UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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GOOGLE LLC,

Petitioner,

v.

DDC TECHNOLOGY, LLC,

Patent Owner.

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IPR2023-00708

U.S. Patent 9,811,184

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**DECLARATION OF BOB MACKEY**

## I. Introduction

1. I have been retained by DDC Technology, LLC ("Patent Owner") as a technical expert in connection with the proceeding identified above. I submit this declaration in support of the Patent Owner's Response to the Petition for Inter Partes Review of U.S. Patent No. 9,811,184 ("the '184 patent"). I have been retained to provide a technical opinion concerning the '184 patent with respect to the challenges presented by the Petitioner.

2. I am being compensated for my time working on this matter at my customary hourly rate for consulting work of this nature. I have no personal stake nor interest in the outcome of the present proceeding or in either party to this proceeding.

3. In forming my opinions stated in this declaration, I reviewed and am familiar with the '184 patent. I understand that Petitioner has requested Inter Partes Review ("IPR") of the '184 patent. I have also reviewed the materials Petitioner cited in support of its petition, including the Declaration of Kurtis P. Keller (Ex. 1002), the '184 patent, its prosecution history, and the art cited in the Petition.

## II. Background and Qualifications

4. Appendix A is a copy of my curriculum vitae with a list of cases where I have been retained in the past 5 years.

5. I am a retired engineer and researcher with over twenty years of experience in the consumer electronics industry developing electronic displays, touch sensors, human interfaces, and biometric devices. Approximately 70 U.S. patents have been issued for my inventions and hundreds more have been prosecuted with my input. From 2001 to 2017, I was employed by Synaptics, where I led development of touchscreens and launched the "ClearPad" transparent touchscreen product line in 2002. In 2006 we provided the touchscreen for the world's first all-touchscreen smartphone, the LG Prada. A year later, Apple launched the iPhone, bringing touchscreen interfaces to the mass markets. While at Synaptics, we supplied billions of capacitive touchscreens and touch-displays to all of the major smartphone suppliers. Twenty-seven of the patents listed in Appendix A are for innovations in capacitive touch sensing. After retiring from the consumer electronics industry in 2017, I have consulted on intellectual property strategy, invention harvesting, and patent prosecution.

6. By virtue of at least the above education and experiences, I have gained a detailed understanding of the technology that is the subject of my Declaration. As such, I am qualified to provide opinions regarding the state of the art at the time of the priority date (which is July 16, 2014, the filing date of the first provisional application to which the '184 patent claims priority), as well as how one of ordinary skill in the art at that time would have interpreted and understood

the claimed inventions. However, the opinions I express herein would not change if the priority date were July 16, 2015, the filing date of the first non-provisional application to which the ’184 patent claims priority.

## III. Relevant Legal Standards

7. I am not an attorney and I have no opinions on the law. Patent Owner’s legal counsel has provided me with legal standards and asked me to apply those standards to the facts and to my opinions in the present IPR.

8. I understand that the validity analysis involves two steps. First, one must construe the terms of the patent claims to understand what meaning one of ordinary skill in the art would give the terms (which process may conclude that a term should be given its plain and ordinary meaning). Second, after the claim terms have been construed, one may then assess validity by comparing a patent claim to the “prior art.” I understand that the teaching of the prior art is viewed through the eyes of a person of ordinary skill in the art (“POSA”) at the time the invention was made.

### A. Obviousness

9. I understand that Petitioner has asserted that the challenged claims currently at issue are invalid as being obvious under 35 U.S.C. § 103 in light of the prior art. I understand that in an IPR, a claim may be invalid under § 103 if the Petitioner establishes by a preponderance of the evidence that the claimed

invention as a whole would have been obvious to a POSA at the time the invention was made. I understand that obviousness is a legal conclusion. I do not offer a legal conclusion, but rather provide testimony herein regarding the relevant facts underlying the legal conclusion. This includes the relevant art, the scope and content of the prior art, the motivation to combine the art, and the differences between the prior art and the claims.

10. I understand that even though an invention may not have been identically disclosed or described before it was made by an inventor, in order to be patentable, the invention must also not have been obvious to a POSA in the field of technology of the patent before the priority date of the patent.

11. I understand that in determining whether a claimed invention is obvious, one must consider the level of ordinary skill in the field of the invention that someone would have had as of the patent's priority date, the scope and content of the asserted prior art, any differences between the prior art and the claimed invention, whether a POSA would have been motivated to combine the prior-art references, and, if present, objective evidence or secondary considerations.

12. I understand that it is not permissible to use hindsight or *ex post* reasoning in assessing whether a claimed invention is invalid for obviousness. For example, an invention should not be considered in view of what a POSA would

know today, nor can it be reconstructed after the fact by reading into the prior art the teachings of the invention at issue.

13. I understand that obviousness cannot be proven merely by showing that an invention is a combination of elements that were previously known in the prior art. Rather, in an IPR, a patent challenger must further establish by a preponderance of the evidence that there were apparent reasons that would have prompted a POSA to have combined these known elements in the fashion claimed by the patent. Such reasons might include, for example, teachings, suggestions, or motivations to combine that would have been apparent to a POSA.

