

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VICOR CORPORATION

Petitioner,

v.

DELTA ELECTRONICS, INC.

Patent Owner.

Case No. IPR2024-00705

Patent No. 9,819,263

**DECLARATION OF DR. JOSHUA PHINNEY IN SUPPORT OF
PATENT OWNER'S RESPONSE TO PETITION**

I, Joshua Phinney, do declare as follows:

I. INTRODUCTION

1. I have been retained by Delta Electronics to address issues brought forth in Vicor Corporation's IPR Petition ("IPR2024-00705") against U.S. Pat. No. 9,819,263 (the "'263 Patent").

2. I am being compensated for my time. My compensation is not contingent on any result.

3. I understand that Delta Electronics is submitting my declaration to the PTAB with its patent owner response. In no way should be construed that my not addressing an item is a concession, or that I otherwise bear an opinion on it one way or another by any omission.

II. BACKGROUND AND QUALIFICATIONS

4. I am a Principal Engineer in the Electrical and Semiconductors practice at Exponent, a multidisciplinary science and engineering consulting firm with headquarters at 149 Commonwealth Drive, Menlo Park, California 94025.

5. I received a Ph.D. in Electrical Engineering from the Massachusetts Institute of Technology ("MIT") in 2005. I also earned S.M. and B.S. degrees in Electrical Engineering from MIT and the University of Illinois, Chicago, respectively. My doctoral work centered on the miniaturization of power converters, including voltage regulator modules for application processors and

GPUs. I received my Masters in Electrical Engineering from MIT in 2001, and my Bachelors in Electrical Engineering from University of Illinois, Chicago in 1999. I am the co-inventor on patents for improving the performance of capacitors, EMI filters, and common-mode chokes.

6. For my publications related to both my Master's and Ph.D. thesis, I received the William M. Portnoy Prize Paper Award (2003) and the IEEE Power Electronics Society Transactions Prize Paper Award (2004).

7. After earning my Ph.D., I joined Exponent and have led technical investigations pertaining to power systems, industrial electronics, portable electronic devices, microcomputers, and electromechanical devices. My job functions include analyzing hardware and software of these devices to understand their modes of failure, and testifying regarding these devices in legal matters involving patents and trade secrets.

8. I have testified regarding internal circuitry, physical embodiments, and software-defined features, of electronic equipment. Regarding circuitry, I have testified regarding the power electronics and communication circuitry in microcomputers, portable electronic devices, peripherals, and machine controllers. In particular, I have testified regarding power-sequencing and power-on behavior of laptop computers, desktop computers, rack-mounted servers, and mobile terminals. In addition, I have testified regarding power management in computers

and portable electronic devices, including the historical state of the art in power management between 1990 to 2020.

9. Regarding the mechanical elements of electronic equipment, I have testified regarding buttons and touch interfaces, connectors, linear and rotary actuators, position-measuring devices, and the design and construction of modular housings for computerized equipment and peripherals. In particular, I have testified regarding user interfaces (including buttons, indicators, touch interfaces and card readers) as they are constructed in relation the housing and underlying electronic assemblies, including PCBs, flex printed circuits, and other connector assemblies within the housing of electronic equipment. I have also conducted design reviews and performed failure analysis of printed circuit boards (“PCBs”).

10. I have laid out multilayer PCBs, including multilayer PCBs with controlled impedance, and worked directly with PCB fabricators to ensure performance and yield.

11. Additional details about my employment history, fields of expertise, publications, and testimony are further described in my curriculum vitae, which is attached as Exhibit A.

III. MATERIALS REVIEWED

12. My opinions expressed in this declaration are based on my education, knowledge and experience with power electronics and communication circuitry, as

well as review of documents and materials identified in this declaration, including the '263 Patent, the prior art references and background materials discussed in this declaration, and the other references specifically identified in this declaration. I have considered these materials in their entirety, even if only portions are discussed here. The following is an exemplary list of the materials on which I based on opinion:

- the U.S. 9,819,263 (“’263 patent”) (VICOR-1001);
- the file history of the ’263 patent (VICOR-1002);
- the declaration and curriculum vitae of Dr. R. Jacob Baker, Ph.D., P.E. (VICOR-1003);
- U.S. Patent No. 10,264,664 to Vinciarelli et al. (“Vinciarelli-664”) (VICOR-1005);
- U.S. Patent No. 8,427,269 to Vinciarelli et al. (“Vinciarelli-269”) (VICOR-1006);
- U.S. Patent No. 7,361,844 to Vinciarelli et al. (“Vinciarelli-844”) (VICOR-1007);
- U.S. Patent No. Patent Application Publication No. 2009/0175014 to Zeng et al. (“Zeng-014”) (VICOR-1008);
- U.S. Patent Application Publication No. 2014/0355218 to Vinciarelli et al. (“Vinciarelli-218”) (VICOR-1009);
- U.S. Patent No. 8,966,747 to Vinciarelli et al. (“Vinciarelli-747”); and
- The Petition and the Board’s institution decision.

and any other material I refer to in this declaration in support of my opinions.

13. I may also consider additional documents and information in forming any necessary opinions — including documents that may not yet have been provided to me. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided.

14. This declaration represents only those opinions I have formed to date.

IV. LEVEL OF ORDINARY SKILL IN THE ART

15. The '263 Patent identifies the relevant field of art as follows: “[t]he present disclosure relates to a power converting technology, and more particularly, to a power converter and a method for manufacturing the same.” ’260 Patent, 1:13-

15. The '263 Patent claims priority to CN 2015/10648280 which was filed on October 9, 2015. My opinion remains the same if an earlier date were applied (or a later date of the U.S. filing of October 5, 2016).

16. Based on that description of the field of art, my experience, and the information I have reviewed for purposes of this proceeding, I believe a person of ordinary skill in the art (“POSITA”) in October 9, 2015 would have had a Bachelor’s degree in electrical engineering, or a related field, and one to two years of experience with the design or implementation of integrated power converters or packaging, 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.

17. My level of skill in the art as of October 9, 2015 was at least that of a POSITA. I am qualified to provide opinions concerning what a POSITA would have known and understood at that time, and my analysis and conclusions herein are from the perspective of a POSITA as of that date.

V. RELEVANT LEGAL STANDARDS

18. I am informed by attorneys from Perkins Coie of the relevant legal principles related to patent validity, and hereby describe my understanding of the legal principles and how I apply them in my analysis.

A. Claim Construction

19. I understand that claim terms are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art at the time of the invention when read in the context of the specification and prosecution history unless a patentee sets out a different definition or clearly disavows claim scope.

20. I further understand that extrinsic evidence such as expert or inventor testimony, dictionaries, and learned treatises can help determine the meaning of claim terms, although that evidence is less significant than the claims, specification, and prosecution history.

B. Anticipation

21. I understand that anticipation under 35 U.S.C. §102, a single asserted prior art reference must disclose all of the claim limitations as arranged or combined in the claim, either explicitly or inherently to a person of ordinary skill in the art. I also understand that in order for a reference to inherently disclose a claim limitation, that claim limitation must necessarily be present in the reference and may not be established by probabilities or possibilities.

22. I understand that different embodiments and references cannot be combined to anticipate. Additionally, I understand that for a reference to be an anticipating reference, it must describe the claimed subject matter with sufficient clarity to establish that the subject matter existed and that its existence was recognized by persons of ordinary skills in the field of the invention.

C. Obviousness

23. I understand that even if a patent claim is not anticipated, the claim is invalid if it claims an aspect of an invention that would be obvious to a POSITA at the time of the alleged invention. Specifically, I understand that if the differences between the asserted claim and a single prior art reference or a combination of prior art references are such that the subject matter as a whole would have been obvious to a POSITA at the time the invention was made, a patent may be invalid for “obviousness.”

24. I understand that an obviousness evaluation can be made by using a single reference or by combining several prior art references. For example, a single reference, when considered in view of the knowledge of a POSITA, could render a claim obvious.

25. I also understand and have been informed by counsel that a determination of obviousness is made after weighing the following factors: (1) level of ordinary skill in the pertinent art; (2) the scope and content of the prior art; (3) the differences between the prior art as a whole and the claim at issue; and (4) as appropriate, secondary considerations of non-obviousness.

26. In evaluating obviousness, both the prior art and the claimed invention should be viewed through the knowledge and understanding of a POSITA at the time of the invention—*hindsight* should not be used to decide whether a claim is obvious. In particular, it is my understanding that to render a patent claim invalid as being obvious from a combination of references, *indication* should be given as a whole to suggest the motivation, desirability and thus the obviousness, of making the proposed combination in a way that would produce the patented invention.

27. I understand that an explicit teaching, suggestion, or motivation to combine prior art references is not required. I also understand that an obviousness analysis involving two or more references generally must account for a *reason* why a POSITA would have made a particular combination and that there would

have been a reasonable expectation of success. I understand that the POSITA's common sense or ordinary creativity can be used by itself as a motivation for combining references. I understand that a particular combination of prior art references can be made by merely showing that it was obvious to try the combination. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, common sense may be a good reason for a POSITA to pursue known options.

28. I am informed and understand that a patent claim composed of several elements is not proven obvious merely by demonstrating that each of its elements was, *independently*, known in the prior art. When combining multiple prior art reference or elements to argue the combination is obvious, I understand that I should consider whether there is an "apparent reason" or *motivation* to combine the prior art references or elements in the way the patent claims.

29. I am informed and understand that when the prior art "*teaches away*" from combining prior art references or certain elements, discovery of a successful means of combining them is more likely to be nonobvious. A prior art reference may be said to "teach away" from a patent when a person of ordinary skill in the art, upon reading the reference, would be *discouraged* from the path set out in the patent or would be led in a direction divergent from the path that was taken by the patent. Additionally, a prior art reference may "teach away" from a claimed

invention when substituting an element within that prior art reference for a claim element would render the claimed invention *inoperable*.

30. I am informed and further understand that to ascertain the scope and content of the prior art, it is necessary to first examine the field of the inventor's endeavor and the particular *problem* for which the invention was made. The relevant prior art includes prior art in the field of the invention, and also prior art from other fields that a person of ordinary skill in the art would look to when attempting to solve the problem.

31. In evaluating obviousness, I understand that one must look at the claimed subject matter as a whole and through the eyes of a POSITA at the time the invention was made. In other words, when determining obviousness, one considers the perspective of a hypothetical POSITA. I further understand that the asserted claims of the patent should be read from the point of view of a POSITA at the time the claimed invention was made. To evaluate whether a patent claim would have been obvious, I understand that one may analyze the interrelated teachings of multiple prior art references.

32. I further understand that it is assumed a hypothetical POSITA knows and has all relevant prior art in the field of endeavor covered by the asserted patent and all analogous prior art. I understand that the POSITA must interpret the references for what they teach based on the skill level of that person. A POSITA is

not necessarily an expert, and the question is what the POSITA would think, not what someone who's an expert in the field would think.

33. I understand that at least the following rationales may support a finding of obviousness: (1) combining prior art elements according to known methods to yield predictable results; (2) simple substitution of one known element for another to obtain predictable results; (3) use of a known technique to improve similar devices (methods, or products) in the same way; (4) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (5) “obvious to try”—choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (6) a predictable variation of work in the same or a different field of endeavor if a POSITA would be able to implement the variation; (7) there existed a known problem for which there was an obvious solution encompassed by the patent's claims at the time of the claimed invention; (8) known work in one field may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to a POSITA; and (9) some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

34. I also understand that evidence of so-called “objective indicia” or “secondary considerations” should be considered when determining whether an asserted claim would have been obvious. “Objective indicia” include: (1) commercial success attributable to the invention; (2) long-felt but unsolved need for the invention; (3) failure of others; (4) skepticism by experts; (5) praise by others; (6) teaching away by others; (7) recognition of a problem which the claimed invention addresses; (8) copying by others; and (9) unexpected results. But these secondary considerations only apply if there is a “nexus” between the asserted secondary consideration and claimed invention, and the secondary considerations cannot be due to extraneous factors, such as marketing or unclaimed features of an embodiment of the invention.

35. I also understand that if others having ordinary skill in the field independently made the claimed invention at about the same time the inventor made the invention, often referred to as “simultaneous invention,” this can be an indication of obviousness. I understand that simultaneous invention can be persuasive evidence that the claimed apparatus or method was merely the product of ordinary engineering skill. I understand that invention even within a year can be considered a comparatively short time.

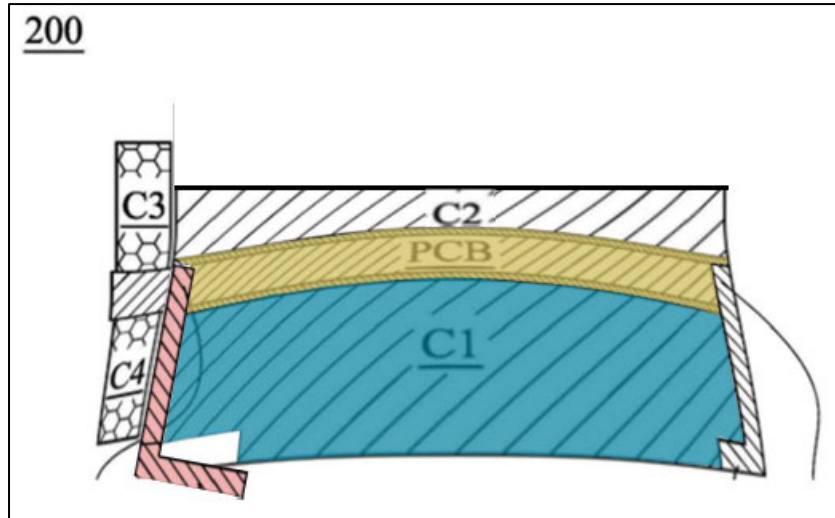
VI. OVERVIEW OF THE '263 PATENT

36. I have reviewed and analyzed the '263 Patent. This section outlines my opinion as to the technical inventions captured and claimed in the '263 Patent.

37. The '263 Patent is directed to improvements in the design and manufacture of power converters. *See generally* '263 Patent.

38. The '263 Patent identifies the concepts of efficiency and power density, which are two key metrics in the field of power converter design. *See* '263 Patent at 1:17-25. The optimization of these key metrics is a challenge in this field. Another challenge in this field is structural integrity and durability of a power converter, particularly with respect to mitigating mechanical stress within a power converter. It is commonly known that the converter heats up during operation, which causes warping of the printed circuit board (PCB) within a power converter. Stress is a result of the warping of the PCB.

39. Generally, warping can cause uneven stresses and releases throughout a converter's body, which can lead to electrical connection failures. Below I have demonstrated an example of electrical connection failure occurring due to warping and stress in the modified version of FIG. 2 of the '263 Patent. I include this modified version of FIG. 2 only for demonstrative purposes, and do not suggest that the power converter illustrated in FIG. 2 would actually warp as shown, or warp at all.



40. Optimizing a power converter design for structural integrity (*i.e.*, mitigating warping and stress), however, will sacrifice one or both of the two metrics of efficiency and power density. For example, a thicker PCB is less likely to warp, or may warp to a lesser degree. But manufacturing of the thicker PCB is more costly, and good power density or efficiency would be sacrificed. The thicker PCB occupies space within the power converter that could otherwise be used for components. It also requires larger room for fitting power converters in electronic devices such as servers. The counterexample is a very thin PCB that maximizes power density and efficiency. Larger space of the power converter would be composed of components that deliver the power converting functionality. Room can be saved for stacking power converters in electronic devices. However, the thinner PCB would be more susceptible to warping and stress.

41. Simultaneously controlling both warping/stress mitigation and power density is addressed by disposing carriers at $1/3$ to $2/3$ of a height of the power converter. *See, e.g.,* '263 Patent at 5:3-22, 5:43-59.

42. This height range within the power converter necessarily determines a ratio of thicknesses of upper components and lower components. In effect, the '263 Patent discloses requirements that the height or thickness of upper components "is not greater than twice" that of the lower components, and *vice versa*. *Id.* The $1/3$ to $2/3$ height range for the carrier defines carrier thickness and component thickness ratios, in consideration of structural integrity and power density factors. A precise location of the carrier can also be derived from those two relations; a carrier that is not disposed at the $1/3$ to $2/3$ height range would likely suffer from less optimized power density or less optimized structural integrity. For example, a carrier that extends below the $1/3$ to $2/3$ height range (*i.e.*, into the bottom third of the power converter) would result in either one or both of: (i) the upper components being more than twice the thickness of the lower components (meaning more susceptibility to warping/stress), or (ii) the carrier being thicker than a third of the power converter (meaning less power density).

VII. CLAIM CONSTRUCTION

43. As noted above, I understand that claim terms are generally given their ordinary and customary meaning as understood by a person of ordinary skill

in the art at the time of the invention. Extrinsic evidence such as expert or inventor testimony, dictionaries, and learned treatises can help determine the meaning of claim terms, although that evidence is less significant than intrinsic evidence including the claims, specification, and prosecution history.

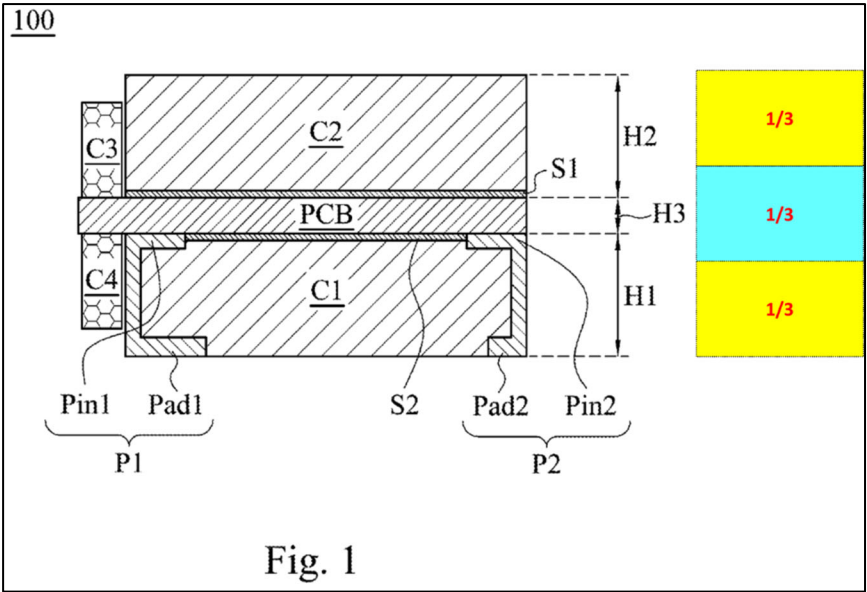
44. I have been asked to provide construction for [1g] and [1f] below.

A. Limitation [1f]: “wherein the carrier is disposed at 1/3 to 2/3 of a height of the power converter”

45. Limitation [1f] should be construed to describe the carrier’s location to be at 1/3 to 2/3 of the height of the power converter, not that only a portion of the carrier is located at 1/3 to 2/3 of the power converter’s height.

46. This is supported by both the claim language and specification. The claims define the carrier’s exact location without qualifier: “the carrier is disposed at 1/3 to 2/3 of a height of the power converter.”

47. Further, the specification depicts the carrier’s location at 1/3 to 2/3 of the height of the power converter. (’263 Patent at FIGS. 1- 13, 15-23, 11:14-18.) FIG. 1 shows where the carrier has a thickness H3 that is at 1/3 to 2/3 of the height of the power converter. (*Id.* at 5:14-18; see also *id.* at 5:54-57 (“the second height H2 is not greater than twice the first height H1, or the first height H1 is not greater than twice the second height H2”).) All other embodiments consistently describe the same.



48. It is incorrect as Petitioner does to apply the phrase to mean that only a portion of the carrier need be within the middle 1/3rd region. (Pet. at 31, 78 (arguing that the carrier need only be in the middle).) This interpretation would provide for a wide array of carrier positions that are out of line with the specification to cover examples where the carrier encompasses nearly 100% of the device, or is in the bottom 1/3rd portion of the device. A few examples of this incorrect interpretation are shown below, with the yellow portions depicting a component and the aqua components depicting the carrier. Such an application renders [1f] meaningless.

		1/3	
		1/3	
		1/3	

B. Limitation [1g]: “wherein the first connection part is fabricated by mechanical support of the first electronic component.”

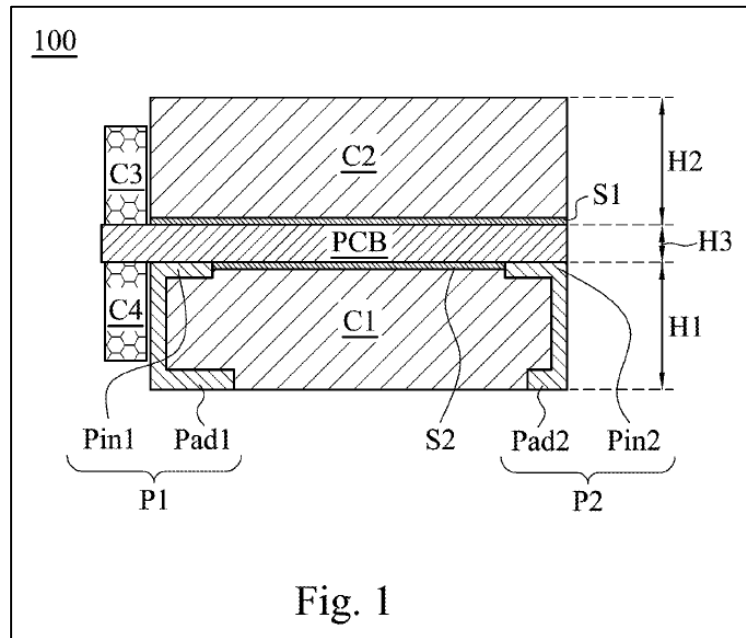
49. The proper construction of [1g] - “wherein the first connection part is fabricated by mechanical support of the first electronic component” - is its plain meaning, as understood by POSITAs.

50. I note that the Board found structure and stated that “claim 1 requires a structure in which the first connection part comprises a first terminal at one end coupled to a surface of a carrier such as a circuit board, and a second terminal at the other end attached to a surface of the first component, such that the first connection part has mechanical support of the first electronic component.” (Paper 11 at 10.) This is consistent with the claims.

51. I am informed that claims directed to products and devices are by default interpreted in their structural sense. I am informed that claim language is interpreted as product-by-process only if that language does not describe structure. As detailed below, it is my opinion that [1g] imparts structure and thus should be construed by its plain meaning, and not as product-by-process.

52. Limitation [1g] describes structure, finding its support from the specification of the '263 Patent. This structure is exemplified by various figures in the '263 Patent (as *opposed to process* or flowchart figures). FIG. 1 (reproduced below), for example, shows connection parts P1/P2 that are “fabricated by mechanical support of the first electronic component [C1].” FIG. 1 is consistent

with the texts in the specification, depicting component C1 is connected with parts P1/P2.



53. As another exemplary embodiment for this term, the '263 Patent discloses “curving the connection part by mechanical support of the first electronic component to fix the connection part at the first electronic component.” ’263 Patent at 10:48-50. This example further explains the connection part can be curved to be affixed to the first electronic component. Physical attachment between objects, such as fixtures, is structure. A POSITA would understand that “wherein the first connection part is fabricated by mechanical support of the first electronic component” conveys structure, under its plain and ordinary meaning, which is consistent with the '263 Patent specification.

