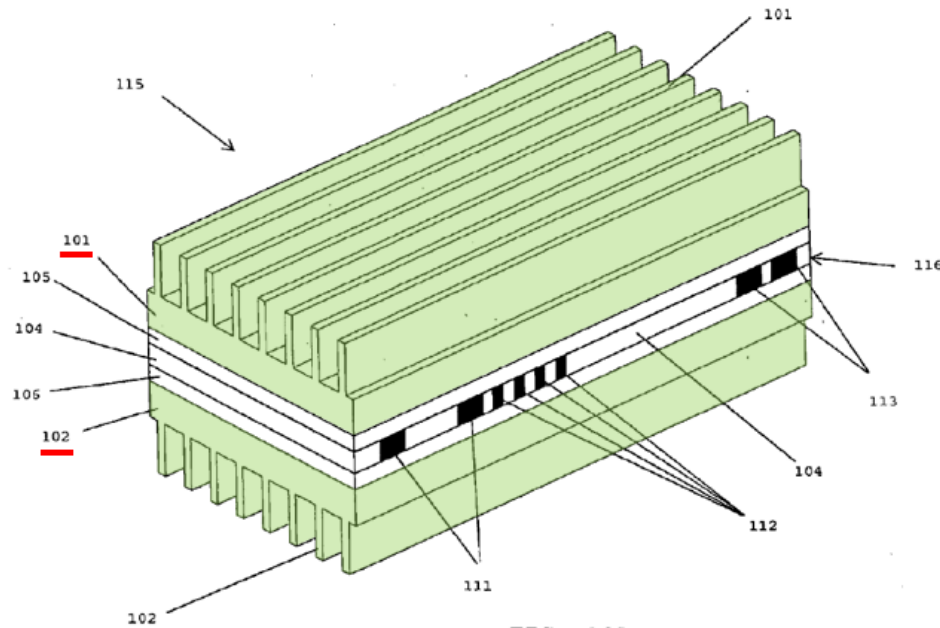


FIG. 10A

Annotated Vinciarelli-218 Fig. 10A

With respect to the heatsink-less modules, Petitioner's suggestion to stack the heatsink-less modules actually defeats its purpose for the proposed combination. Indeed, Vinciarelli-218 discloses that "[a]s internal components are reduced in height, *e.g.* reducing the thickness of the magnetic core, the depth of the interior cavity may be decreased bringing the heat sink panels closer together, reducing the encapsulant thickness and the resulting module thickness." Vinciarelli-218, ¶135. Nowhere does Vinciarelli-218 teach or suggest that its power converters can be stacked. Phinney, ¶180. Petitioner has provided no reason why a POSITA would have been motivated to stack two or more heat-sinkless modules 815 and increase the device height. Doing so would be in direct contradiction to the original purpose

of reducing device height by removing the heat sink. *Id.*

In addition, Dr. Phinney explains that stacking singulated modules 815 would have exacerbated heat dissipation and a POSITA would not have been motivated to do so. Vinciarelli-218 does not state that its heat-sinkless singulated module 815 is modified to produce less heat than the other modules in the heat-sink embodiments. Phinney, ¶181. Rather, removing the heat-sink from singulated module 815 makes it more susceptible to problems caused by poor heat dissipation. *Id.* Stacking additional singulated modules 815 on the existing singulated module 815 would further block air flow (e.g., hot air will be trapped between opposing surfaces of two stacked modules), reduce thermal transmittance, and exacerbate the heat dissipation problem, which in turn leads to poor device performance and even hazardous conditions. *Id.* Therefore, for at least the above reasons, a POSITA would not have been motivated to stack Vinciarelli-218's singulated module 815.

On the other hand, making a stacking device is required by the claims as they recite “two SMD pads of each of the pins are extending to an upper surface and a lower surface of the insulating material, respectively.” ’534 Patent, 21:28-29, 22:12-14. If a POSITA had no motivation to make a stacked device (which it does not as described above), there would be no reason to add an SMD pad on both the top and bottom surfaces of Vinciarelli-218. Phinney, ¶182. Because connections to Vinciarelli-218's device is through its downward terminals, there is no reason to

provide a connection point to the top of Vinciarelli-218's device; to state that there would have been motivation is pure hindsight bias. *See Metalcraft*, 848 F.3d at 1367; Phinney, ¶182.

Petitioner fails to demonstrate that a POSITA would have been prompted to combine the teachings of Vinciarelli-218 and Park to realize a device that achieved all of the features of independent claims 1 and 10. Petitioner's disregard of fundamental differences between Vinciarelli-218 and Park's devices render Ground 7 fatally deficient. For these additional reasons, the Board should find that Petitioner has not demonstrated a reasonable likelihood of prevailing on at least one claim in Ground 7 and institution should be denied. Phinney, ¶¶183-184.

H. Ground 8 Fails to Present a Reasonable Likelihood of Success

Ground 8 restates arguments presented in Ground 7, and fails for the same reasons. Phinney, ¶185.

V. THE BOARD SHOULD EXERCISE ITS DISCRETION TO DENY THE PETITION

The Board should exercise its discretion to deny the Petition under 35 U.S.C. §§ 314(a) and 316(b). Petitioner presented an excessive number of grounds against the '534 Patent, with a large number of grounds being objectively excessive.

Petitioner has presented an excessive number of grounds against the '534 Patent's claims. It filed two Petitions, with an excessive number of challenges per independent claim. IPR2024-00706 provides 8 separate grounds against the

independent claims (with 6 grounds attacking independent claim 1). IPR2024-00715 provides 6 separate grounds against substantially identical independent claim 13. In both Petitions, Petitioner presented the same prior art.

Petitioner rationalized the need for further grounds stating that a different priority date is being used. Petitioner, however, only identifies a single piece of prior art being used in IPR2024-00715 (Vinciarelli-664). Everything else is redundant / cumulative. Indeed, the analysis for IPR2024-00706 and IPR2024-00715 appears substantively copy / pasted.

Finally, a larger percentage of Petitioner's grounds lack merit. For instance, Grounds 4-8 of IPR2024-00706 and Grounds 2-4 of IPR2024-00715 rely on Park, which is an inductor reference. As described herein, Petitioner identifies Park's inductor as being the power supply apparatus, the bearing plate, and the inductor's magnet which is an internal component as the insulating material for the inductor. These grounds lack merit, warranting denial as to the whole of IPR2024-00706 and IPR2024-00715. *See, e.g., Adaptics Ltd. v. Perfect Co.*, Case IPR2018-01596, Paper 20 (March 6, 2019) (stating that the Board can deny rather than institute the entire petition under *SAS Institute* when there are a significant number of excessive grounds that lack merit).

VI. CONCLUSION

For the reasons discussed herein, the Petition should be denied.

Dated: July 10, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT UNDER 37 CFR § 42.24(d)

Under 37 C.F.R. § 42.24(d), the undersigned certifies that the word count for this Patent Owner's Preliminary Response to the Petition for *inter partes* review totals 11,851 excluding the parts exempted by 37 C.F.R. § 42.24(a). The word count was made using the built-in word count function in the Microsoft® Word software used to prepare this document.

Dated: July 10, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that I caused to be served a true and correct copy of the foregoing: PATENT OWNER'S PRELIMINARY RESPONSE and accompanying exhibits by email to the electronic service addresses for Petitioner on the date indicated below:

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