VIII. ANALYSIS OF PETITIONER’S GROUNDS

A. Grounds 1A-1C (Vinciarelli-664, solely or primarily)

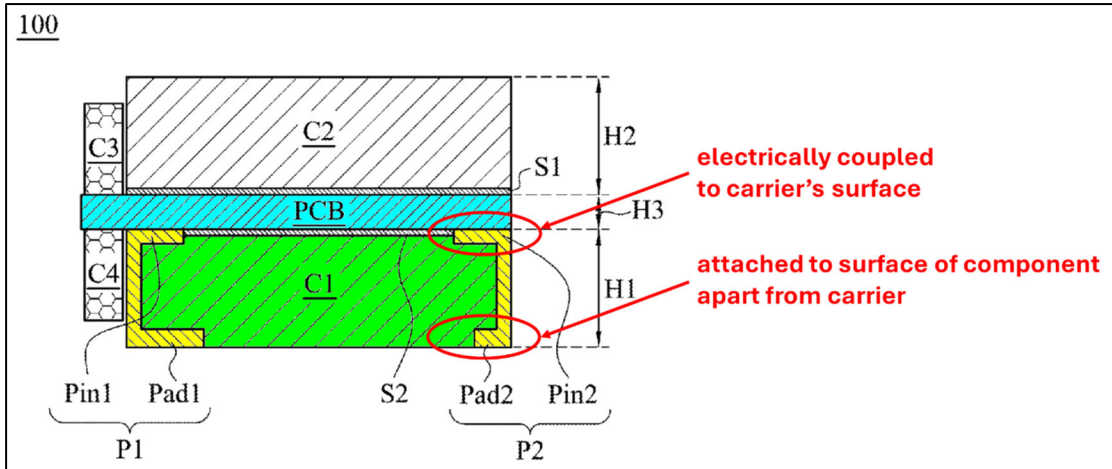
a. Ground 1A: Claim 1’s Features are Not Disclosed

a. Ground 1A, [1c], [1d], [1e], [1g]: Vinciarelli-664 does not teach the “connection part” with all limitations of [1c], [1d], [1e], [1g]

54. Petitioner has failed to demonstrate that Vinciarelli-664 anticipates the connection part’s elements described in [1d], [1e], and [1g]. The “connection part” of [1c] has several requirements:

- [1d]: “a first terminal electrically coupled to the upper surface or the lower surface of the carrier”
- [1e] “a second terminal attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a bonding pad”
- [1g] “wherein the first connection part is fabricated by mechanical support of the first electronic component.”

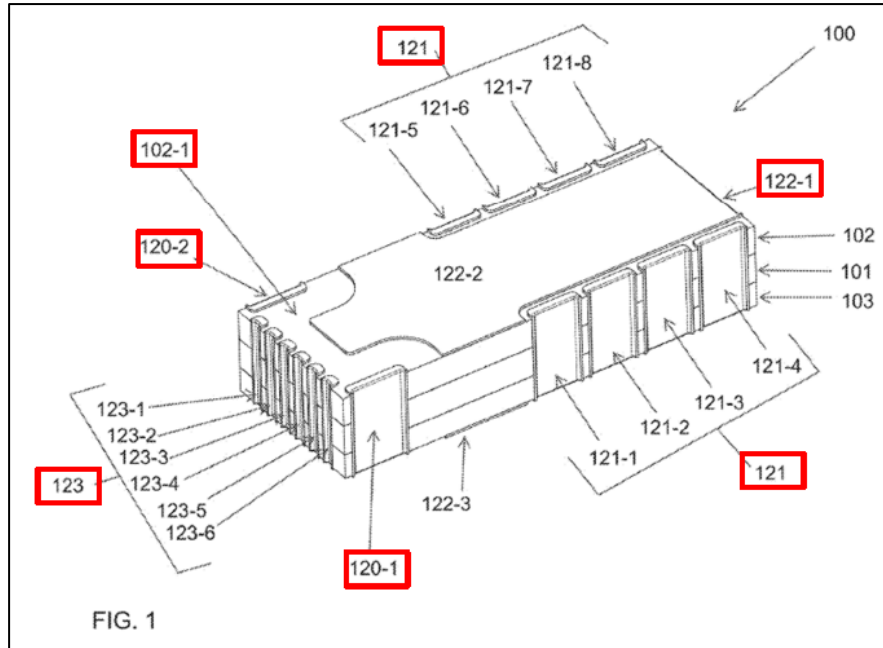
55. The connection part is illustrated in FIG. 1. The pin (yellow) has two terminals (red) with one terminal coupled to the carrier’s (aqua) surface and the other on the opposite side of the carrier on the component C1 (green). (See [1d] and [1e].) The “connection part” has structure where it is supported by the component C1. ([1g].)



i. Vinciarelli-664 does not teach the connection part's two terminals of [1d] and [1e].

56. Ground 1A fails to demonstrate that [1d] and [1e] are anticipated by Vinciarelli-664.

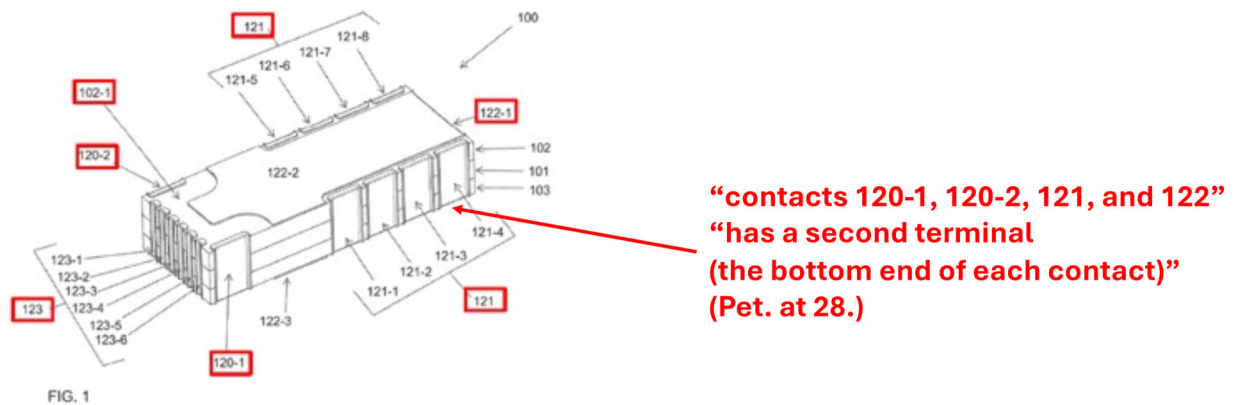
57. Ground 1A alleges that the power converter's contacts 120-1, 120-2, 121, and 122-1 teach the "connection part" of [1c]. (Pet. at 21.) This fails to demonstrate that Vinciarelli-664 anticipates the connection part's two terminals as required by [1d] and [1e]. (See generally Paper 11 at 16-18 (holding that the Petition failed to present a reasonable likelihood for these limitations).)



58. First, in my opinion the Petition fails to illustrate [1d]’s “first terminal” that is “electrically coupled to the upper surface or the lower surface of the carrier” via failure to identify. I note that the Board stated that the Petition is devoid of any identification of the “first terminal” in Vinciarelli-664. (Paper 11 at 18 (“Petitioner does not point to any portion of Vinciarelli-664 for disclosure of such terminals”).) “Terminal” is mentioned only in reference to “contacts 120-1, 120-2, 121, and 122.” (Pet. at 22.) The remainder of the analysis of [1d] does not mention the “terminal” again and does not mention where on those “contacts 120-1, 120-2, 121, and 122” the first terminal exists. (Pet. at 22-23.)

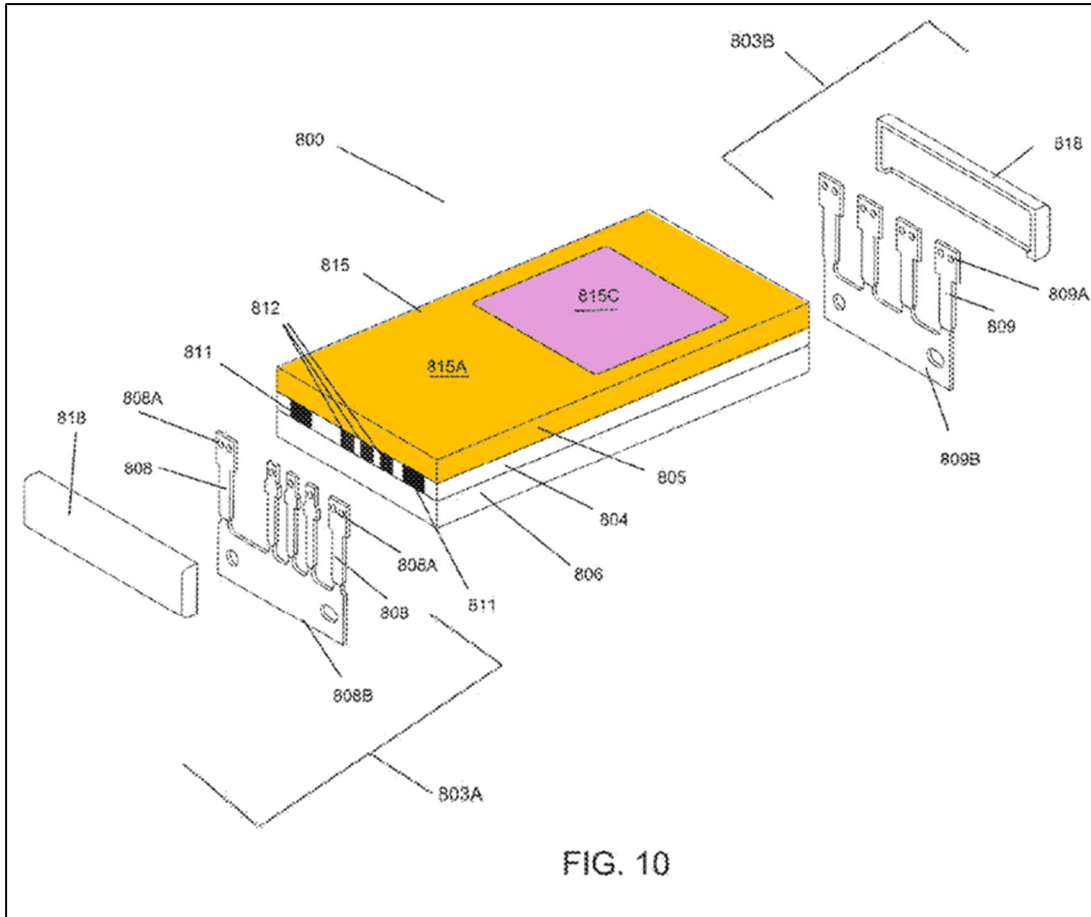
59. Second, in my opinion the Petition fails to demonstrate that the “second terminal” is “attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a

bonding pad” as required by the claims. Petitioner argues that the “second terminal” is on “the bottom end of each contact” of “contacts 120-1, 120-2, 121, and 122” and continues that Vinciarelli-664 teaches an “‘exposed core’ transformer[]” that is the “exemplary electronic component.” (Pet. at 28.)

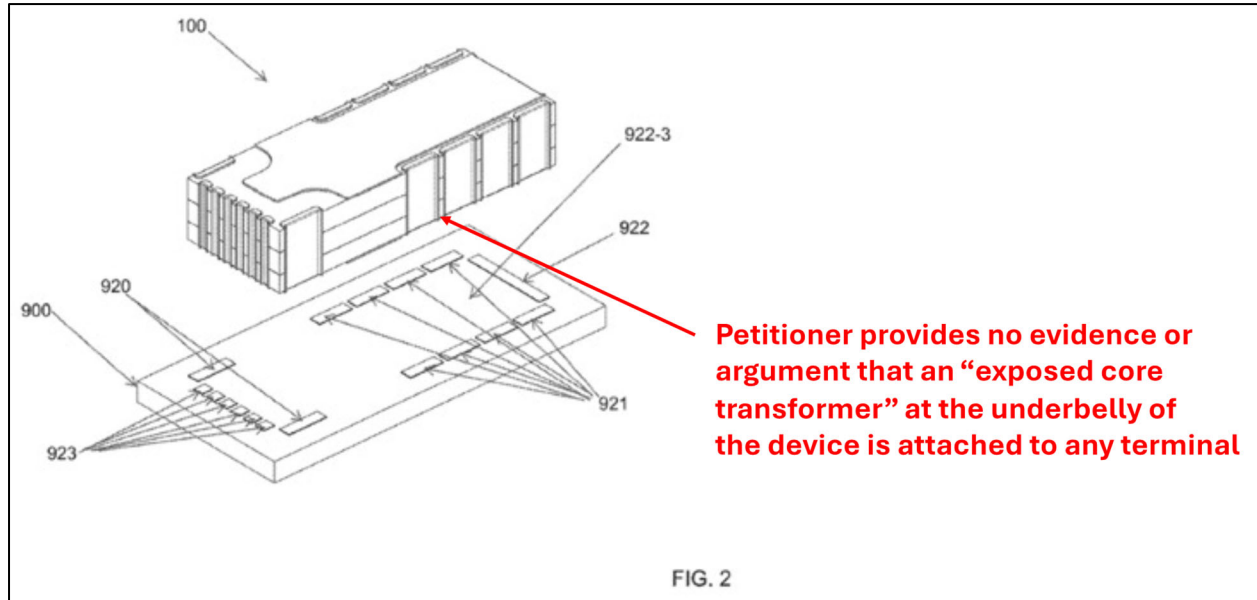


60. This fails to teach “attached to a surface of the first electronic component apart from the carrier, wherein the second terminal of the first connection part is a bonding pad” as be required by [1e].

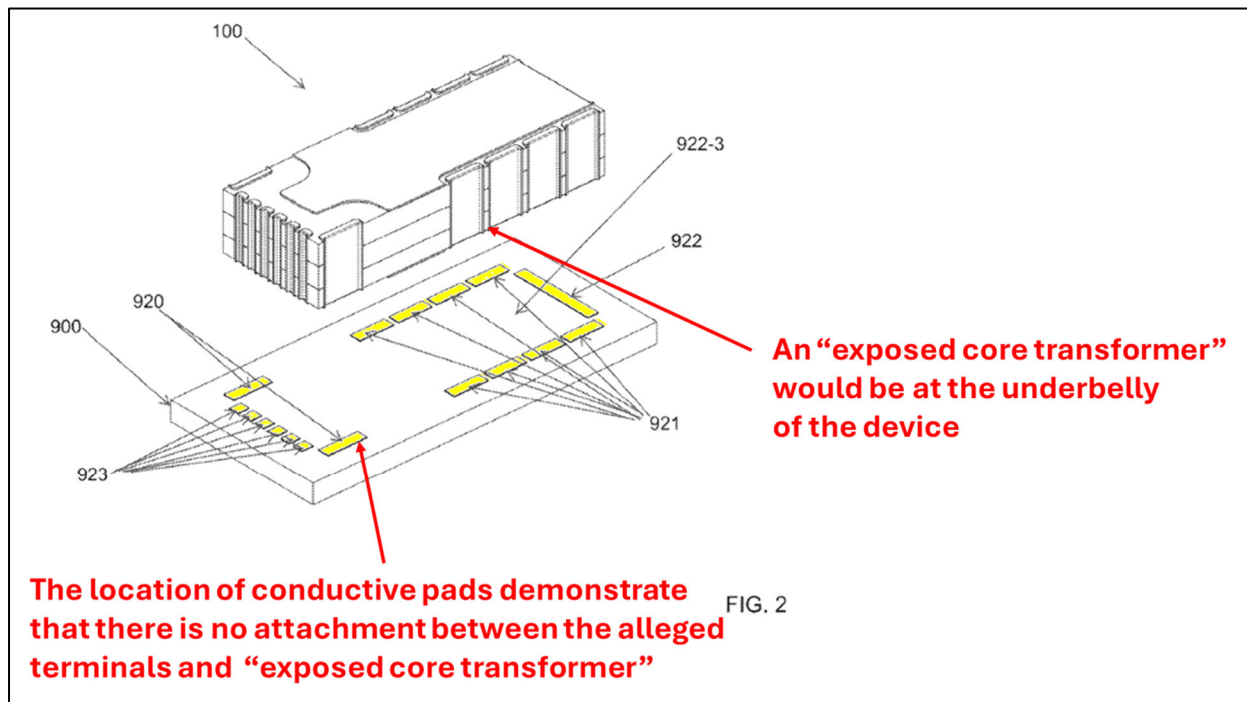
61. As argued by Petitioner, the exposed core transformer is at “the same level as the surrounding encapsulant.” (Pet. at 28.) Petitioner provides no illustration in its relied-upon embodiment, but FIG. 10 provides a depiction with an exposed magnetic core 815C (lavender) surrounded by encapsulant 815A (orange). (EX1005 at 7:13-22.) As can be seen from the below, the exposed core is relatively centrally located and surrounded by encapsulant.



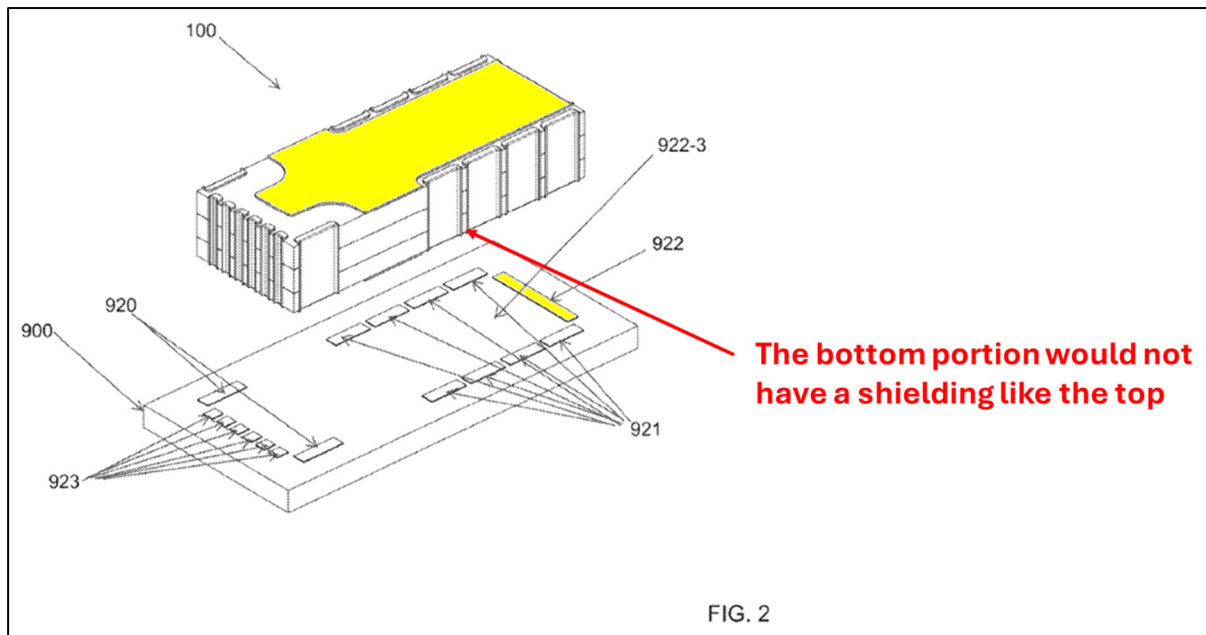
62. Translating the above demonstrative to Petitioner’s allegations surrounding Vinciarelli-664’s FIG. 2, the central portion of the underbelly of the module 100 would presumably have an exposed core. Petitioner, however, provides no argument or evidence that this exposed core transformer’s exposed surface is attached to the bottom end of any of “contacts 120-1, 120-2, 121, and 122.” (See generally Pet. at 28-31.)



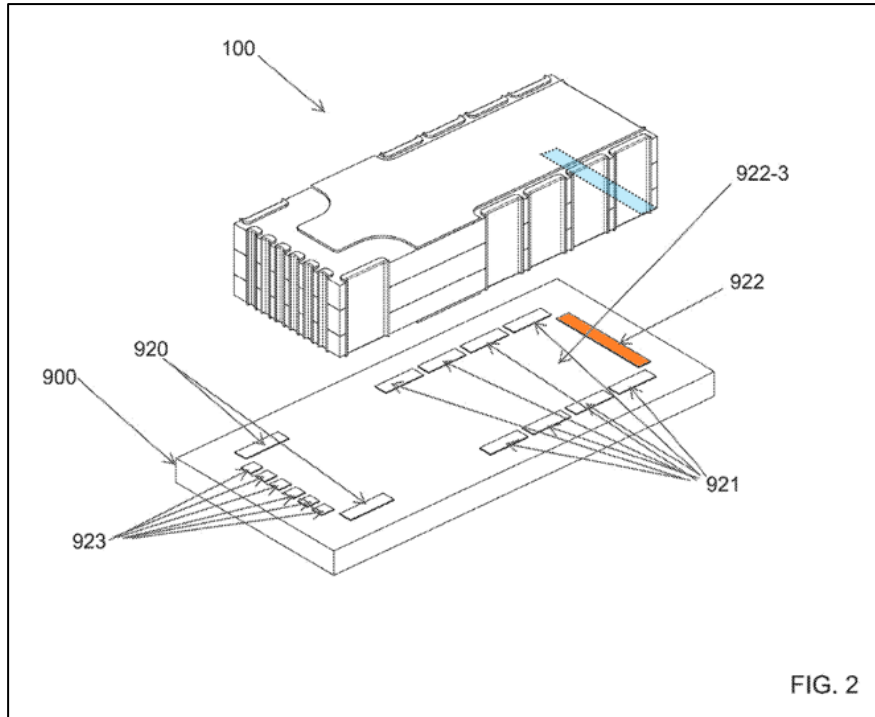
63. Further, none of Vinciarelli-664’s conductive pads extend to the central portions of the module 100, indicating that there is a lack of attachment to any presumed exposed core on the device’s bottom surface.



64. In attempts to remedy this, Petitioner argues that “the bottom common contact would be comparable in size to the top contact.” (Pet. at 29.) This is incorrect. The location of the solder pad 922 (yellow) illustrates that contact 122-1 (also yellow) would not extend across the bottom surface. If contact 122-1 extended as Petitioner alleges, the reflow of solder would cause solder to extend beyond the solder pad 922 which would cause damage to the Board and potential issues with connectivity.



65. Instead, if anything, a POSITA would have understood the bottom shield/contact 122-3 to be shaped as demonstrated (in blue) in the annotated version of Vinciarelli-664’s FIG. 2.



66. Petitioner’s argument that a POSITA would have had contact 122-1 extend across the bottom surface is not literally taught by Vinciarelli-664. If anything, this represents a modification to the literal teachings of Vinciarelli-664 which, to my understanding, is not a proper analysis under anticipation. As a consequence, the alleged “second terminal” is not “attached to a surface of the first electronic component apart from the carrier” as required by [1e].

67. Ground 1A fails to show that “second terminal of the first connection part is a bonding pad” as required by [1e]. As noted immediately above in FIG. 10, any “exposed magnetic core” would be centrally located in the encapsulant. There is plainly no bonding bad there.

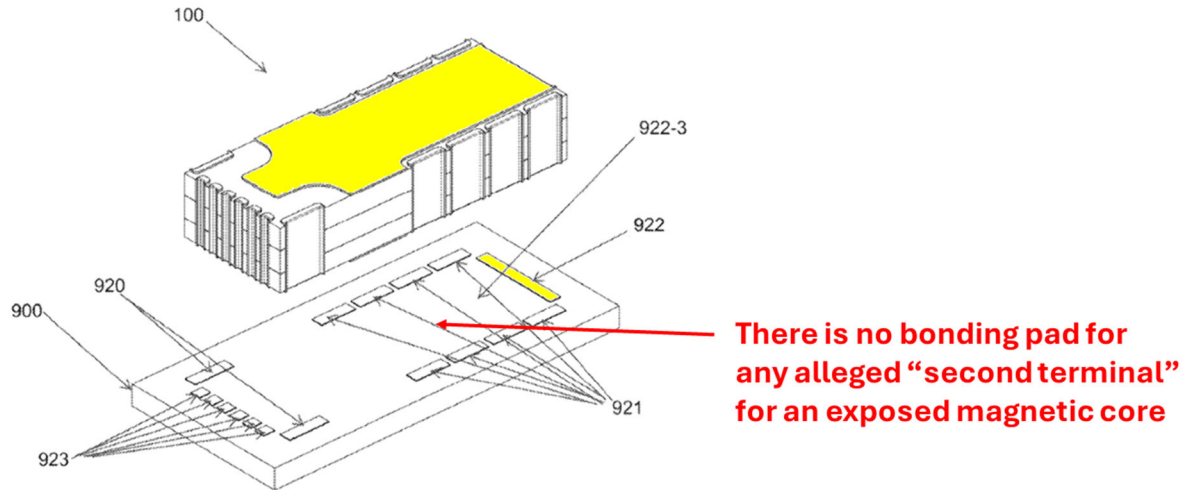


FIG. 2

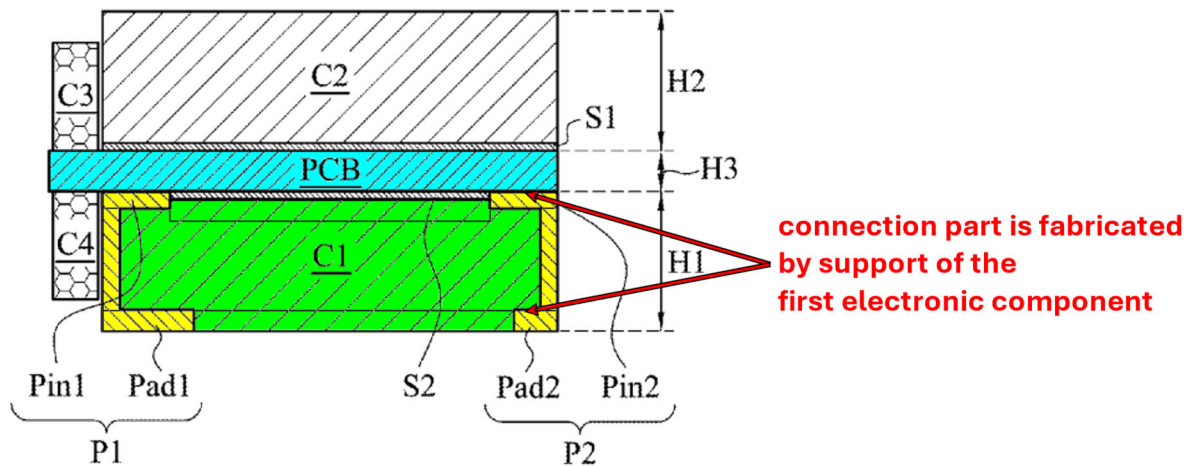
68. The Petition thus fails to demonstrate that Vinciarelli-664 anticipates [1d] and [1e].

69. The Board further found that the Petition failed with respect to this limitation. (*See also* Paper 11 at 19 (“[C]laim 1 requires the ‘first connection part’ to comprise a terminal electrically coupled a surface of the carrier on one end and a terminal at another end apart therefrom attached to a surface of the first electronic component. Ex. 1001, 15:31–37. Because Petitioner relies on Vinciarelli-664’s contacts 120-1, 120-2, 121, and 122 as the ‘first connection part’ but does not identify any terminal on the contacts, let alone one coupled to a surface of a carrier and another on the same contact but apart from the carrier that is attached to a surface of an electronic component.”).)

ii. Petitioner failed to show that Vinciarelli-664 teaches the connection part’s limitations of [1g]

70. In my opinion Ground 1A fails to demonstrate the “connection part” [1c] “wherein the first connection part is fabricated by mechanical support of the first electronic component” of [1g].

71. The Petition ignores the parts of the “connection part” described in [1d]-[1e] when analyzing [1g]. Claim 1 requires a “structure in which the first connection part comprises a first terminal at one end coupled to a surface of a carrier such as a circuit board, and a second terminal at the other end attached to a surface of the first component, such that the first connection part has mechanical support of the first electronic component.” (Paper 11 at 10 (describing the limitations of the connection part).) As shown in the ’263 Patent specification, the connection part P1 (annotated yellow, below) “is curved by mechanical support of the first electronic component” (green). (’263 Patent at 11:2-4.) This is so “the connection parts P1 and P2 themselves can be determined according to electrical requirements without additionally considering their mechanical strengths and mounting requirements.” (*Id.* at 5:29-32.) Petitioner has not shown that Vinciarelli-664 anticipates [1g].

100

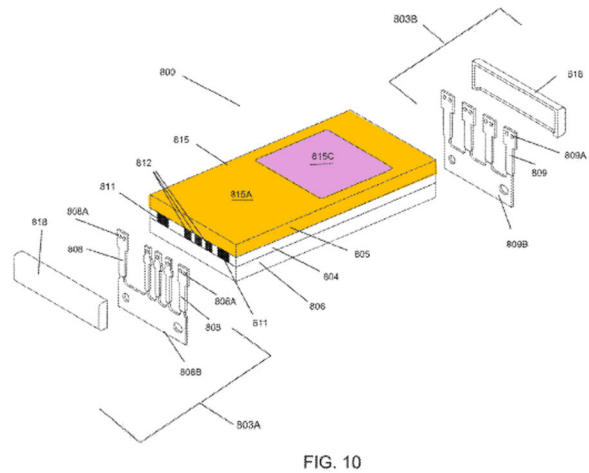
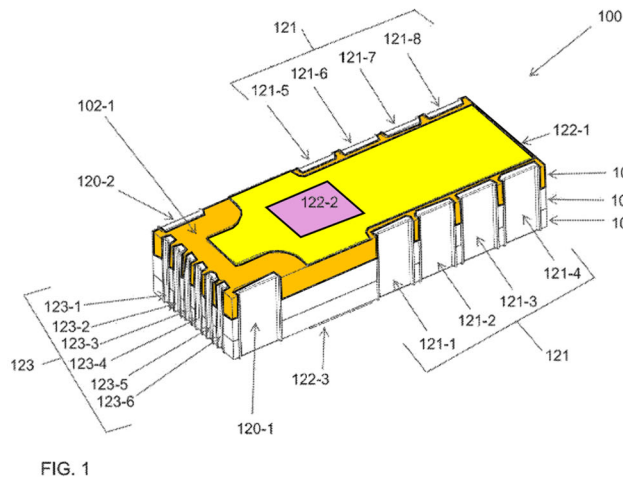
72. As an initial matter, Petitioner argues that “[u]nder the product-by-process construction, the element is not entitled to patentable weight.” (Pet. at 35.) As detailed in the claim construction section, this is incorrect.

73. Petitioner’s alternative argument further fails to demonstrate that Vinciarelli-664 anticipates [1g]. It fails to identify [1g]’s required structural relationship between connection part and electronic component. (Pet. at 21-31, 55-61, 69-77, 88-90.)

74. At best for Petitioner, it identifies a contact that is positioned to cover a magnetic core, but this fails to make any demonstration that the core mechanically supports the “connection part” according to [1g]. Petitioner fails to provide any analysis for the physical attachment and bonding pad of [1e] and how those components provide the structural relationship of [1g]. (Id. at 28, 61, 76-77 (arguing under [1e]).) Moreover, there is also no illustration that there is any type

of physical attachment between these portions of the connection part and the electronic component.

75. At most, the magnetic core would be centrally located. Shown below-left is a presumed magnetic core (lavender) centrally located encapsulant (orange) annotated onto FIG. 1 from FIG. 10. Petitioner fails to describe a physical attachment between the conductor and the core and moreover fails to describe how the core would provide mechanical support.



76. Vinciarelli-664 does not disclose the structure associated with [1g]. Vinciarelli-664 discloses that “a plurality of electrical contacts, e.g., 120-1, 120-2, 121, 122-1, and 123, [are] situated in grooves located along all four perimeter edges of the module.” Vinciarelli-664 at 5:56-60. Vinciarelli-664 also discloses that castellation being performed to form these grooves and the electrical contacts situated in the grooves. Vinciarelli-664 at 9:25-48, 11:24-36. However, I do not

find any explicit disclosure or suggestion within Vinciarelli-664 of whether there is a connection with mechanical support between the electrical contacts and the module's sidewall or grooves. See *id.* I also find no such teaching in Vinciarelli-664 as to whether or how the electrical contacts are fixed to the module's sidewall or grooves.

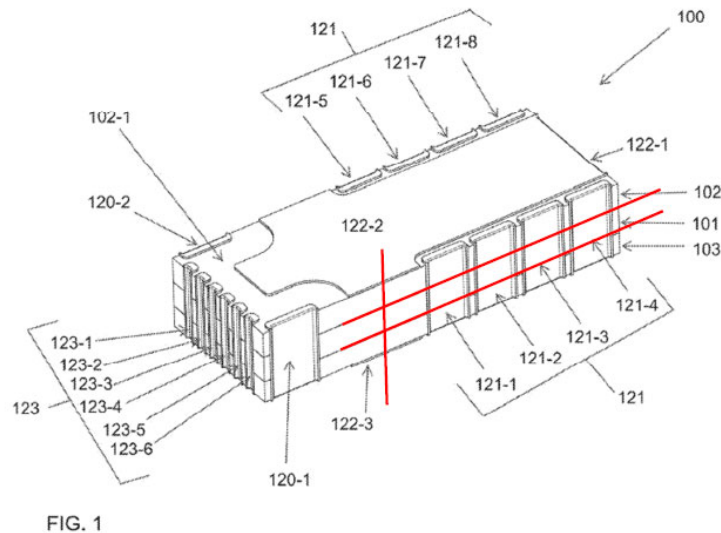


FIG. 1

(Petition at 32)

77. I also reviewed Dr. Baker's analysis of Vinciarelli-664 with respect to [1g]. Dr. Baker did not find whether or not Vinciarelli-664 discloses that the sidewall contacts are mechanically supported by any components of the assembly. See EX1003 at ¶¶ 107-109. Dr. Baker also did not find whether or not Vinciarelli-664 discloses that the sidewall contacts are fixed at any components. See *id.* I also note that the Petition lacks a discussion of this structure that I have associated with [1g]. Petition at 35.

b. Vinciarelli-664 does not disclose [1f].

78. Vinciarelli-664 does not disclose this limitation. Nowhere in Vinciarelli-664 explicitly discusses carrier or PCB thickness, or positioning the PCB at a certain height range. Without specific description in Vinciarelli-664's text, a POSITA would not understand Vinciarelli-664 as limiting the PCB position at the claimed height range, or would otherwise extend outside the claimed height range. It would be even more strenuous to argue that Vinciarelli-664 discloses positioning the PCB at the claimed range – "1/3 to 2/3 of a height of the power converter."

79. Neither does Vinciarelli-664 nor has the Petition pointed to any reference that patent figures are drawn to scale. Nonetheless, because Petitioner and Dr. Baker appear to rely upon Vinciarelli-664's figures, I also considered Vinciarelli-664's figures and discussed my viewpoints below. *See* EX1003 at ¶ 103.

80. I disagree with the conclusions drawn by Petitioner and Dr. Baker that "the figure[s] clearly show[] that the carrier is within the claimed range." *See* EX1003 at ¶ 103. To the contrary, at least FIG. 1, which Petitioner cites to, demonstrates that the carrier is outside the claimed range. In measuring the relative positions of these components, I printed out FIG. 1 of Vinciarelli-664 on

standard printer paper (8.5 inches by 11 inches) and ruler-measured each layer of FIG. 1's module. My measurement reveals that, on the printout:

- A. The bottom encapsulant layer (103) is about 0.45 cm;
- B. The middle PCB (101) is about 0.55 cm; and
- C. The top encapsulant layer (102) is about 0.55 cm.

I converted this to percentages, which resulted in the bottom encapsulant layer (103) being disposed at 0% - 29.0% along the power converter's height, the middle PCB (101) being disposed at 29.0% - 64.5%, and the top encapsulant layer being disposed at 64.5% - 100%. This demonstrates that FIG. 1 depicts the middle PCB (101) *outside* of the claimed range. Specifically, the middle PCB (101) is drawn to extend into the bottom third of the module (since 29.0% is less than 33.3%, or 1/3), and the bottom of the middle PCB is located squarely below the 1/3 height of the power converter. Thus, the cited reference fails to meet the claimed limitation as showing the middle PCB being disposed outside of the 1/3 to 2/3 height range.

81. I've also done another exercise, to demonstrate that [1f] is not met by Vinciarelli-664. Taken below is an excerpt of FIG. 1 with the specific area in question blown-up alongside a ruler in the Microsoft® PowerPoint software showing more precision. For the ease of demonstration, the first four inches are shaded; the 1st inch is red, the 2nd inch is green, the 3rd yellow, and the 4th is blue.

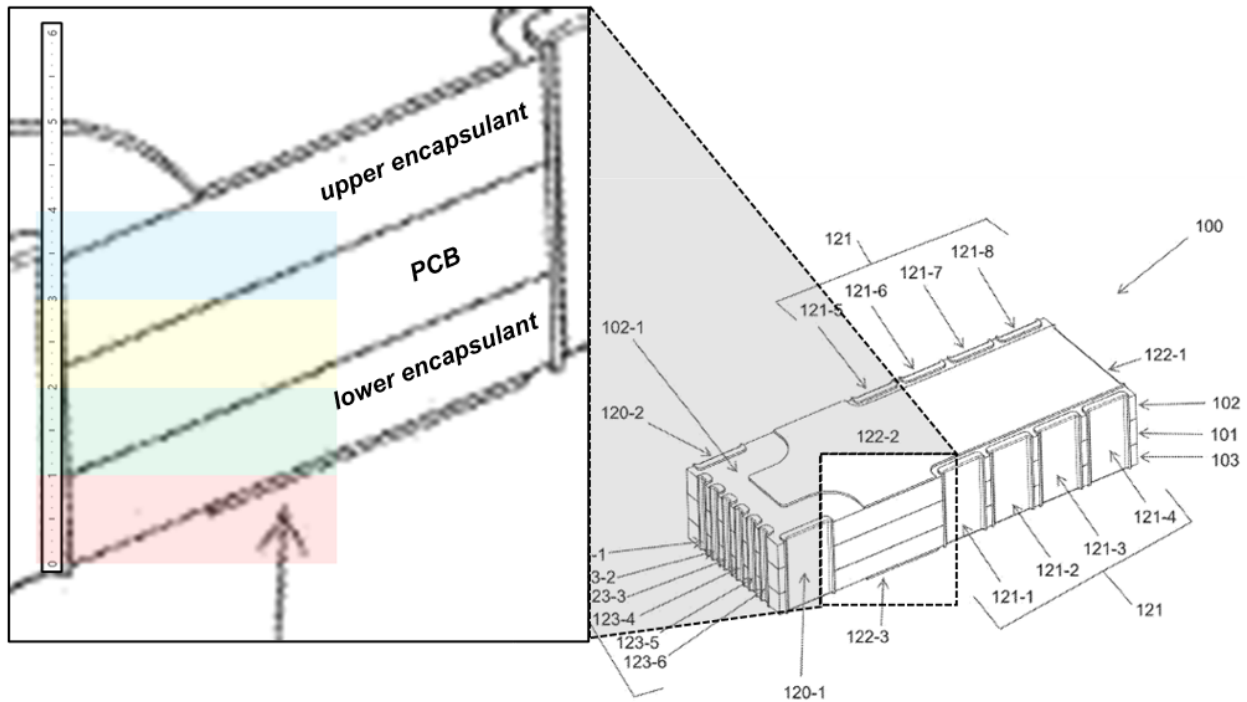


FIG. 1

As illustrated, the lower encapsulant layer is one inch high. The carrier thickness is, however, not an inch; it is bigger at approximately 1.25 inches. The upper encapsulant layer is approximately 1.125 inches. This makes the ratio $1 / 1.25 / 1.125$, and using percentages this works out to 29.6% / 37% / 33.3%. Thus, the illustrated carrier is larger than 1/3 (33.3%), and the carrier's bottom is below the 1/3 height of the power converter.

82. This measurement also demonstrates that Vinciarelli-664's middle PCB (101) is disposed outside of the claimed height range. These precise findings are consistent with my measurements based on measuring the printout as described above.

83. Failing [1f]'s requirements means that the illustrated carrier fails on the power density aspect that is required by this quantitative limitation. Because the illustrated carrier is larger than $1/3$ of the power converter height and too thick to be disposed entirely within the $1/3$ to $2/3$ height range, it is my view that power density has not been optimized relative to mechanical stress as the manner embodied in [1f], and as contemplated by the patented invention.

84. Dr. Baker could not derive precise dimensions by using an eyeball test. As shown in Dr. Baker's annotated figure (reproduced below), he drew two lines on FIG. 1 and then dashed to the conclusion that "the carrier is within the claimed range" and so does not extend outside " $1/3$ to $2/3$ of the height of the power converter." Other than the red lines drawn on FIG. 1, Dr. Baker conducted no analysis and did not even scientifically measure to derive his conclusion that the carrier is within the $1/3$ to $2/3$ height range. While at this, I again note that figures are not drawn to scale and that this exercise was prompted by Dr. Baker's analysis to show that Vinciarelli-664 fails to disclose any dimensions or sizes in its description.

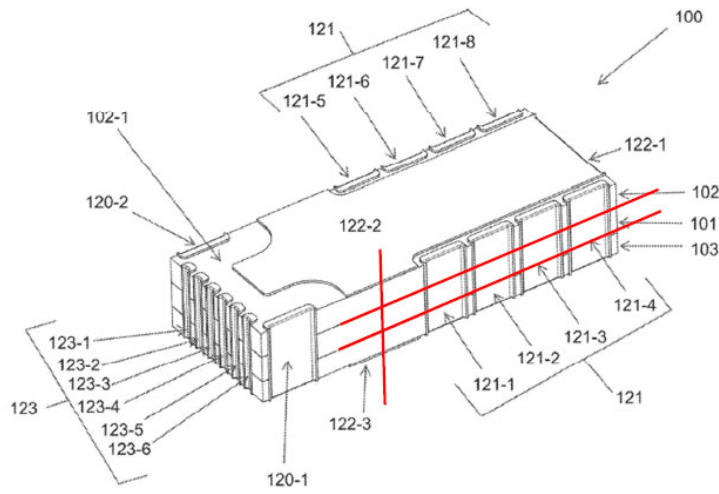


FIG. 1

(Petition at 32)

i. Dr. Baker is wrong that sandwiched PCBs meet [1f].

85. I also note that Dr. Baker makes an incorrect assumption that is inconsistent with the '263 Patent, and the Petition also advances with that incorrect assumption. Specifically, Dr. Baker states “[a] centered printed circuit board with components on both sides would meet this height requirement.” EX1003 at ¶ 63. Dr. Baker continues, “the circuit board in thus embodiment is centered within the magnetic cores and thus disposed at 1/3 to 2/3 of a height of the power converter.” EX1003 at ¶ 104.

86. However, Dr. Baker is incorrect. This would effectively mean any PCB sandwiched by components on both sides meets [1f], but this is wrong. As I stated previously in the claim construction section, [1f] simultaneously incorporates both a carrier thickness requirement and a component thickness ratio

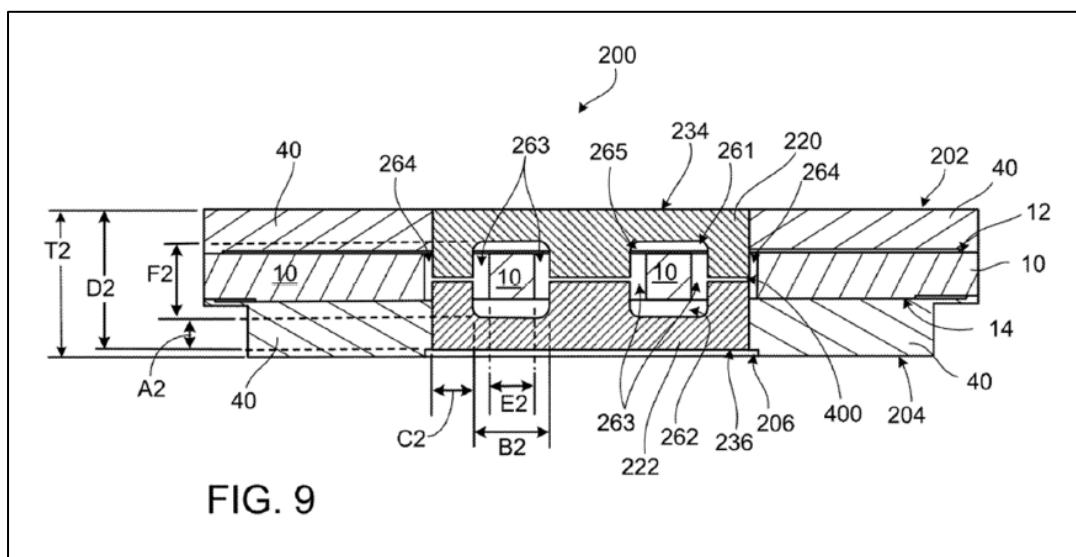
requirement; it is through both these requirements acting together that the carrier ends up within the claimed $1/3$ to $2/3$ height range. Specifically, [1f] incorporates both requirements: (i) the carrier thickness be less than a third of the power converter's total height; and (ii) upper components are not more than twice the thickness of the lower components, and *vice versa*. The result is that [1f] requires both carrier thickness and carrier position. On a higher level, these dual requirements of [1f] optimizes both power density and warping/stress mitigation. This is clear because a very thick PCB would not satisfy [1f]; it would extend outside of " $1/3$ to $2/3$ of a height of the power converter" and thus sacrifice power density. That would defeat the purpose of the invention contemplated in addressing the flaws that were observed in the prior art.

87. As such, the Petition fails as a centered PCB with components on both sides does not meet [1f], because [1f] requires more.

ii. Vinciarelli-269 also does not disclose [1f].

88. Next, Vinciarelli-269 also does not disclose this limitation. Petitioner and Dr. Baker rely upon Vinciarelli-269 in combination with Vinciarelli-664 for this limitation, but again, they fail to point to any portion of Vinciarelli-269 that discusses carrier thicknesses. Vinciarelli-269 discloses some variables relating to some thicknesses within a power converter module, but none of those correspond to a carrier thickness. *See Vinciarelli-269 at FIG. 9.* These include assembly

thicknesses T1/T2 and transformer thicknesses D1/D2. *Id.* at 9:57-10:3. Neither of these relate to carrier thickness. Vinciarelli-269 discloses variables F1/F2 (in FIG. 2, reproduced below) relating to a height of the interior spaces within a transformer. *Id.* at 10:53-67; *see also id.* at FIG. 18B. Vinciarelli-269 discloses these interior spaces “are greater in height than the maximum thickness of the PCB 10 and the minimum gap size required for the top 261 and bottom 262 interstitial gaps.” *Id.* However, this does not inform particular thickness of the PCB itself, nor the claimed range - “1/3 to 2/3 of a height of the power converter.”



89. Prompted by Petitioner and Dr. Baker's reliance on eyeball testing of FIG. 9 of Vinciarelli-269, I again measured the components despite understanding that patent figures are not drawn to scale. As with my previous exercise, I printed out FIG. 9 in a standard printer paper (8.5 inches by 11 inches) and measured the bottom layer (40), the middle layer or PCB (10), and the upper layer (40). In this

first iteration, I began measuring the bottom layer from the bottom of height T2 in FIG. 9. Vinciarelli-269 generally teaches making the core structure thickness (D2) and the assembly thickness (T2) approximately equal. Vinciarelli-269 at 9:59-64, 10:4-25. Encapsulant may be shaved off (reducing T2 to reach D2), or a larger core structure may be used (increasing D2 to reach T2). *Id.* Therefore, both a T2-tall power converter and a D2-tall power converter should be considered.

90. In the first iteration, my measurement shows, on the printout:

- A. The bottom layer (40) is about 1.15 cm;
- B. The middle layer or PCB (10) is about 0.95 cm; and
- C. The top layer (40) is about 0.90 cm.

I converted this to percentages, which resulted in the bottom layer (40) being disposed at 0% to 38.3% along the power converter's height, the middle layer or PCB (10) being disposed at 38.3% to 70.0%, and the top layer (40) being disposed at about 70.0% to 100%. This establishes that FIG. 9's PCB extends into the top third of the module where the top of the PCB is located squarely above the 2/3 height of the power converter—*outside* of the claimed 1/3 to 2/3 height range.

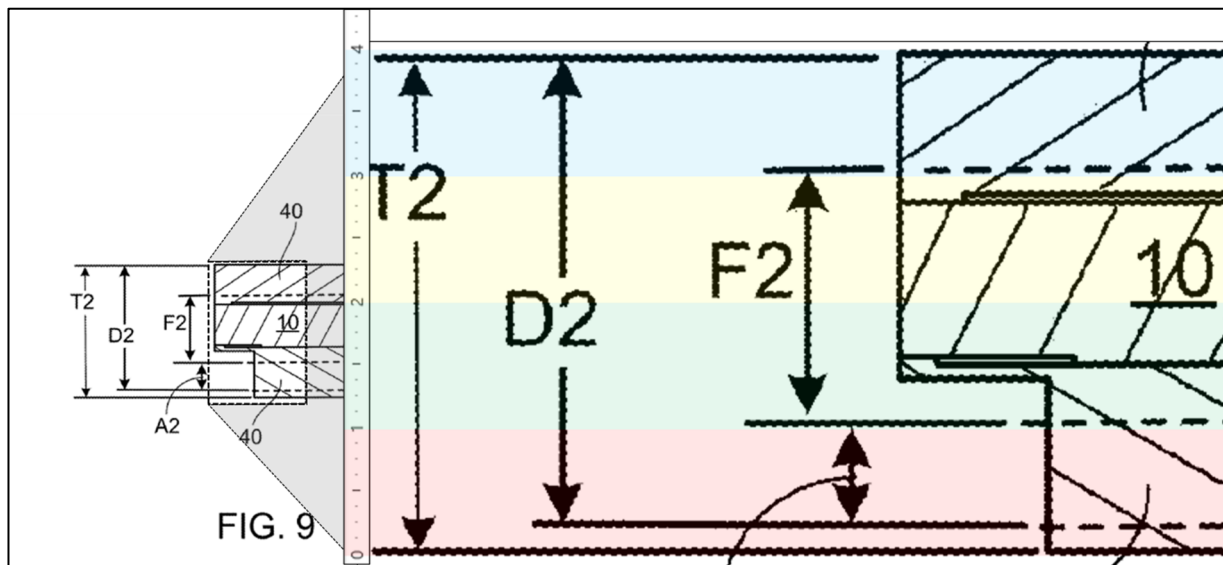
91. In the second iteration (D2-tall power converter), my measurement reveals, on the printout:

- A. The bottom layer is about 1.00 cm;
- B. The middle PCB is 0.95 cm; and

C. The top layer is about 0.90 cm.

Converting to percentages, this results in the middle PCB being disposed at 35.1% to 68.4% of the power converter's height. This demonstrates that, even in a D2-tall power converter, the PCB extends into the top third of the module, *again outside* of the 1/3 to 2/3 height range.

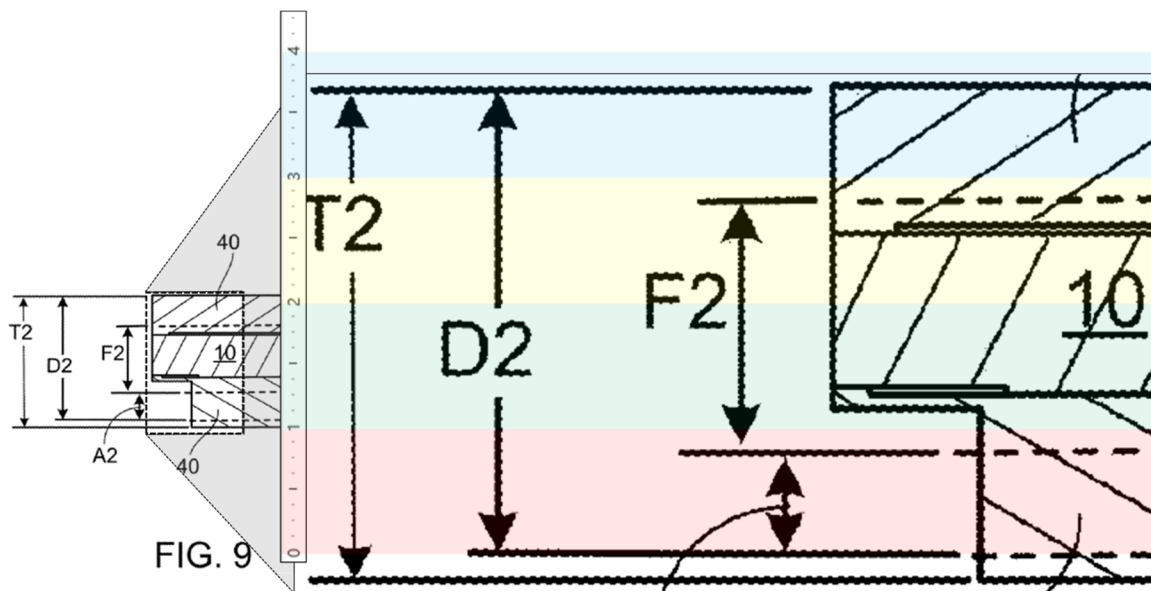
92. I have done another exercise, to demonstrate that [1f] is not met by Vinciarelli-269. The below excerpts of FIG. 9 follow the same exercise with respect to Vinciarelli-664 as demonstrated above using precisely measured shapes in a consistent PowerPoint scale with inch markers shaded.



93. Whether taking total thicknesses T2 or D2, Vinciarelli-269 does not illustrate a PCB disposed within the 1/3 to 2/3 height range. As depicted above, the lower encapsulant 40 is approximately 1.6 inches, while the PCB 10 extends from 1.6 inches to 2.8 inches on the ruler. The upper encapsulant above the PCB

extends from 2.8 to 4 inches on the ruler. This makes the ratio $1.6 / 1.2 / 1.2$, i.e., $40\% / 30\% / 30\%$. As such, the PCB extends outside of the $1/3$ to $2/3$ height range, and thus [1f] is not met.

94. The same conclusion is drawn if the power converter is considered to span only D2. Shown below (where the PowerPoint ruler is moved to start at the bottom of D2), the bottom encapsulant is approximately 1.3 inches, the PCB is approximately 1.2 inches, and the upper encapsulant is approximately 1.2 inches. This results in a ratio of $1.3/1.2/1.2$, i.e., $35\% / 32.5\% / 32.5\%$.



95. These ratios are similar to my measuring the figures with a ruler, as described above. This results in the top of the PCB extending above the $2/3$ height of the converter (into the top third of the converter), and thus [1f] is not met.

96. These measurements all demonstrate that Vinciarelli-664's middle PCB (101) is disposed *outside* of the claimed height range. These precise findings

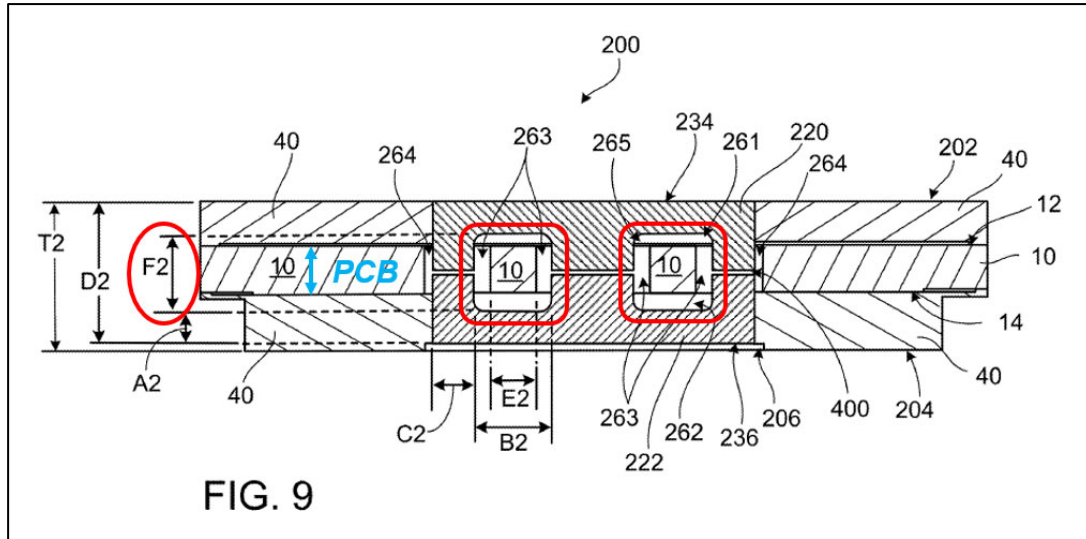
are consistent with my measurements based on measuring the printout as described above.

97. Therefore, Vinciarelli-269 does not teach a PCB that is disposed within the claimed height range. Neither Dr. Baker nor the Petitioner pointed to evidence contradicting it.

iii. Vinciarelli-269 teaches the opposite of Dr. Baker's incorrect conclusion under [1f].

98. Indeed, my review of Vinciarelli-269 finds it teaching the opposite of Petitioner and Dr. Baker's characterization of Vinciarelli-269. Petitioner and Dr. Baker conclude that Vinciarelli-269's circuit board is halfway within the transformer, thus "in the middle of the power converter." EX1003 at ¶ 106. As stated above, a PCB positioned halfway within the transformer does not meet [1f]. But in addition to this not meeting [1f], Vinciarelli-269 teaches away from a circuit board being halfway within a transformer.

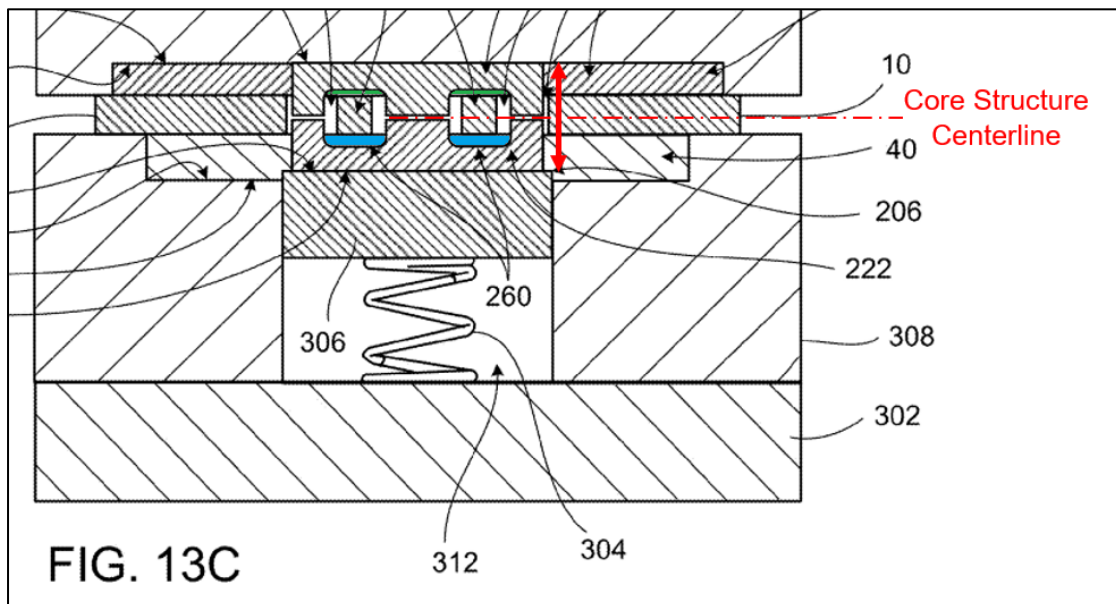
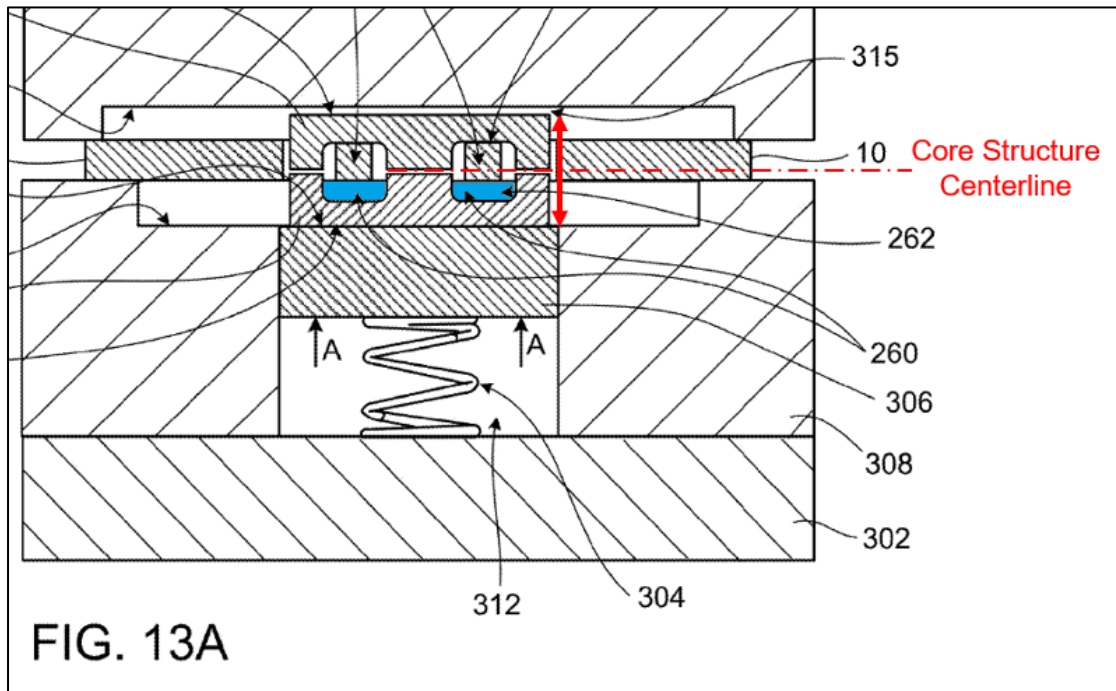
99. Vinciarelli-269 discloses that the "legs" of the two E-shaped core halves composing a transformer face each other, forming large interior spaces between those "legs." *See* Vinciarelli-269 at FIG. 9 (reproduced below with annotation). Vinciarelli-269 discloses that the PCB is positioned somewhere within the interior spaces formed by the magnetic core halves. *Id.*



100. Vinciarelli-269 explains that the large interior spaces are intended to allow offset and biased positioning of the PCB from a center region between the matching core halves. Vinciarelli-269 at 10:53-11:12. Vinciarelli-269 refers to a top interstitial gap 261 and a bottom interstitial gap 262 that give freedom in disposing the PCB *away from the center* between the core halves. *Id.*

101. Vinciarelli-269 discloses “clamping [the PCB] relative to the mold *and biasing* [the transformer] *in position* against a predetermined feature of the mold.” *Id.* at 3:15-34. “The minimum height F2 of interior space 260 is set to allow the assembled core 210 to *move vertically relative to the PCB 10* which may be used during the manufacturing process to adjust the core surface 234 *into a precise position relative to the PCB* for encapsulation.” *Id.* (emphasis added); *also id.* at 11:1-12. The core structure can be moved upward relative to the PCB, so that the PCB is positioned below the vertical center of the core structure. *Id.*

The core structure can also be moved to a lowered position, resulting in the PCB being positioned above a vertical center of the core structure. *Id.* at 12:7-27, FIGs. 13A-13C (reproduced below with annotation). Therefore, Vinciarelli-269 teaches positioning the PCB offset from the center.



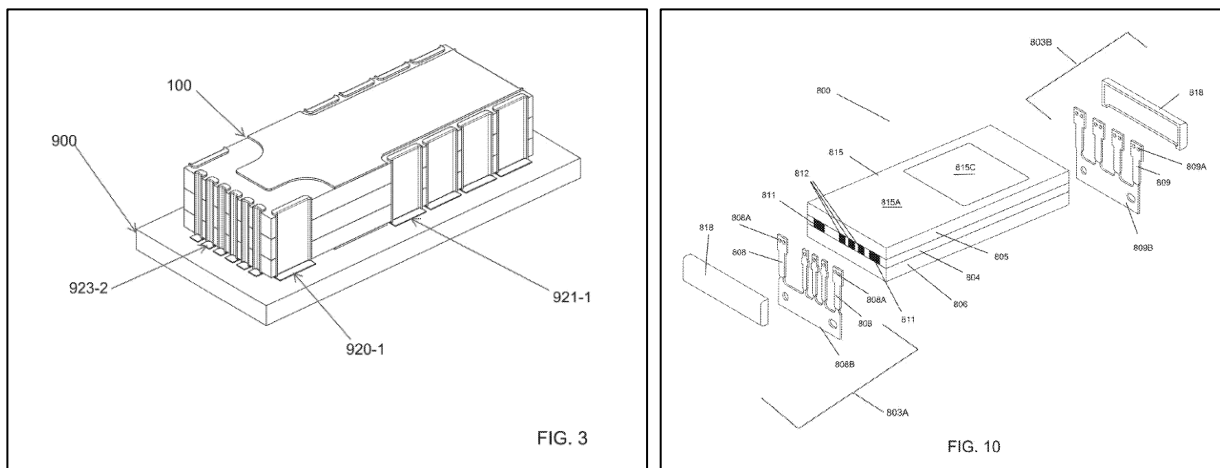
102. Vinciarelli-269 does not teach a PCB that is positioned halfway within a transformer and instead literally teaches a PCB that is ***not*** positioned halfway within a transformer. As such, Petitioner and Dr. Baker are incorrect in their conclusion that Vinciarelli-269 teaches a PCB halfway within a transformer. However, as stated previously, this is moot because [1f] requires more than a PCB occupying a central region.

iv. Ground 1A: [1b] does not necessarily exist in Vinciarelli-664.

103. As previously noted, I am informed and understand that anticipation requires that all of the claim limitations be disclosed in a single prior art reference as arranged or combined in the claim. I am informed that this means that different embodiments and references cannot be combined to anticipate. I am also informed that in order for a reference to inherently disclose a claim limitation, that claim limitation must ***necessarily*** be present in the reference and may not be established by probabilities or possibilities.

104. Petitioner combined distinct embodiments for limitation [1b], which recites “a first electronic component disposed at the lower surface of the carrier” and “a second electronic component disposed at the upper surface of the carrier” (limitation [1b]). I have reviewed the Petition’s analysis of [1b] under Ground 1A, and I have the opinion that the Petition resorts to combining embodiments due to Vinciarelli-664 not illustrating components disposed on both upper and lower

carrier surfaces in its figures. This opinion is also based on my review of Dr. Baker's statements, which point to the fact that, in Vinciarelli-664's illustrations, "the encapsulant layers 102 and 103 cover the components mounted on the printed circuit board 101." EX1003 at ¶ 76 (citing Vinciarelli-664 at 6:21-27). Because encapsulant covers any components that may exist on a carrier surface, I therefore conclude that each illustrated figure of Vinciarelli-664 does **not** necessarily include both an electronic component on the lower carrier surface and an electronic component on the upper carrier surface. For example, while FIG. 3 (reproduced below) may show encapsulant layers on both the upper and lower carrier surfaces, it is not conclusive nor necessary that FIG. 3's module includes components **on** both carrier surfaces.



105. I have reviewed each of Vinciarelli-664's thirteen figure sheets, and only see an electronic component depicted in FIG. 10 (reproduced above). But in FIG. 10, the illustrated magnetic core 815C is **shown** on the upper surface of the

carrier, and there is no view of any components mounted on the lower surface of the carrier. In the field of power converter design, it is possible for components to only be mounted on one side of the carrier.

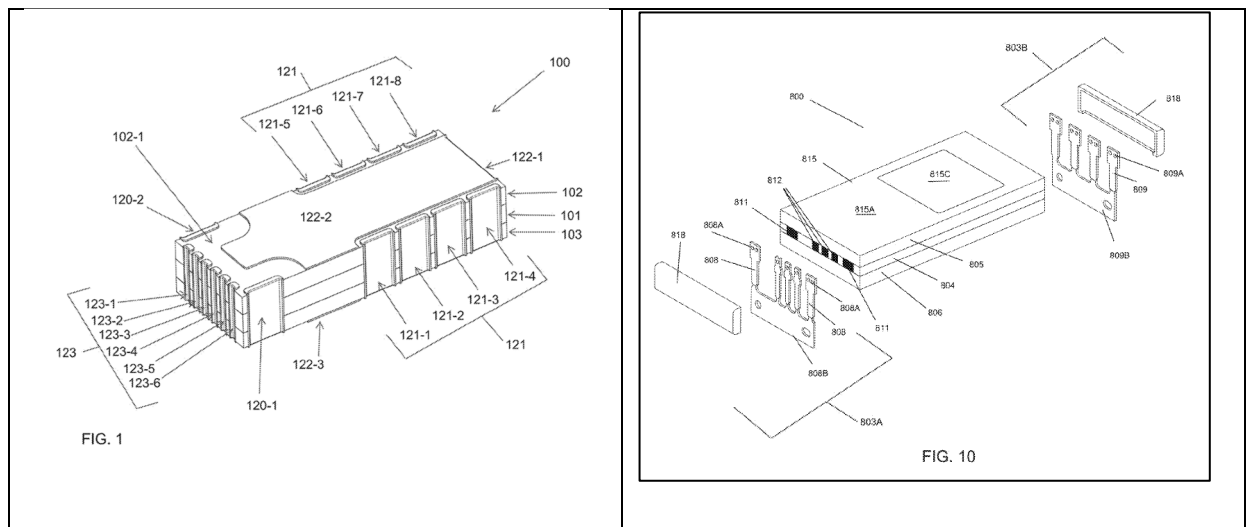
106. Therefore, I have the opinion that the electronic module disclosed in Vinciarelli-664 does not necessarily include “a first electronic component disposed at the lower surface of the carrier” and “a second electronic component disposed at the upper surface of the carrier.” I am informed that [1b] is therefore not anticipated by Vinciarelli-664. I also do not opine on the probability or possibility that the electronic module disclosed in Vinciarelli-664 does include components disposed on both surfaces, because I am informed that inherency of a claim limitation may *not* be established by probabilities or possibilities.

v. Ground 1A: [1d] does not necessarily exist in Vinciarelli-664.

107. Continuing here is my understanding that anticipation requires that all of the claim limitations be disclosed in a single prior art reference as arranged or combined in the claim. I am informed that this means that *different* embodiments and references cannot be combined to anticipate.

108. Limitation [1d] requires “a first terminal electrically coupled to the upper surface or the lower surface of the carrier.” I have the opinion that Vinciarelli-664 does not disclose this limitation because Vinciarelli-664 does not teach terminal connections on the upper/lower surfaces of its PCB. Specifically,

Vinicarelli-664's contacts 120-1, 120-2, 121, and 122 "extend from the bar codes up and down the sidewalls and onto selected portions of the top and top [sic] and bottom surfaces of the module." Vinciarelli-664 at 6:56-60. But, any connection point of these contacts is not the PCB's upper/lower surface. For example, the bar codes (811 and 812 in FIG. 10, reproduced below) are on the *side* surfaces/edges of the PCB, and not on the top or bottom surfaces of the PCB.



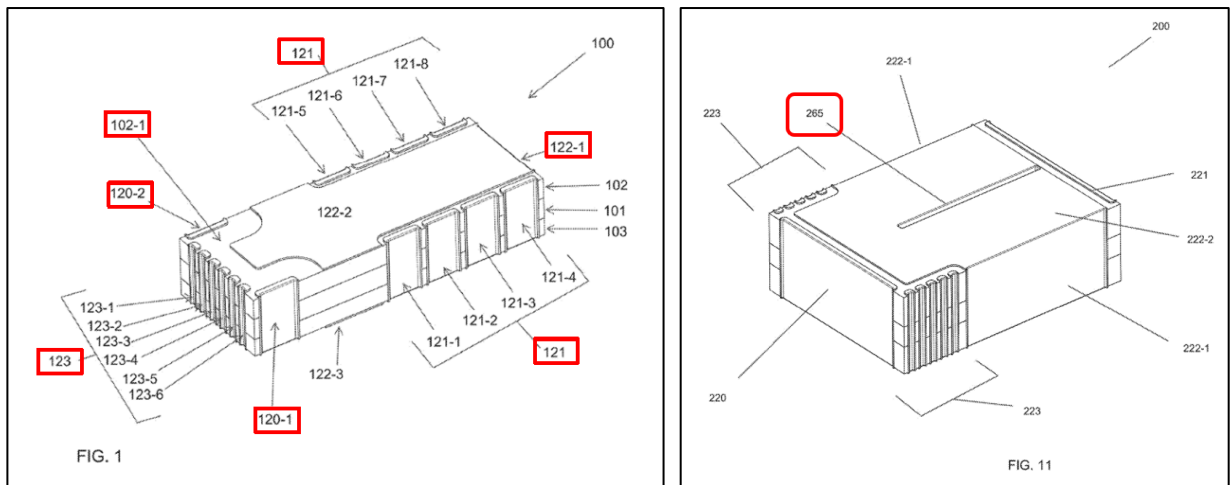
109. My review of the Petition suggests that Petitioner reaches the same conclusion that [1d] is not met due to the bar codes only being on the PCB side surfaces/edges (as opposed to the top or bottom surfaces). In an attempt to address that defect, the Petition then turns to (i) Vinciarelli-747 to discuss conductive through-holes (Petition at 23-25), (ii) the FIG. 11 embodiment for a thermal conduit (Petition at 25-26), and (iii) Vinciarelli-844 to discuss a board that includes

conductive runs 65 (Petition at 26-27). I have reviewed each of these three teachings and have confirmed that Vinciarelli-664 discloses none specifically in relation to FIG. 1, which depicts the contacts 120-1, 120-2, 121, and 122. As further explained below, I believe that none of these three teachings necessarily exist in the FIG. 1 module of Vinciarelli-664.

110. Firstly, the Petition proposes to modify Vinciarelli-664 to replace its buried vias with conductive through-holes that are coupled to the contacts according to Vinciarelli-747. Petition at 23-25. I do not find that Vinciarelli-664 discloses these conductive through-holes as alternatives to the buried vias or bar codes. Instead, these conductive through-holes are only introduced in Vinciarelli-747. I also find that Vinciarelli-747 *points away* from having upper/lower connections on its PCB. Vinciarelli-747 states that “[i]n the alternative to buried conductive features, conductive through-holes . . . may be used . . . to form interconnects extending through the thickness of the PCB from top surface to bottom surface” but later states that “[a] penalty of using through-holes for the interconnects is the *loss of surface area* on the top and bottom of the PCB which may otherwise be used for setback or other safety and agency approval requirements.” Vinciarelli-747 at 16:40-49. It is apparent to a POSITA reading Vinciarelli-747 to notice these drawbacks for providing connections at the top/bottom surfaces. POSITAs would be discouraged to incorporate those

through-holes into Vinciarelli-664 as a result. Dr. Baker failed to address why a POSITA would still attempt the modification in light of the drawbacks explicitly identified in Vinciarelli-747.

111. Secondly, the Petition proposes to combine two distinct embodiments in Vinciarelli-664 to replace the bar codes. The two different embodiments being combined are shown respectively in FIG. 1, which includes the contacts connected to the bar codes, and FIG. 11 (shown below).

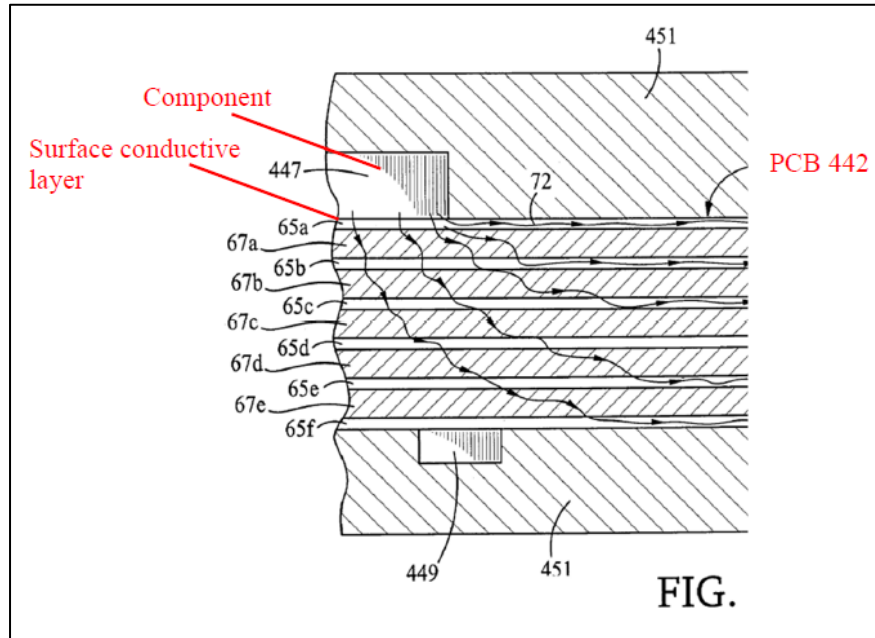


112. Besides the clear form factor difference, there are electrical connection differences. Vinciarelli-664 discloses that the FIG. 1 device has a top shield 122-2 “separated from the input contacts 120-1 and 120-2, output contacts [121-X], and control contacts [123-X].” Vinciarelli-664 at 10:62-11:5. On the other hand, Vinciarelli-664 discloses that FIG. 11’s device has “a conductive shield 222-2 on the top of the module which may as shown be electrically and connected to the common contacts 222-1.” *Id.* at 13:7-10. The Petition’s analysis did not

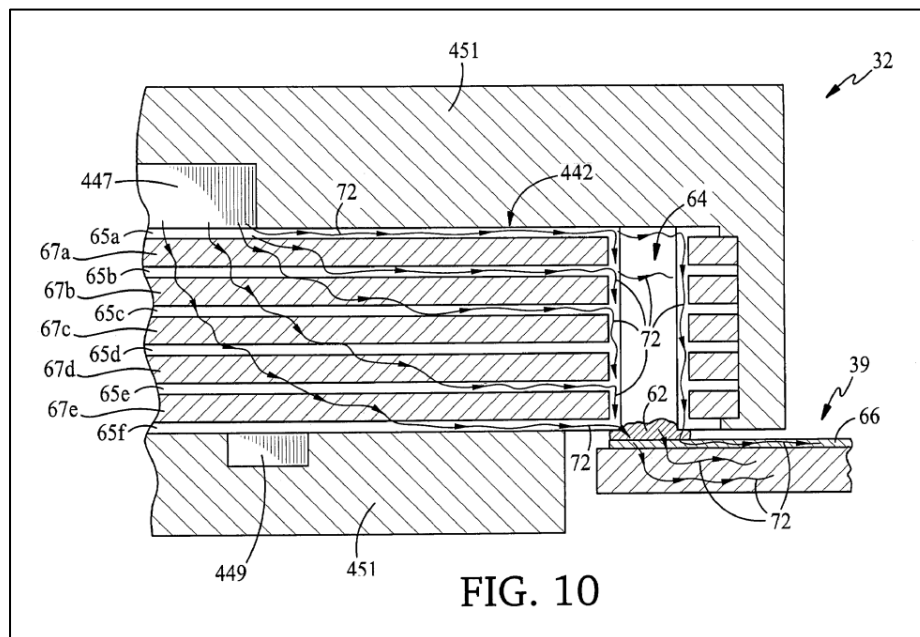
articulate any motivation for a POSITA to combine these two *disparate* embodiments, or specifically for a POSITA to modify the FIG. 1 embodiment to include the thermal conduit feature of FIG. 11. That is, Vinciarelli-664 only describes that the FIG. 11 device (a different device with a more square shape) has the thermal conduit but does *not* describe the thermal conduit in the context of the FIG. 1 device (a different device). As such, there is no teaching or even suggestion in Vinciarelli-218 that the FIG. 1 device includes the thermal conduit. The Petition also does not explicitly explain that the thermal conduit would or even can be ported from the FIG. 11 device to the FIG. 1 device, nor explain why a POSITA would make that modification.

113. Thirdly, the Petition reproduces an excerpt of Vinciarelli-844's FIG. 10, which shows multiple buried conductive runs. Petition at 27 (Petitioner-annotated excerpt of FIG. 10 reproduced below). To the best that I understand, the Petition uses this excerpt of FIG. 10 to show that the conductive runs 65a, 65b, . . . 65f are electrically coupled together, and therefore, a contact coupled to one buried conductive run is then electrically coupled to runs on the surfaces of the carrier. However, I note that the arrows in the Petition's excerpt of FIG. 10 represent heat and *not electrical flow*. I also note that this configuration of conductive runs is not disclosed in Vinciarelli-664 in connection with the bar codes, and Dr Baker

provides no indication or suggestion that the bar codes in Vinciarelli-664 necessarily have the same configuration as depicted in Vinciarelli-844.



(Petition at 27)



(Vinciarelli-844 at FIG. 10)

114. Therefore, I have the opinion that [1d] does not exist in Vinciarelli-664.

b. Ground 1B: Combination is Still Deficient and Not Motivated

i. Ground 1B: [1f] is Not Shown to Present

115. Ground 1B relies on Ground 1A, and generally discusses that the challenged claims would be rendered obvious in combination with Vinciarelli-269, Vinciarelli-844 and Vinciarelli-747. Petition at 48-53.

116. As described above, Vinciarelli-664 (and Vinciarelli-269) fail to teach [1f]. While the Petition describes [1f] limitation in a passing under Ground 1B, it appears to repeat Ground 1A's analysis of [1f] by alleging that a skilled artisan would find it obvious to have "roughly equal size component on both sides." Petition at 52 (citing EX1003 at ¶ 129).

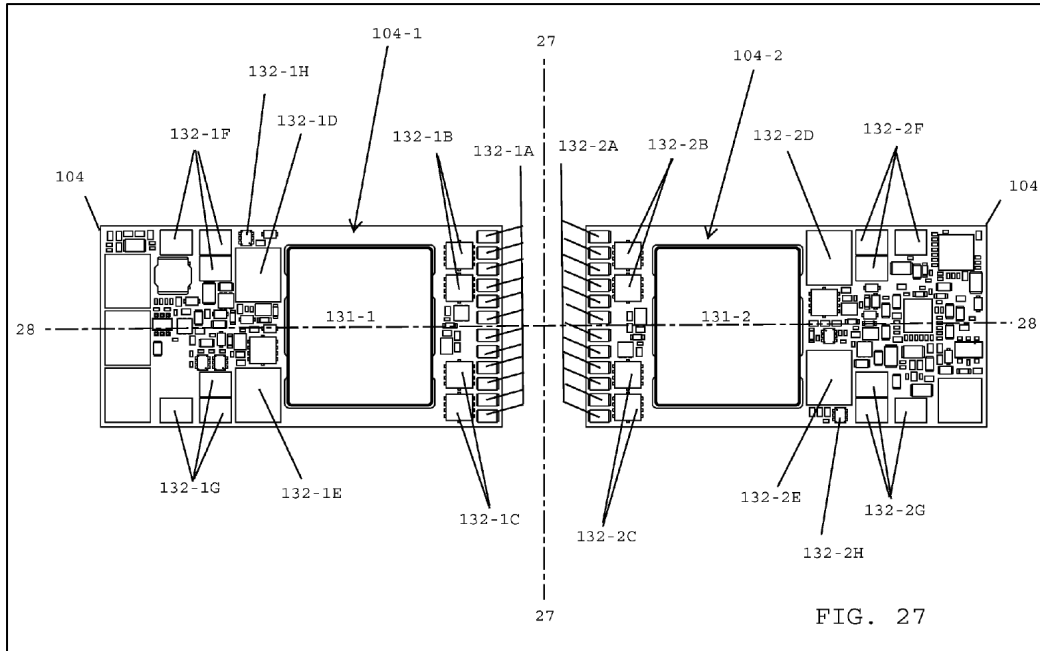
117. The Petition and Dr. Baker do not provide support or rationale for their argument; Petitioner only appears to describe the general rough centering of a PCB, which is defective to meet the precise sizings of [1f], as Petitioner explained with Ground 1A. Petitioner's citation to Dr. Baker (EX1003 at ¶ 129) is not even related to [1f], and instead describes placing power converters near loads and making them small (reproduced below):

129. A skilled artisan would have been further motivated to turn to Vinciarelli-269 for details concerning the designing of compact transformers for power converters and would provide transformers that have windings in the

printed circuit board and transformer core halves above and below the windings. Vinciarelli-269, 2:10-33, FIGS. 1, 5, 8, 9, 18 (A, B), and 19 (A, B). Vinciarelli-269 explains that “[c]ores of the type shown in FIG. 1 are known in the field of planar magnetics and are commonly used in applications where sizes reduction is important.” Vinciarelli-269, 6:16-17. For example, one of the applications for small power converters is for placement at or near the “point of load,” and thus a skilled artisan would be motivated to reduce the size of the power converter as much as possible. Even in other applications, there is a general motivation in circuit layout to reduce space as much as possible so that more functionality may be fit into a smaller package. This can be readily seen in the trend to reduce the size of computing components generally, and particularly components in computer servers servicing the Internet and corporate computing, so that more computing may be provided in a smaller footprint. Given that power converters of the type at issue here have applications in such computing systems, a skilled artisan would be motivated to reduce the size of the power converter.

118. Petitioner cites to two columns of Vinciarelli-747 for relating to [1f].

Petition at 52 (citing Vinciarelli-747 at 22:46-24:49). This section refers to Vinciarelli-747’s FIG. 27 (excerpted below), but FIG. 27 does not describe the symmetry of component *sizes* in the vertical direction. It instead refers to symmetrical components, but that is not relevant to analysis for [1f]. Moreover, Dr. Baker only generically repeats Petitioner’s statements and broad recitation to two whole columns of Vinciarelli-747. EX1003 at ¶ 131. Vinciarelli-747 does not cure the deficiencies of Ground 1A that fails to disclose [1f].



119. Therefore, I have the opinion that Ground 1B does not meet [1f].

ii. Ground 1B: No Proper Motivation to Combine

120. In my opinion, Ground 1B fails to provide motivations to arrive at the claimed invention. Petitioner's challenge to the claims under Ground 1B can be summarized in the following statement:

It would have been obvious to a skilled artisan to look to [the '269 patent], [the '844 patent], and [the '747 patent] to *provide details concerning power converters* that may be absent from Vinciarelli-664 for all the reasons discussed in Ground 1A. VICOR-1003, ¶¶123-132. See discussion for each claim in Ground 1A regarding the combination of Vinciarelli-664, [the '269 patent], [the '844 patent], and [the '747 patent].

Petition at 48-49 (emphasis added).

121. Ground 1B suffers same deficiencies as missing same limitations that are absent in Ground 1A. I understand that the petition must specify where each

element of the claim is found in the prior art patents or printed publications relied upon. Ground 1B does not meet this requirement because it does not specifically identify any claim limitation of claim 1, and not provide a motivation to arrive at any of those claim limitations.

122. Indeed, neither the Petition nor Dr. Baker addressed the dissuading disclosure from Vinciarelli-747, which counteracts the combination of Vinciarelli-747's through holes with Vinciarelli-664's disclosure of buried vias. Specifically, Vinciarelli-747 states that "[a] penalty of using through-holes for the interconnects is the loss of surface area on the top and bottom of the PCB which may otherwise be used for setback or other safety and agency approval requirements." Vinciarelli-747 at 16:40-49. Petitioner identifies no incentive or even address why a POSITA would have made the proposed combination.

123. As such, Petitioner fails to identify a proper motivation for Ground 1B.

c. Ground 1C: Combination is Still Deficient and Not Motivated

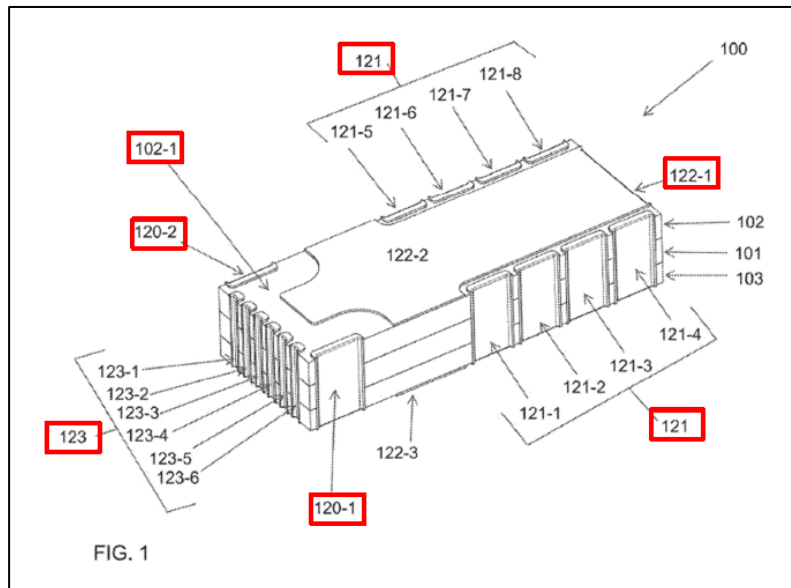
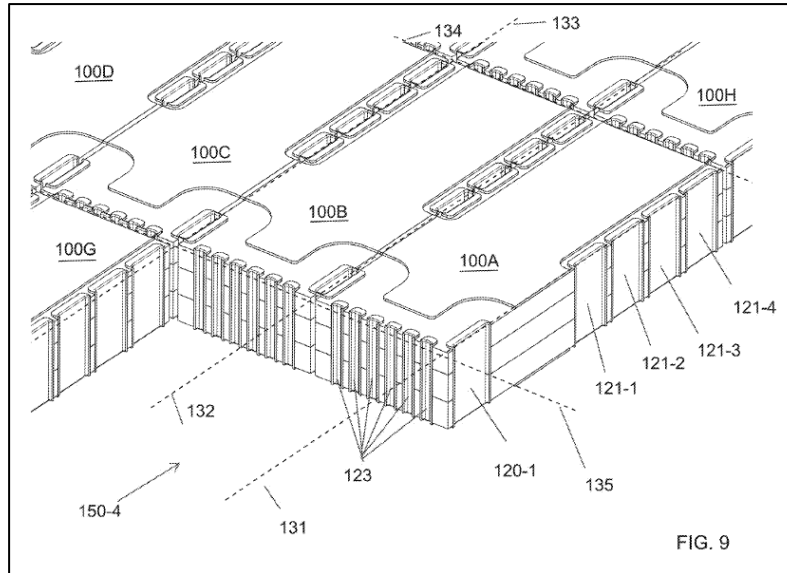
i. There is no motivation to combine Vinciarelli-664 and Zeng-014

124. As an initial matter, Petitioner's combination does not describe how the upper surface of Vinciarelli-664's supposed exposed core would contact the added conductors of Zeng-014.

125. Ground 1C is based upon a proposed combination of Vinciarelli-664 and Zeng-014. I have reviewed Petitioner's and Dr. Baker's reasoning for why and how a POSITA would combine Vinciarelli-664 and Zeng-014. Their reasonings are wrong, and it is my opinion that a POSITA would not be motivated to form the proposed combination. In particular, motivation is lacking due to *incompatibilities of manufacturing processes, which cannot be reconciled*, between Vinciarelli-664's bulk production at scale and Zeng-014's individual and specific lead frame wrapping.

126. First, Vinciarelli-664 is directed to a method for making electronic modules with "complex contact structures" on their surfaces. Vinciarelli-664 at Title, Abstract. In this method, multiple electronic modules are formed "by encapsulating *panels containing pluralities of electronic modules delineated by cut lines* and having conductive interconnects buried within the panel along the cut lines." *Id.* (emphasis added). Vinciarelli-664 discloses: its module formation method "start[s] with an encapsulated and preferably lapped panel [of un-singulated modules]" and then finishes with singulation "to separate individual modules from the panel." *Id.* at 8:27-11:63. Each of the figures via which Vinciarelli-664 teaches its module formation method depicts a panel that includes multiple un-singulated modules. *Id.* at FIGs. 4-9.

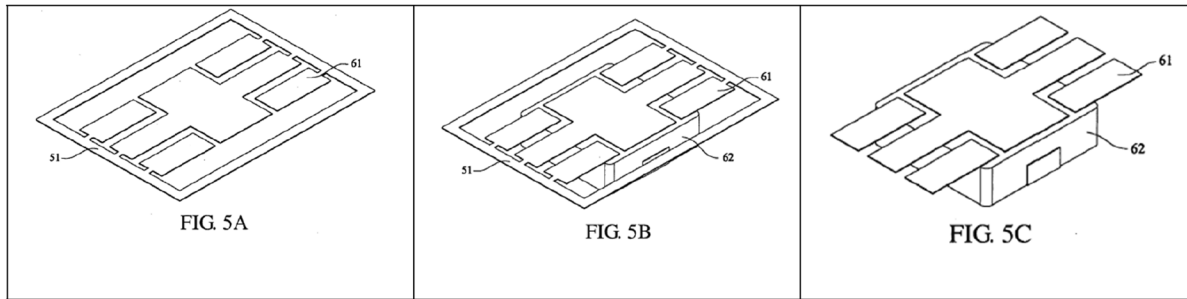
127. Vinicarelli-664 discloses that the “complex contact structures” are formed *prior to singulation* during this manufacturing method. *Id.* at 8:46-9:48 (“A. Castellations”), 10:12-11:16 (“C. Plating”; “D. Patterning”; “E. Finish Plating”). Forming these contacts while the modules are un-singulated and part of a large panel has a clear purpose and clear benefits. For one, the top shields 122-2 for every module in a panel can be substantially formed at the same time, via the depositing of the material layers that form the top shield 122-2 across the entire panel. Additionally, as Vinicarelli-664 demonstrates through FIGs. 7-9, castellations and cutting along a cut line allows for production of the sidewall contacts for both modules on either side of the cut line simultaneously.



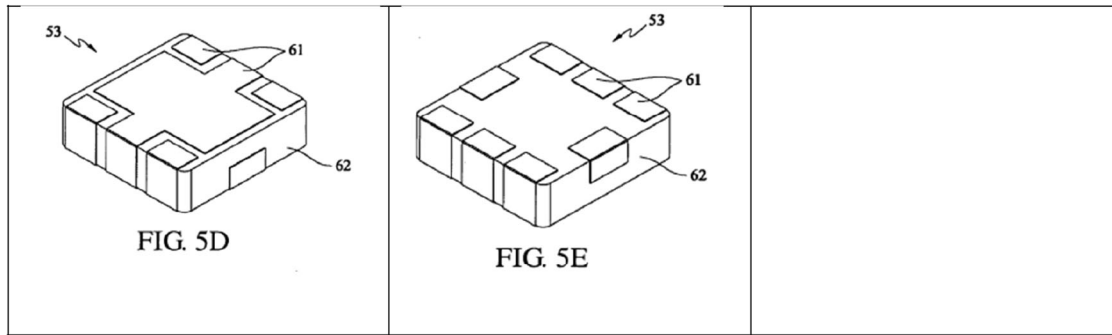
128. Therefore, Vinciarelli-664 is rooted with the idea of producing electronic modules *at scale*. Vinciarelli-664 confirms this by stating that “the contacts will be formed preferably before the panel is singulated to facilitate bulk processing of common sized panels compared with individual modules of varying

sizes and shapes.” Vinciarelli-664 at 8:53-60. This is consistent with today’s efforts in electronic assembly production, where

129. By contrast, Zeng-014 discloses a “a method to form the first conductive layer 61 on a body surface of the inductive component 62.” Zeng-014 [0062]-[0064]. Specifically, Zeng-014 discloses wrapping around one individual three-dimensional object to result in conductors located on multiple surfaces of the three-dimensional object. *Id.* FIGs. 5A-5E of Zeng-014 first depict a frame 51 that includes multiple conductors (i.e., portions of a first conductive layer 61). *Id.* at [0062], FIGs. 5A-5C. This frame has a wider area than a body surface of an individual electronic component (e.g., an inductor) that is to be wrapped with the conductors. *Id.*



130. As a result, the frame can be compressed onto the surface of the component, and the multiple conductors are bent and wrapped onto the side surfaces of the component. *Id.*; see also *id.* at FIGs. 5D-5E.



131. I initially note that Zeng-014’s lead frame wrapping cannot be applied onto one of Vinciarelli-664’s modules before the module is singulated. Prior to singulation, not all of the module’s surfaces are exposed for contacts to be wrapped thereon. Therefore, lead frame wrapping must occur *after singulation* if lead frame wrapping is to be used for forming contacts on Vinciarelli-664’s modules, and Zeng-014’s lead frame wrapping would be performed individually, repeatedly, and specifically on each module. This is consistent with the Petition’s and Dr. Baker’s proposed combination. Petitioner and Dr. Baker specifically propose that “[i]n the combination, a skilled artisan would modify the method of manufacture disclosed in Vinciarelli-664 to replace the process of cutting slots between the modules in the panel and filling the slots with conductive material, and instead apply the lead frame of Zeng-014 after the modules are *singulated*, and thus make the manufacturing process less sophisticated and more suitable for factories making prior art products.” Petition at 60-61; EX1003 at ¶ 144 (emphasis added).

132. I disagree that a POSITA would do so because the POSITA would recognize that Vinciarelli-664's *bulk/scale production* and Zeng-014's lead frame wrapping for *individual components* are inherently incompatible with one another. Modifying Vinciarelli-664's bulk production to instead use individual frame wrapping makes the manufacturing process *significantly less operable and efficient* than its original design. In practice, wrapping a lead frame on a component takes effort, precision, and time to perform correctly. Performing lead frame wrapping on individual modules would create a bottleneck in Vinciarelli-664's production process and likely reduce production output by a factor of at least *ten*. Manufacturing facilities that implement Petitioner's and Dr. Baker's combination would find it *counterproductive* and nearly impossible to keep up with the global market's demand. This would be much more costly as they at least would need to invest resources in scaling up their capabilities dramatically.

133. In fact, Vinciarelli-664 itself explicitly emphasizes how intrinsic and of critical importance bulk production is to its teachings. Vinciarelli-664 discloses:

The slots or holes, e.g. 160, 161, 162, 163, may preferably be cut vertically down, from a surface, e.g. top surface 102-1 or bottom surface 103-1 (not shown) of the encapsulated panel 150 along the cut-lines in the areas where *the contacts will be formed preferably before the panel is singulated to facilitate bulk processing of common sized panels compared with individual modules of varying sizes and shapes.*

Vinciarelli-664 at 8:53-60 (emphasis added).

134. Replacing Vinciarelli-664's pre-singulation contact formation with a post-singulation contact formation based on Zeng-014's teachings would be a significant modification that conflicts with the purpose and preferences disclosed in Vinciarelli-664. A POSITA would not make a modification to a prior art reference when said modification would defeat the stated purpose of that prior art reference. Indeed, it would be physically impossible to wrap Vinciarelli-664's electronic module using a frame if those side surfaces are not exposed.

135. Dr. Baker seems to recognize this incompatibility but nonetheless supports the combination on the basis of newness of technology, but I continue to disagree. Dr. Baker first acknowledges that Vinciarelli-664's process at scale is advantageous, as "there is no need to attach and bend contacts against the module after it is cut from the panel." EX1003 at ¶ 139.

136. Nonetheless Dr. Baker provides another alleged motivation in support of the proposed combination:

a skilled artisan would have been motivated to use such established manufacturing technologies which would lower the risk factors involved in the manufacturing process from using a newer technology (and of course, the skilled artisan would have been motivated to use new technology as well—both motivations exist and the deciding factor would be the available manufacturing equipment).

EX1003 at ¶ 144.

137. Dr. Baker then says that some facilities lack the equipment to “reliably cut and metalize the slots in the panels” according to Vinciarelli-664’s bulk production process. *Id.* Dr. Baker then states that the lead frame wrapping of Zeng-014 could then be used instead with available equipment so that facilities do not need to acquire new equipment to perform Vinciarelli-664’s process. *Id.* at ¶¶ 140, 144. Dr. Baker also states that, by only relying on available equipment and avoiding new equipment, facilities can “lower the risk factors involved in the manufacturing process from using a newer technology.” *Id.*

138. I do not believe that a POSITA would sacrifice the production output scale and efficiency that I mentioned above for the sake of using available manufacturing equipment. I also disagree with Dr. Baker’s reasoning of avoiding the need to obtain new equipment, because unless a facility is willing to accept a huge drop in production output, it would at the very least still need to acquire additional units of its existing equipment to maintain its production output.

139. Further, a POSITA would understand that the current level of the lead is proportional to its thickness. A thinner lead may be easier to bend, but would not be unable to generate higher currents. For higher currents, thicker leads would be used, but those leads would have to be thicker. A POSITA would have understood that, with thicker leads, curving may cause damage to the body. The power module of Vinciarelli-664 uses higher current leads, and a POSITA would

have understood that there would be risks of damage if a *bending* process as proposed by Dr. Baker were used on them.

140. Therefore, a POSITA would not be motivated to combine Vinciarelli-664 and Zeng-014. It is my opinion that a POSITA would consider Vinciarelli-664 and Zeng-014 to be at odds with each other, particularly with respect to the combination and misplaced motivations as proposed by the Petition and Dr. Baker.

B. Ground 2 (Vinciarelli-218 and Zeng-014)

a. A POSITA Would Not Be Motivated to Combine Vinciarelli-218 and Zeng-014.

141. It is my opinion that a POSITA would not be motivated to combine Vinciarelli-218 and Zeng-014. First, it is my opinion that Vinciarelli-218 already teaches surface mount connectors and a POSITA would not have looked to Zeng-14. Second, it is my opinion that a POSITA would not succeed using Zeng-014's lead frame wrapping to connect to Vinciarelli-218's bar codes. Third, Zeng-014 itself suggests that its lead frame wrapping cannot be used for connecting to Vinciarelli-218's bar codes. Fourth, I have reviewed the Petition's motivation reasoning and find that it is contradictory.

i. Vinciarelli-218's Conductors are Specifically Created for Vinciarelli-218's Modules

142. A POSITA would not have used Zeng-014's conductors with Vinciarelli-218's power modules because Vinciarelli-218 discloses optimal conductors for its power modules.

143. A POSITA would not have considered using the connection techniques from Zeng-014 and would instead have utilized the connectors detailed in Vinciarelli-218. Petitioner wrongly argues that a POSITA would have been motivated to look at Vinciarelli-218's power modules and use Zeng-014's surface mount conductors because "Vinciarelli-218 does not have surface mount conductors." (Pet. at 71-74.)

144. Vinciarelli-218 discloses surface mount conductors that are specifically designed for the unique PCB bar codes. Each of Vinciarelli-218's device modules first exist as part of a larger panel. (EX1009 at Title, Abstract, [0085]-[0087].) From this panel, individual power modules are singulated, *i.e.*, cut. (*Id.*) Shown below is a panel assembly 120 showing an individual device module (annotated yellow) that is cut along lines 128 / 129 (red). (EX1009 at [0105].)

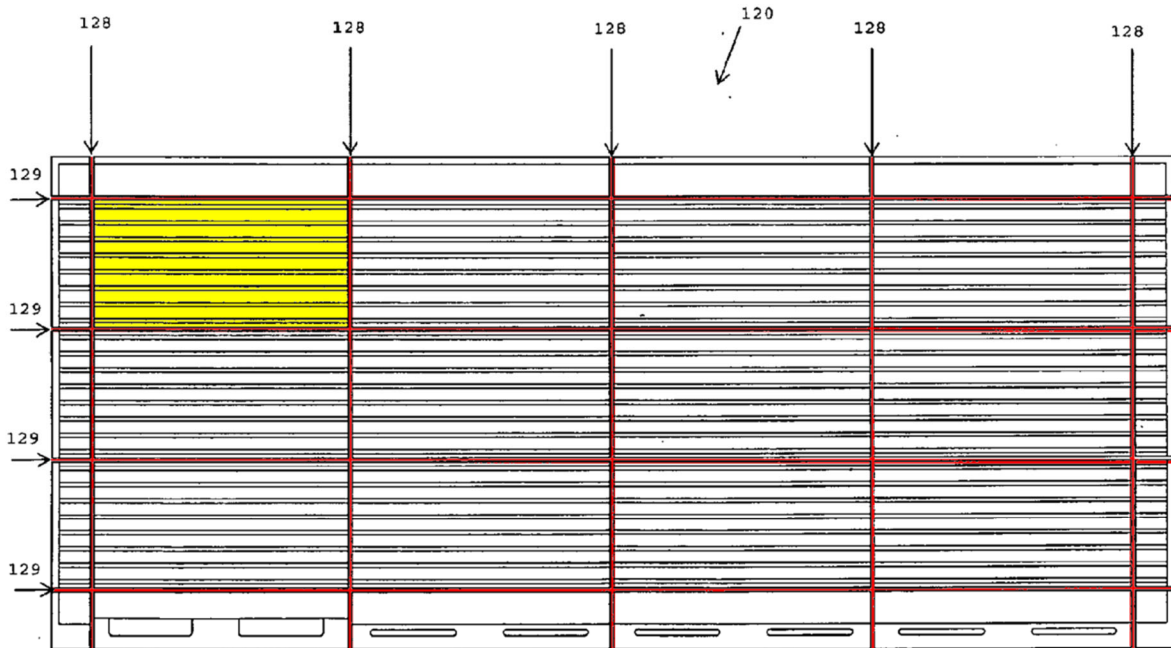
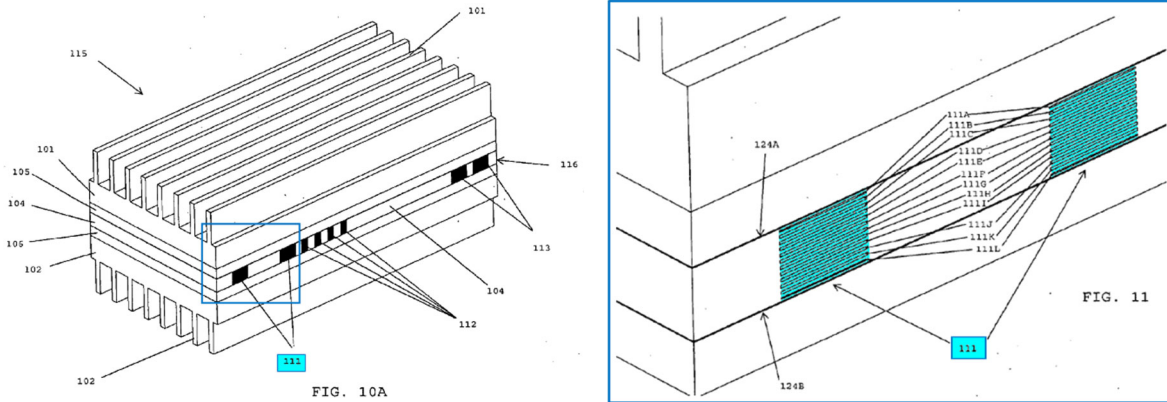


FIG. 9A

145. Cutting Vinciarelli-218's panel to extract a power module exposes its sides, which exposes the power module's conductors (called PCB bar codes) for its internal electronic components. FIGS. 10A and 11 illustrate individual modules' PCB bar codes 111 (aqua) exposed after singulation of the individual module from the panel. (EX1009 at [0108] (stating that conductive features 111 are "formed along the cut line on a plurality of the conductive layers of the PCB [that] form a stack of conductive strips resembling a bar code after singulation"); [0107] (stating that these interconnection features "may be embedded in the PCB panel 124, preferably along the boundaries of the individual circuits" and are exposed on the PCB side edges when a module is singulated from the panel).) The PCB bar codes 111 (aqua) are illustrated in FIG. 10A's depiction of a singulated module (below-

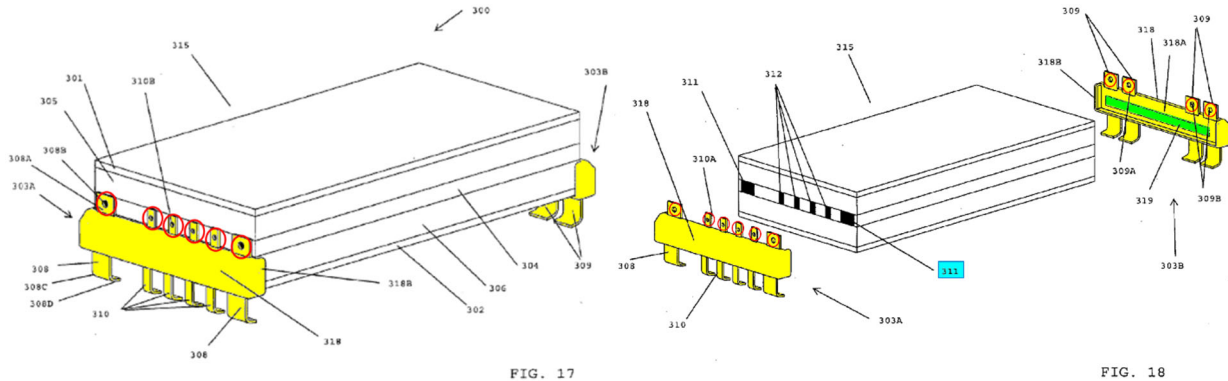
left) and FIG. 11 (below-right) shows an enlarged portion of that module (the approximate portion in the blue box). (*Id.*)



146. Vinciarelli-218’s power module’s PCB bar codes are on its sides because the top and bottom portions of the device are covered with encapsulant (and optionally heat sinks 101, 102) prior to being singulated from the panel. Vinciarelli-218’s panel molding process results in encapsulant covering the top and bottom surfaces of the panel (and its modules) prior to singulation. (Vinciarelli-218 at [0087] (describing a mold cavity that “may be filled at least in part by an encapsulant encapsulating the surfaces of the PCB panel 124 and the electronic components on the PCB panel 124.”).) As a result, the interconnection features for each individual module are necessarily located along the side edges of the power modules.

147. Vinciarelli-218’s adaptors and conductors are designed specifically for its PCB bar codes. While Petitioner argues “Vinciarelli-218 does not have surface mount conductors” (Pet. at 74), in fact it does. Vinciarelli-218’s FIGS. 17-

18, for example, illustrate surface mount adapters 303A/B (yellow) for its PCB bar codes. (*Id.* at [0119]-[0120]; *see also id.* at [0122]-[0125] and FIGS. 19-20.) To provide connection, holes (red) are provided for better solder joints. (*Id.* at [0120].) An epoxy (green) is provided to secure the adapters (yellow) to the module. (*Id.* at [0121].) A POSITA looking at Vinciarelli-218's FIG. 33 would use its own disclosed adapters specifically adapted for its PCB bar codes if a POSITA desired to provide a surface mount device.



148. A POSITA would have understood that Vinciarelli-218's surface mount adapters provide the optimal choice for surface mount devices. While Petitioner proposes wrapping a lead frame onto Vinciarelli-218's FIG. 33, this would lead to complications. None of Vinciarelli-218's adapter/connectors rely upon wrapping, curving, or bending (all of which would be an extra manufacturing step) required by Zeng-014, but all can be directly applied onto the PCB bar codes of Vinciarelli-218. For instance, adapters 803A, 803B have terminal portions formed from a lead frame directly attached or pressed to a heat-sink-less module's

side edge bar codes. (EX1009 at [0160], FIG. 35.) By being attachable directly at the location of side edge bar codes, Vinciarelli-218's own adapters/connectors are superior in establishing and maintaining electrical connection and are attachable in fewer steps (with additional steps leading to potential defects). For these reasons, a POSITA would have chosen Vinciarelli-218's surface mounted adapters, rather than a wrapping process as described by Zeng-014 as alleged by Petitioner.

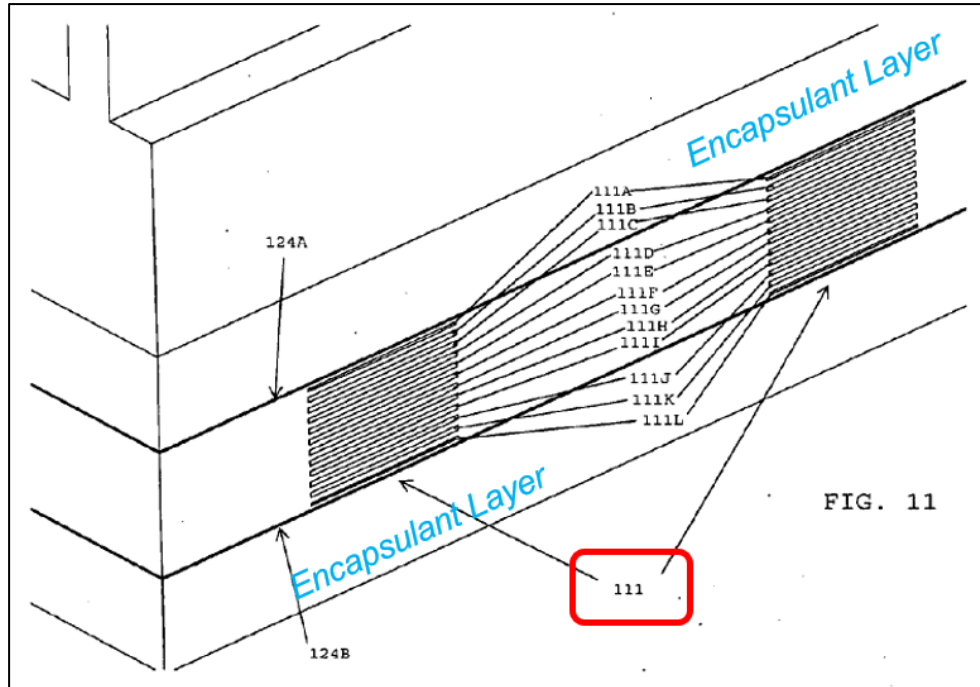
ii. A POSITA would not succeed with Zeng-014's lead frame wrapping on Vinciarelli-218's modules

149. A POSITA would view Zeng-014's teachings as an inferior alternative to solutions already described in Vinciarelli-218. In particular, a POSITA would consider Zeng-014's lead frame wrapping to be infeasible for contacting PCB side edge "bar codes," compared to Vinciarelli-218's adapters specially suited for that purpose.

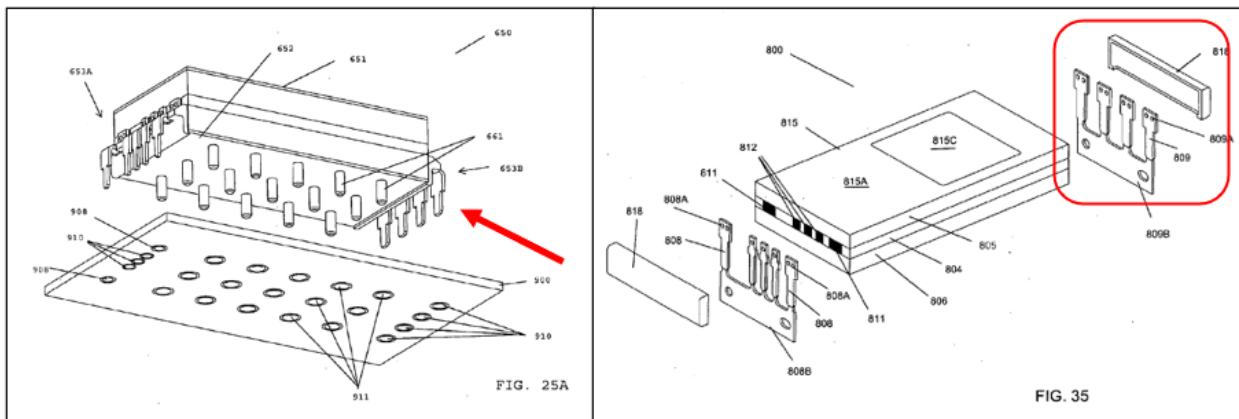
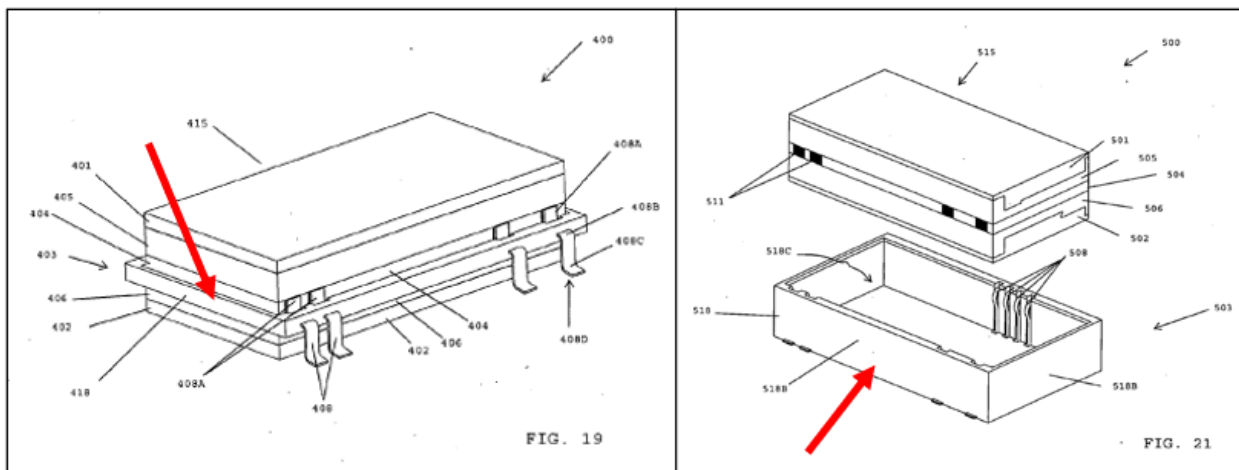
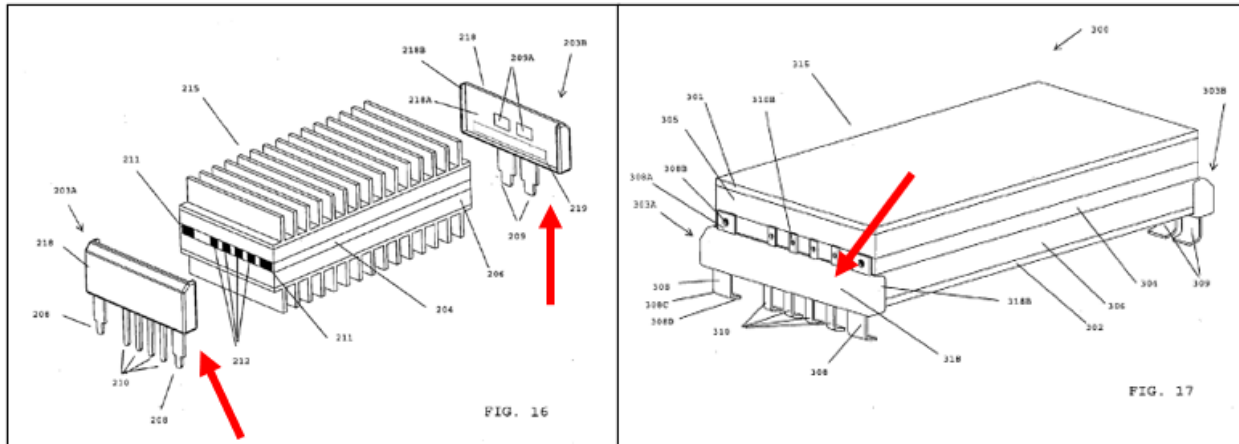
150. As an initial matter, there are differences in materials that Petitioner fails to consider. Conductive wrapping in Zeng-014 is feasible because the inductive component's body is made of a "co-fired magnetic material as a substrate" (EX1008 at [0073]-[0075]) which a POSITA would understand to include a hard ceramic. The conductive material is compressed and bent around the substrate body (EX1008 at [0062]-[0063]) which a POSITA would understand to be feasible given the materials used. Furthermore, the conductor 61 of Zeng-014's FIG. 5B is adhered with a "thermosetting adhesive" via a thermal process.

(EX1008 at [0063].) Petitioner fails to consider these techniques, and further fails to consider bonding to the PCB bar codes of Vinciarelli-218 which makes the combination infeasible.

151. Vinciarelli-218 discloses a need to connect to interconnection features that are disposed on the side edges of a module's PCB ("bar codes") and exposed through panel singulation. The interconnection features have a limited footprint due to encapsulation and panel singulation. The interconnection features are *not on the upper/lower surfaces* of the PCB panel because they would be covered by the encapsulant. Therefore, the interconnection features are necessarily located along the side surfaces/edges of the PCB, which are relatively small. Vinciarelli-218 states that these interconnection features "may be embedded in the PCB panel 124, *preferably along the boundaries* of the individual circuits" and are exposed on the PCB side edges when a module is singulated from the panel. Vinciarelli-218. at [0107]. Specifically, these interconnection features are described as "bar codes", with multiple conductive strips arranged vertically along the *edges* of the PCB. *Id.* at [0108], FIG. 11 (reproduced below with annotation).



152. A POSITA would initially view the small footprint of these bar codes as a potential problem. However, a POSITA would find the solutions to this potential problem later on in Vinciarelli-218. Vinciarelli-218’s disclosure provides “various types of connectors or adapters [that] may be coupled to the exposed interconnects . . . at the edges of the singulated module.” *See* Vinciarelli-218 at [0160]; *see also id.* at [0112]-[0133], FIGs. 13-26, 35 (selectively reproduced below with annotation).



153. For example, the Horizontal Through-Hole Mount adapter shown in FIG. 16 (see above) includes “exposed areas [of two power terminals that] align

with their respective interconnects when the adapters 203A, 203B are assembled onto the module 215.” *Id.* at [0116]. As another example, the Surface-Mount Lead Frame includes a frame body that “leave[s] a portion of the terminals exposed for making connections to their interconnects during assembly and for post assembly inspection.” *Id.* at [0124]. In heat-sink-less embodiments (FIGs. 33-35), adapters 803A, 803B are attached to the horizontal ends of the module where the bar codes are exposed. *Id.* at [0158]-[0160], FIGs. 33-35. Vinciarelli-218 discloses that one of these adapter units can be assembled forming an adapter body to terminals provided on a lead frame, which is removed after assembly. *Id.* Regarding the flush-mount module of FIG. 25A, Vinciarelli-218 discloses that pins 661 electrically connect the bottom heat sink 652 to the customer board (e.g., to ground it), and otherwise provide mechanical support and enhanced thermal conduction. *Id.* at [0133]. Vinciarelli-218 does not describe pins 661 as an interconnections to the PCB, which are separately provided via adapters 653A and 653B. *Id.*

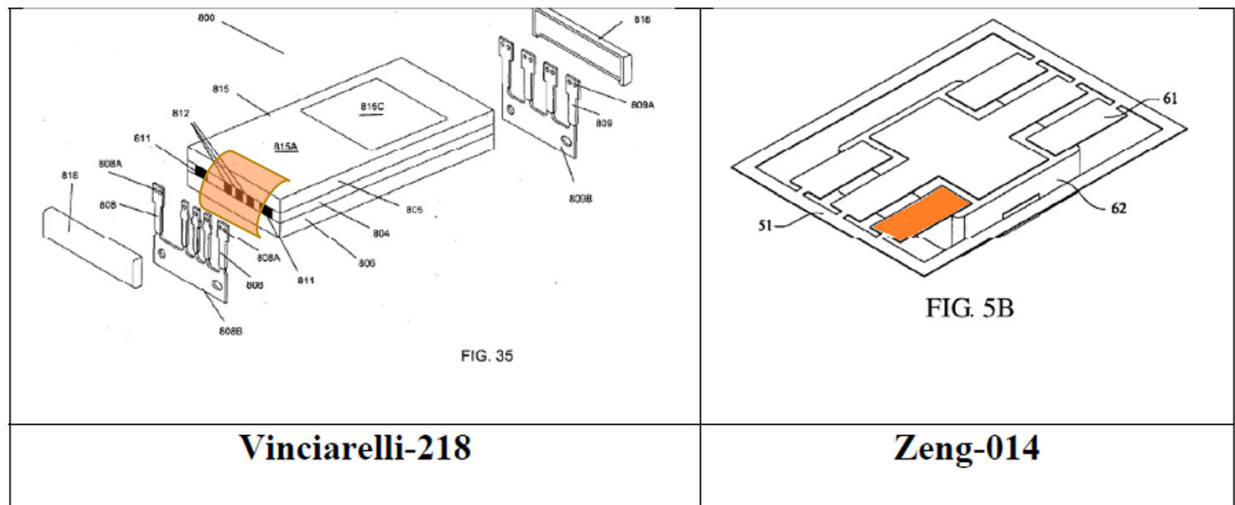
154. A POSITA would readily appreciate that the wide variety of these adapters are well-suited for providing electrical contact to the small bar codes, while also providing versatility to different customer needs. *See id.* at [0132]. It is my opinion that a POSITA reading Vinciarelli-218 would readily recognize these adapters as the solution to the earlier concerns of small bar codes.

155. To the best that I understand, the Petition’s proposed combination uses Zeng-014’s lead frame wrapping as an alternative solution for connecting to the small bar codes of Vinciarelli-218’s module. Petition at 74. The Petition states that “[t]he skilled artisan would recognize that the conductive layer 61 would provide contacts to the interconnects and that the conductive layer and interconnects would each be adjusted as necessary to make the desired electrical contacts.” *Id.* It is my opinion that a POSITA would not do so ***unless driven by hindsight***, given Vinciarelli-218’s disclosure of the adapters (identified above) and the likely electrical failures resulting from the combination (explained below).

156. Petitioner states that the combination is based upon “applying Zeng-014’s lead frame to the module of Vinciarelli-218 and curving the contacts against the module such that the modules form a unitary structure with contact surfaces on the top, bottom, and sides of the module, as taught by Zeng-014.” Petition at 73. Petitioner further explains that “the lead frame in Zeng-014 . . . would be curved over module 800 from the bottom to the top” to replace Vinciarelli-218’s adapters. Petition at 73-74.

157. However, a reasonable POSITA would immediately recognize that curving and wrapping a lead frame like Zeng-014 onto Vinciarelli-218 would fail to ***reliably establish and maintain electrical contact with*** the bar code interconnects. The portions of the lead frame bent from the bottom (or top) onto

the Vinciarelli-218's FIG. 35 module's side surface would retain a degree of bow and bend. Thus, a contact bent onto a module sidewall would not be flush against the module sidewall. From this bowing and bending, there would be a significant gap between the lead frame contact and the side edge bar codes, and it would be difficult to establish an electrical contact between a curved contact and a bar code interconnect. This bending and bowing is demonstrated in the annotated figures below.



158. The bending or bowing is a first obstacle to using wrapped/curved lead frame contacts to contact the bar code interconnects. It is my opinion that this is sufficient to deter a POSITA from forming the combination proposed by the Petition. A POSITA would avoid these bending/bowing problems and stick with Vinciarelli-218's own adapters.

159. Even assuming a POSITA would still attempt to use a curved and bowed contact to contact the bar code interconnects by inserting wet solder into the gap between the contact and the bar code interconnects, a POSITA is bound to run into more problems. Compare, for instance, the engineered contacts of Vinciarelli-218, which are provided with holes for better solder joints (Ex 1009 at [0120], Fig. 17). These holes are located on small tabs, which a POSITA would appreciate provides a smaller thermal mass, as well as a wetting surface to both the barcode and adapter terminals. The PCB bar codes themselves are insufficient wetting surface and would not reliably hold solder, as they do not function as a pad to hold solder and ensure a reliable connection. For mechanical stability, an epoxy is provided to secure the adaptors to the module, which have a flanged design that is fitted to the module (*Id.* at 121). The proposed combination eliminates or detracts from these features, designed to create reliable electrical connections between conductors that may be located near one another. Neither Dr. Baker nor the Petition articulate how, in the proposed combination, a POSITA would have an expectation of success when such features are eliminated.

160. These bowing and imprecision effects necessarily result from Zeng-014's lead frame wrapping but are of little consequence in Zeng-014's intended purpose. Zeng-014's use of this lead frame wrapping does not target small interconnection features disposed on the wrapped body itself. Therefore, it is my

opinion that a POSITA would also recognize that Zeng-014's lead frame wrapping is not particularly well-suited for targeting Vinciarelli-218's bar codes.

161. A POSITA would understand that the current level of the lead is proportional to its thickness. A thinner lead may be easier to bend, but would not be unable to generate higher currents. For higher currents, thicker leads would be used, but those leads would have to be thicker. A POSITA would have understood that, with thicker leads, curving may cause damage to the body. The power module of Vinciarelli-218 uses higher current leads, and a POSITA would have understood that there would be risks of damage if a bending process were used on them.

162. Furthermore, Vinciarelli-218's own adapters/connectors do not suffer from such bowing and imprecision as Zeng-014's lead frame wrapping would. None of Vinciarelli-218's adapter/connectors rely upon wrapping, curving, or bending, and can be directly applied onto the side edge bar codes. For instance, the adapters 803A, 803B having terminal portions formed from a lead frame are directly attached or pressed to a heat-sink-less module's side edge bar codes. Vinciarelli-218 at [0160], FIG. 35. By being attachable directly at the location of side edge bar codes, it is my opinion that Vinciarelli-218's own adapters/connectors are superior in establishing and maintaining electrical connection than the proposed application of Zeng-014's lead frame wrapping.

163. Finally, it is my opinion that a POSITA would not have been motivated to use (1) physical attachment, (2) adhesive, or (3) solder for the combination. As I initially stated, a pure mechanical attachment would not work as there would not be reliable connection with the PCB bar codes. Second, a POSITA would not have been motivated to take Vinciarelli-218's solder bonds to adapters and replace it with conductive adhesives (such as those that use tin or silver). Those types of adhesives are more expensive than solder and have less electrical and thermal connectivity. Finally, soldering Zeng-014's conductors onto Vinciarelli-218's PCB bar codes would be impractical. There would be physical material (the solder) between Zeng-014's conductor and Vinciarelli-218's module prior to bending; and the process of bending the conductor onto Vinciarelli-218's module could result in damage due to the solder creating a small pressure point between the conductor/module. Furthermore, bending then reflowing solder would result in more difficulties; since solder could migrate under the leadframe during reflow, or down the lateral face of the assembly. A POSITA would recognize that this reflow process would be hard to reliably control, especially with multiple solder joints and/or barcodes.

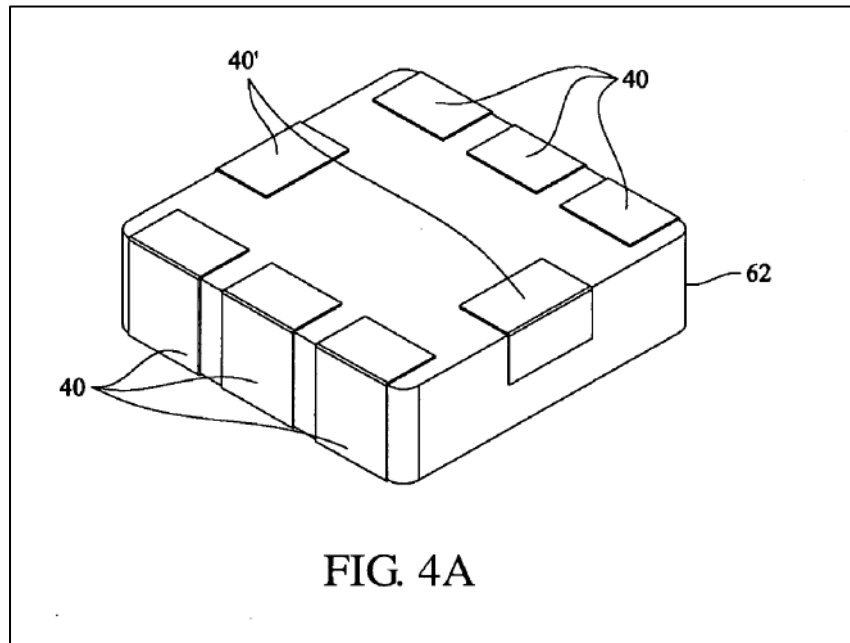
164. In my opinion, this expected failure is sufficient for a POSITA to not be motivated to apply Zeng-014 to Vinciarelli-218.

iii. A POSITA would not contradict Zeng-014's intended purpose with lead frame wrapping.

165. It is also my opinion that Zeng-014 *teaches away* from using its lead frame wrapping to electrically contact Vinciarelli-218's bar code interconnects. Zeng-014's wrapping avoids direct electrical contact with internal parts of the wrapped body; yet, that is the exact goal described by Petitioner in its alleged prior art combination.

166. Zeng-014 discloses that the lead frame that is wrapped is *not soldered* at any location; instead, adhesives are used to attach the lead frame to the wrapped body. Zeng-014 at [0063]. It is also clear to a POSITA that the component being wrapped is encased; for example, the active inductor coil is located within insulation material. *Id.* at [0075]. Zeng-014 explicitly explains that the wrapped lead frame is kept electrically separate from pin conductors that are coupled to the internals of the wrapped body (e.g., a magnetic core or inductive coil). In contrast to pin conductors of the conductive surface, the connecting conductors that are added to the conductive surface via wrapping do not directly form electrical connections with any part of the body being wrapped. *Id.* at [0059] ("no direct physical and electrical connection exists on the outer surface between at least a portion of the connecting conductor 40 and the pin conductor 40'."). Zeng-014 discloses that "the pin conductor is configured to be pins of the inductor for indirect connection with the connecting conductor *via the first carrier.*" *Id.* at claim 5 (emphasis added). Zeng-014 explains that keeping this separation between

the connecting conductors and the pin conductors (and by extension, the wrapped body's internals) and instead only relying upon indirect connection improves heat dissipation performance. *Id.* at [0059].



167. It is via the lead frame wrapping that these connecting conductors are formed. *Id.* at [0062]. That is, Zeng-014 teaches away from the lead frame being wrapped in any manner that forms direct electrical connection with the pin conductors or other connection features of the body being wrapped. A POSITA would understand the need to electrically isolate the wrapped lead frame from direct connections as such, given Zeng-014's explanation of heat dissipation performance.

168. As a result, it is my opinion that it is a direct contradiction of Zeng-014's teachings to have the wrap a lead frame to establish electrical connection

with the bar codes of Vinciarelli-218's module. In my opinion, this contradiction of Zeng-014's intended purpose is sufficient for a POSITA to not be motivated to apply Zeng-014 to Vinciarelli-218.

iv. None of Petitioner's Reasons to Combine is Supported

169. I have also reviewed Petitioner's stated reasons for combining Vinciarelli-218 and Zeng-014. I believe that those reasons are inconsistent and conflict with one another.

170. Petitioner first argues that Vinciarelli-218's encapsulated embodiment would have Zeng-014's lead frames to "provide a compact surface mount version of the module." (Pet. at 71.) Petitioner fails to present any evidence that modifying Vinciarelli-218's FIG. 33 with Zeng-014's conductors would lead to a "compact" version of the module. Moreover, its arguments do not present any evidence that would demonstrate that a POSITA would not simply choose the surface mount conductors already taught in Vinciarelli-218.

171. This combination would lead to the exact opposite result Petitioner argues for. Placing lead frames atop (and below) Vinciarelli-218's embodiment increases size, not decreases it. *See* Zeng-014's Figs. 8A and 9A where (as exemplary of other embodiments) the wrapped lead frame is not flush with the top and bottom surfaces of the electronic component. Moreover, the only reason to have conductors both on top and bottom is to allow stacked modules. Stacked

modules (i.e., one Vinciarelli-218 module on top of another) also increases overall vertical size of the overall device, an issue Petitioner does not address. Petitioner's first reason for combination fails.

172. Petitioner's second reason is that for devices where heat is not a consideration, stacking is viable to save board space. (Pet. at 72.) Petitioner's argument demonstrates the failure in its rationale; there would be heat considerations when stacking devices. A POSITA looking at Vinciarelli-218 would have understood that heat is a significant consideration of its disclosure. Indeed, nearly the entirety of the specification is dedicated to heat dissipating devices. A POSITA would not have undertaken additional manufacturing steps to create a device for stacking when such device would have problems with heat dissipation. Nonetheless, stacking devices conflicts with the immediately preceding motivation of decreasing height.

173. Petitioner's third reason that the connection part provides flush mounting lacks evidentiary support. (Pet. at 72.) Nonetheless, providing a conductor atop (and below) Vinciarelli-218's encapsulated device increases size and makes the device less flush.

174. Petitioner's fourth reason is simply a broad-stroke statement that a POSITA would apply Zeng-014 to the power-converter modules of Vinciarelli-218 because Zeng-014 states it applies to other electronic components. (Pet. at 73. Ex

1003 at 165) In my opinion, a broad statement like this does not mean that Zeng-014's teachings can simply be combined with anything.

175. Petitioner's fifth reason which refers to increased power density and decreasing area is overly generic. In my experience, conflicting goals of volume and thermal management are always concerns in power electronics. Expressing these generic design goals and applications (e.g., being deployable "at the point of load") would not motivate a POSITA to alter the different interconnection strategies of Zeng-014 or Vinciarelli-218. Petitioner further provides no reason why its combination achieves increased power density and decreases area. For instance, neither Dr. Baker nor Petitioner address why a POSITA would make a device that increases height through extra lead-frames atop and on the bottom of the structure.

176. Petitioner does not answer the question regarding why a POSITA would modify Vinciarelli-218 to add conductors atop it. A POSITA would not provide Zeng-014's conductors as described previously. Moreover, providing conductors atop Vinciarelli-218's power modules contradicts its other teachings. Vinciarelli-218 describes making its devices compatible with heating dissipation, i.e., via heatsinks. (Vinciarelli-218 at [0082], FIG. 1.) Vinciarelli-218 does have a singular embodiment lacking a heatsink (Vinciarelli-218, [0159]-[0160]) but a POSITA would not have read it outside of the context of the rest of the patent

which is directed to heat dissipation. A POSITA would not view an embodiment of Vinciarelli-218 lacking a heatsink as being one where heat dissipation is no longer a concern. Every other embodiment is directed to heat dissipation, and making one of those devices stackable via conductors on top, would cause heat to get trapped on the lower devices. A POSITA would not have made that combination.

177. Therefore, it is my opinion that the Petition does not include an actual motivation for a POSITA to apply Zeng-014 to Vinciarelli-218.

b. Ground 2 does not teach [1g]’s structure.

178. It is my opinion that Ground 2’s prior art combination does not meet the structure associated with [1g]. As stated above, this structure includes the first connection part being fixed at the first electronic component for mechanical support.

179. In the Petition’s proposed combination, Zeng-014’s lead frame wrapping process is applied to Vinciarelli-218’s module, and this involves curving a lead frame contact against Vinciarelli-218’s module. Petition at 80. However, I have found no indication in the Petition or by Dr. Baker that this proposed combination results in mechanically supporting the curved lead frame contact with a component of Vinciarelli-218’s module, or in the curved lead frame contact

being fixed at the component. Therefore, I have the opinion that the prior art combination does not meet the structure associated with [1g].

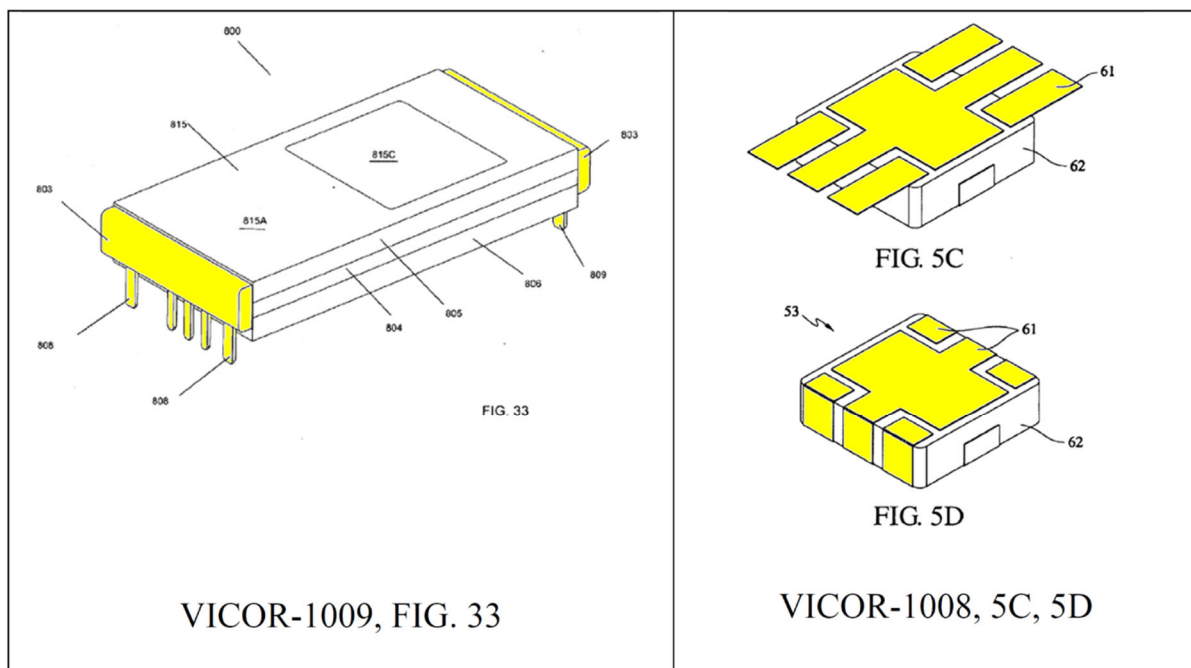
C. Ground 3 (Zeng-014 and Vinciarelli-218)

a. Petitioner's Combination Fails

180. Petitioner's combination for [1g] fails at a threshold level.

181. Petitioner combines Vinciarelli-218's FIG. 33 with Zeng-014's FIG. 5C-5D to arrive at claim [1g]. (Pet. at 93 "the entire power converter would take a shape similar to the module of FIG. 33 of Vinciarelli-218 without the adapter and instead with the Zeng-014 conductive layer 61, which would be applied to the entire module rather than one component.") Petitioner, however, lacks any evidence demonstrating that a POSITA would have made this combination.

**Petitioner applies Zeng-014's conductors
to replace Vinciarelli-218's conductors**



182. Ground 3 is devoid of any rationale supporting wrapping Zeng's conductor of FIGS. 5C/D onto Vinciarelli-218's FIG. 33 (or any other module). (Pet. at 93.) The only motivations for combination provided by Petitioner are inapplicable to the limitations of [1g]; they apply to [1f], which is an entirely different limitation relating the carrier location ("wherein the carrier is disposed at $\frac{1}{3}$ to $\frac{2}{3}$ of a height of the power converter") that does not involve the conductor. (Id. at 90-92.) Moreover, that combination is on entirely different figures of Vinciarelli-218 (FIG. 6) and Zeng-014 (FIG. 6B). (Id. at 90-92.) Petitioner's Ground 3 analysis thus lacks any motivation whatsoever to apply wrapped conductors of Zeng-014 to Vinciarelli-218.

183. Dr. Baker likewise articulates no motivation for combining Zeng-014 and Vinciarelli-218 – beyond the contention that Zeng-014 is general "applicable to many types of power converters" – and instead ignores material differences between the references. (Ex. 1002 at para.190). As Dr. Baker explains Ground 3, "a skilled artisan would start with Zeng-014 and improve the power converter by packaging it as a single module as taught by Vinciarelli-218, and would further modify Zeng-014 to include versions of the device with internals disclosed in Vinciarelli-218 (as well as a Zeng-014 basic power converter). The skilled artisan would then apply Zeng-014's teaching concerning wrapping an electronic component with a conductive layer to the power converter module." *Id.* However,

as I explain below, Dr. Baker provides no reason why a POSITA would jettison interconnect features of Zeng-014, change the internal circuitry of its power module, then bafflingly re-apply Zeng-014's lead-frame wrapping technique to the resulting "single module." Dr. Baker doesn't even show what such a "single module" would look like. Ground 3 accordingly fails at a threshold level because Petitioner and Dr. Baker fail to present any rationale to apply Zeng-014's FIG. 5C/5D conductors to Vinciarelli-218's FIG. 33.

b. Petitioner's Combination Fails to Present a Motivation

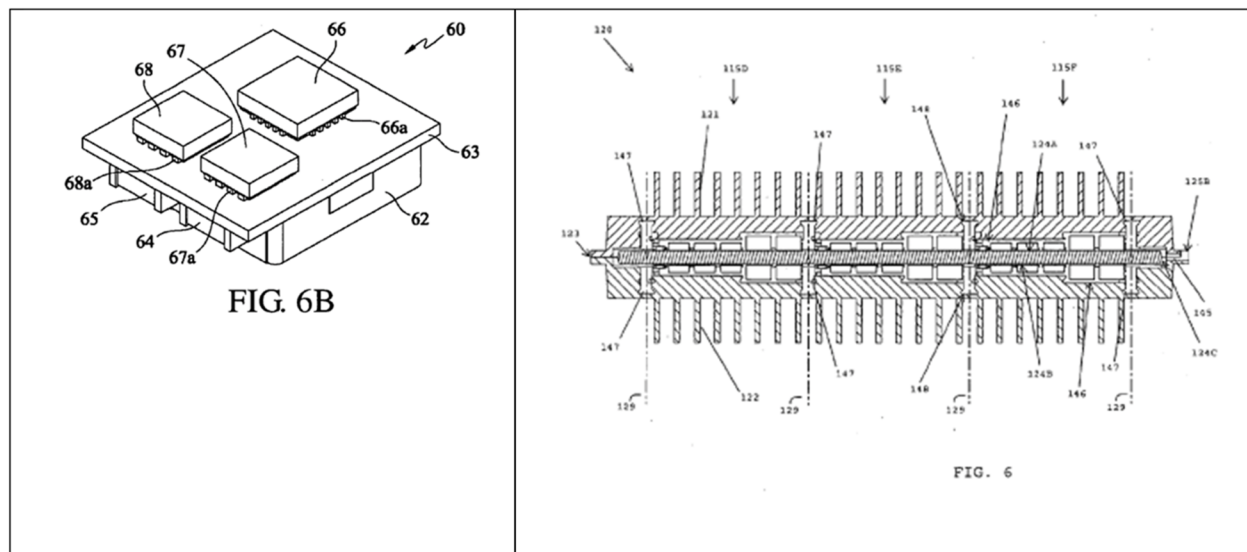
184. As noted, the Petition is devoid of motivations to combine for 1[g]. To the extent that motivations are inferred from Ground 2 to the combination of Ground 3's [1g], Petitioner's motivations to wrap Zeng-014's conductors to Vinciarelli-218's power module in Ground 3 fail for the same reasons as described in Ground 2 because the embodiments relied upon in Ground 2 are substantively similar to the embodiments relied upon in Ground 3.

c. Petitioner's Ground 3 Applies Different Teachings Across Limitations [1f] and [1g].

185. Petitioner's Ground 3 relies on different and contradictory teachings of Vinciarelli-218 between limitations [1f] and [1g]. The Petition does not take consistent embodiments applied consistently across limitations. This fails to demonstrate a motivation to combine and obviousness.

186. Ground 3 relies on Vinciarelli-218's FIG. 6's form factor to satisfy [1f]. Petitioner's analysis for [1f] purports to "package the DC to DC converter 60 of Zeng-014 within an encapsulated module as proposed by Vinciarelli-218—from the form factor on the left below to the form factor on the right." (Pet. at 91)

Petitioner's graphic from page 92 of the Petition showing FIG. 6 of Vinciarelli-218 is excerpted below.



187. Petitioner's combination utilizes the form factor of Vinciarelli-218's FIG. 6 to satisfy [1f] but then analyzes an entirely different form factor of Vinciarelli-218 (FIG. 33) to satisfy [1g].

188. For [1g], Petitioner argues that "the entire power converter would take a shape similar to the module of FIG. 33 of Vinciarelli-218 without the adapter and instead with the Zeng-014 conductive layer 61." (Pet. at 93.) Petitioner's Ground 3 creates a different device between [1f] and [1g] but provides no rationale

describing how it can mix embodiments of Vinciarelli-218 between [1f] and [1g].

Ground 3 thus fails at a threshold level.

189. The change from the form factor in FIG. 6 to the one in FIG. 33 is material. As can be seen in the below left, FIG. 6 has a heat sink panel 121 (yellow). This heatsink would disallow connection of conductors as Petitioner advocates for in [1g]. The two devices (FIG. 6 and FIG. 33) moreover have differently sized components and FIG. 6 has an uneven surface (red arrow). FIG. 33 has flat upper and bottom surfaces, as would be required for the combination of [1g] to make sense with Zeng-014's conductors. Petitioner's change between form factors is material.

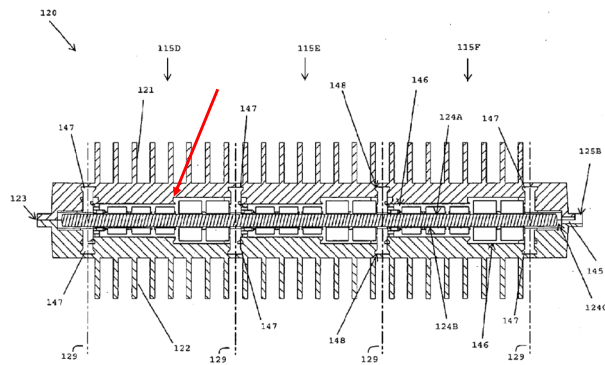


FIG. 6

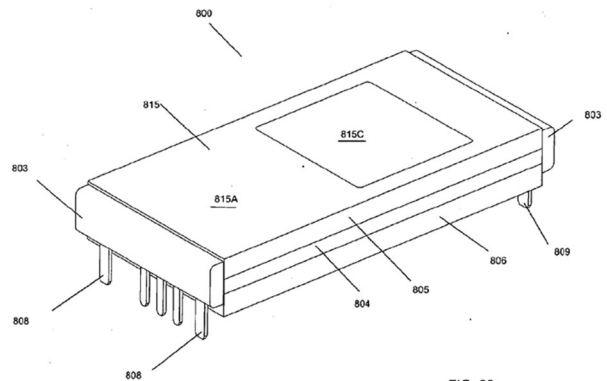


FIG. 33

190. As a consequence, Ground 3 fails at a threshold level because Petitioner relies on entirely different devices of Vinciarelli-218 between [1f] and [1g].

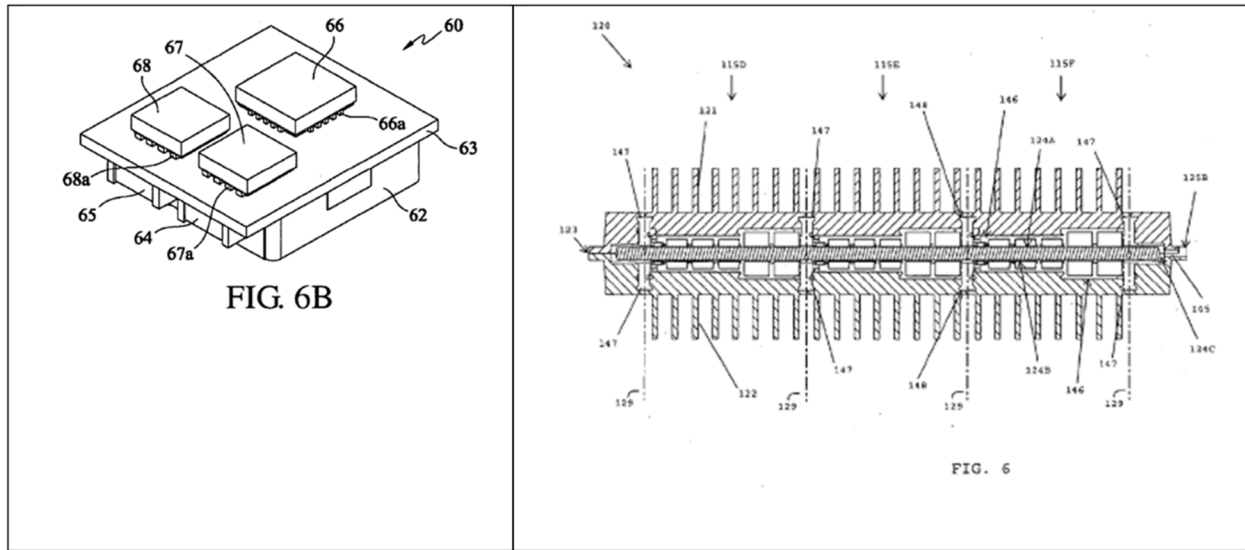
d. Petitioner's Combination Fails with Respect to [1f]

191. Petitioner's combination fails for two reasons. First, it fails to teach limitations of [1f] because Petitioner failed to consider the actual components of its combination. Second, to arrive at the limitation of [1f], an extra bulky component would need to be needlessly added to the circuit. A POSITA would not have added that component, and to do so is hindsight bias.

i. Petitioner's Combination Fails to Teach Limitations of [1f]

192. Petitioner's combination fails to arrive at the carrier-orientation limitation [1f] ("the carrier is disposed at 1/3 to 2/3 of a height of the power converter") because the components of Zeng-014 preclude it from being taught. Specifically, Zeng-014 has a single larger and necessary component (an inductor) that is on one side of the power-supply substrate. The result necessarily has one side of the power supply significantly bigger than the other and, consequently, the limitation of [1f] is not met. *See also* my discussion below regarding lack of motivation to arrive at [1f], which I incorporate here.

193. As noted immediately above, Petitioner's analysis for [1f] purports to "package the DC to DC converter 60 of Zeng-014 within an encapsulated module as proposed by Vinciarelli-218—from the form factor on the left below to the form factor on the right." (Pet. at 91.) Petitioner's graphic from page 92 of the Petition showing FIG. 6 of Vinciarelli-218 is excerpted below.



194. Petitioner, however, fails to consider the actual components of Zeng-014's FIG. 6B (and arrangement of those components) when it combines that device with the form factor of Vinciarelli-218's FIG. 6. Neither Petitioner nor Dr. Baker even show what Zeng-014's DC to DC converter would look like as an "encapsulated module." Specifically, Zeng-014's FIG. 6B has a singular larger component, the inductor 62 (lavender, below),¹ on one side of the device.

(EX1008 at [0065].) "[T]he body of the inductive component 62 ... serves as the mechanical support for the entire DC to DC converter." (EX1008 at [0069].)

Zeng-014, moreover, confirms that a singular inductor is used as confirmed via its other figures. (See, e.g., EX1008 at FIG. 1, 2A, 2B, 3A, 6A, 6B, 6C, 9B, 10, 11A, 11B, 12A, 13A, 13B.) In my opinion, any combination of Zeng-014's FIG. 6B would retain the same components and that single, large inductor. *See also my*

¹ Below, component 66 is a control chip, components 64 and 65 are capacitors, and components 67 and 68 are FETs. (EX1008 at [0066].)

discussion below regarding lack of motivation to arrive at [1f], which I incorporate here.

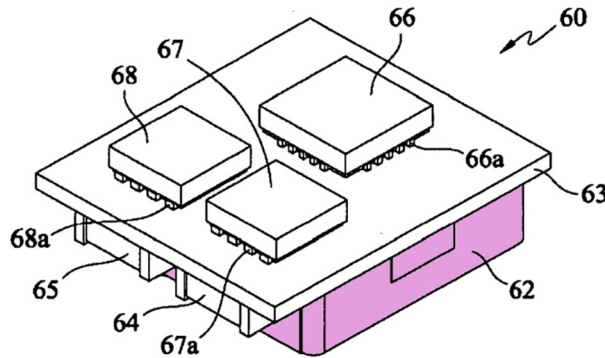


FIG. 6B

195. The inductor's size would preclude the carrier from meeting [1f]. [1f] requires that "the carrier is disposed at 1/3 to 2/3 of a height of the power converter." The inductor, however, is large and because there is only one inductor, the side that maintains the inductor will be significantly larger than the region of the carrier and the top region. [1f] is thus not met by Petitioner's combination.

ii. Petitioner's Combination Fails to Present Motivation to Arrive at [1f]

196. Petitioner's combination further fails to present motivation to arrive at the limitations of [1f] for several reasons. Its combination adds several electrical components (an inductor and connective adaptors) for no reason and to the detriment of the device and its manufacturing process. In my opinion, Petitioner's combination is textbook hindsight bias.

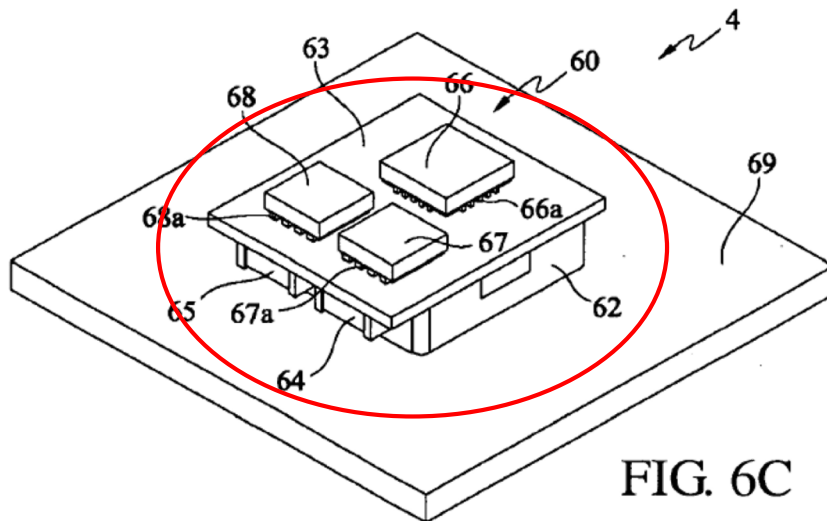
197. First, as detailed above, Ground 3 fails to demonstrate that [1f] is obvious because the inductor on one side of the power supply precludes [1f] from being met. Petitioner presents no motivation to remedy that situation to arrive at [1f], i.e., provide an inductor on the opposite side of the power-supply substrate to mirror inductor 62. Its motivations are generically directed to Zeng-014 and Vinciarelli-218 being directed to the same field of endeavor (Pet. at 90-91), which in my opinion is insufficient. Recitation of generic design goals and applications (e.g., a “DC to DC converter” deployable “at the point of load”) would not motivate a POSITA to modify Zeng-014 or Vinciarelli-218, which have different forms factors dictated by their interconnections. Moreover, Zeng-014 (as a starting point for a POSITA in Ground 3), depicts conventional PCB assembly that is lopsided and employs terminals on its largest component (an inductor) to connect the module as a whole. Zeng-014 does no mention strain in this conventional PCB assembly, encapsulation of the assembly, or any trade-off between strain and power density. In contrast, embodiments in the ’263 Patent specification address both warping/stress mitigation and power density by disposing carriers at 1/3 to 2/3 of a height of the power converter. *See, e.g.*, ’263 Patent at 5:3-22, 5:43-59. In short, none of Petitioner’s motivations specifically address the issue of adding an additional inductor on the opposite end of Zeng-014’s FIG. 6B inductor 62. (Pet.

at 90-91.) Consequently, the Petition fails to demonstrate that [1f] of Ground 3 is obvious.

198. Further, a POSITA would not have added an additional inductor to mirror inductor 62 for several reasons. An additional inductor is another bulky and unnecessary component that a POSITA would not desire to add. *See e.g.*, the schematic of the point-of-load (POL) regulator in Zeng-014, which includes just one inductor (Ex 1008, Fig. 1). A POSITA would appreciate that this inductor is the largest component of the power-supply assembly, and that is exactly how it is depicted in Zeng-014. In both the prior-art modules (*id.* Figs 2A, 2B, 3A, 3B) and Zeng-014's improved modules with compact interconnect (*id.* Figs. 6A, 6B, 6C, 7B, 8B, 9B, 10), the module is lopsided and supported in Zeng-014's improvement by the single, large inductor. Zeng-014 moreover does not depict bi-lateral core pieces joined around traces on the substrate to form a complete magnetic component. Where Zeng-014 does depict inductor traces built into the substrate, the resulting magnetic component is depicted as a block, and the resulting assembly is still lopsided. *Id.* Figs. 11A, 11B, 12A, 12B. Adding *yet another* large component would add to the cost of the device. Moreover, adding another inductor opposite the Zeng-014 inductor on the other side of the substrate would add to the height of the DC-DC power supply, and there would be no functional

reason to do so. The only reason to do so is to arrive at the claims, which is hindsight bias.

199. Second, Petitioner's combination requires added connective adaptors (and manufacturing steps). As shown in FIG. 6C (below), Zeng-014's DC-DC converter is connected to the circuit board 69 via the conductors on the surface of the inductor 62 (lavender). (EX1008 at [0069].) Petitioner's combination takes the DC-DC converter of Zeng-014 and applies to it the form factor of Vinciarelli-218's FIG. 34, which would result Vinciarelli-218's FIG. 34 being encapsulated with additional connectors from Zeng-014.



200. As Dr. Baker explains Ground 3, “a skilled artisan would start with Zeng-014 and improve the power converter by packaging it as a single module as taught by Vinciarelli-218, and would further modify Zeng-014 to include versions of the device with internals disclosed in Vinciarelli-218 (as well as a Zeng-014

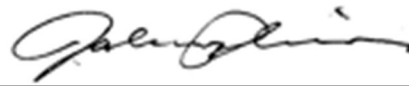
basic power converter). The skilled artisan would then apply Zeng-014's teaching concerning wrapping an electronic component with a conductive layer to the power converter module," (Ex. 1002 at para.190). This combination would require several additional manufacturing steps, which Petitioner has failed to provide any rationale for. A POSITA would not have made this combination because it requires extra components and extra manufacturing steps. Additionally, the features originally in Zeng-014 were there for a reason, as I explained previously (see, e.g., Ex 1008 at [0059], explaining the improved thermal dissipation of wrapping a single component with "connecting conductors" and "pin conductors," with electrical continuity via the substrate). Neither the Petition nor Dr. Baker explain why a POSITA would remove compact interconnect or thermal features of Zeng-014, then re-apply Zeng-014's lead-frame wrapping technique to the resulting "single module" without the benefits that Zeng-014 teaches. As a consequence, the Petition fails to present a motivation to combine to arrive at [1f].

I, Joshua Phinney, declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both,
under Section 1001 of Title 18 of the United States Code.

Dated: December 30, 2024

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Joshua Phinney", written in black ink.

Joshua Phinney, Ph.D.