14. I also understand that one should keep in mind that the existence of each and every element of the claimed invention in the prior art does not necessarily prove obviousness. Most, if not all, inventions rely on building blocks of prior art. In considering whether a claimed invention is obvious, I understand that one should consider whether, at the time of the patent's priority date, there was a reason that would have prompted a POSA to combine the prior art in the manner proposed, taking into account such factors as (1) whether the claimed invention was merely the predictable result of using prior art elements according to their known function(s); (2) whether the claimed invention provides an obvious solution to a known problem in the relevant field; (3) whether the prior art teaches or suggests the desirability of combining elements claimed in the invention; (4)

whether the prior art teaches away from combining elements in the claimed invention; and (5) whether it would have been obvious to try the combinations of elements, such as when there is a design incentive or market pressure to solve a problem and there are a finite number of identified, predictable solutions. To find that the asserted combination of prior art rendered the claimed invention obvious, one must find that the asserted combination of the prior art provided a reasonable expectation of success.

15. I also understand that "obvious to try" is not sufficient in unpredictable technologies.

### B. Independent and Dependent Claims

16. I understand that a dependent claim incorporates by reference all the limitations of the independent claim (and any intervening claims) from which it depends. Therefore, I understand that to prove that a dependent claim is obvious, a prior art reference, combination of references, and/or general knowledge in the art must disclose each and every claim limitation of the dependent claim, in addition to each and every limitation of the claims from which it depends.

## IV. Definition of a Person of Ordinary Skill in the Art

17. Petitioner asserts that a POSA at the time of the invention of the '184 patent would have "a minimum of an undergraduate degree (or equivalent) in mechanical engineering or a related field, with knowledge of mechanical actuation

systems, basic optical design with lenses, head-mounted displays, a basic understanding of touchscreen technology, and at least two years of professional experience in mechanical and basic optical design or engineering."

18. Petitioner's proposed definition of a POSA gives too much weight to certain skills/experience that are of limited importance with respect to the '184 Patent, and too little weight to other skills/experience that are pertinent to the claimed inventions of the '184 Patent. For example, Petitioner proposes a degree in "mechanical engineering or a related field." Petitioner thus affords undue weight to the mechanical actuation mechanism of the claimed inventions, which mechanisms are simple machines readily understood by even those with limited specific educational background. Petitioner further proposes that the POSA should have knowledge of "basic optical design with lenses," despite the fact that the '184 specification makes clear that the lenses in the claimed apparatuses are well known. Similarly, Petitioner proposed that the POSA should have knowledge of "head mounted displays," again despite the fact that head mounted displays were well known. Petitioner's undue weight on technologies that are well-known or not claimed elements of the inventions leads Petitioner to further contend incorrectly that a POSA should have "at least two years of professional experience in mechanical and basic optical design or engineering." In fact, a POSA need not have such extensive experience in "mechanical and basic optical design or

engineering"; rather, a POSA should have sufficient experience in "touchscreen technology" and "capacitive/conductive technology and materials," because they are pertinent to the inventive elements of the claimed inventions.

19. Only after contending that a POSA must have knowledge in each of the aforementioned areas, Petitioner suggests that a POSA should only have "a basic understanding of touchscreen technology." Petitioner's definition of a POSA is backwards. A strong understanding of touchscreen technology is fundamental to the inventions claimed in the '184 Patent.

20. Petitioner's proposed definition falls short in that "a basic understanding of touchscreen technology" would be insufficient to understand the difference between the '184 patent and the art that Petitioner relies on in its petition. Nor would a person having only a basic understanding of touchscreen technology understand the issues involved in determining whether a POSA would have been motivated to combine references in the manner Petitioner proposes.

21. The insufficiency of Petitioner's definition of a POSA is further highlighted by apparent misunderstandings Petitioner has regarding touchscreen technology. For example, Petitioner's expert states that capacitive touchscreens "use the electrical properties of the body to create a change of charge at a location on a polymer coated touchscreen." Ex. 1002 at ¶ 32. While a capacitive touchscreen *may* rely on electrical properties of the human body, as the '184 patent

discloses, it is not *necessary* for a capacitive touchscreen to rely on the human body to induce touch events. Further, the majority of touchscreens used in 2014-era smartphones are glass, not polymer or "polymer coated."

22. In explaining capacitive touchscreens, Petitioner also uncritically quotes an inaccurate passage of Chu stating that a "human body is a good transferor and transferee of electric charge because of the electromagnetic field around the human body at all times." Ex. 1001 ¶ 32 (quoting Ex. 1004, ¶0005). To the contrary, a human body conveys electrical signals easily because the body consists largely of salt water, which is electrically conductive, not because the human body is always surrounded by an electromagnetic field. Everything in the universe is surrounded by an electromagnetic field, so that is not a relevant distinction.

23. Similarly, Petitioner and its expert propose that the prior art references would be combined based on the desire to reach more users, including those with "resistive touchscreen" devices. A POSA would quickly recognize the inaccuracy of that position given the extensive differences in the two technologies and the limited use of resistive touchscreen devices in personal mobile electronic devices. Further, the poor optical properties of resistive touchscreens would render them a poor choice for use in a virtual reality headset.

24. Petitioner's definition also places too much emphasis on mechanical engineering experience. While some familiarity with basic principles of mechanical engineering would be required, it would not require a degree in mechanical engineering or the like. Rather, the necessary familiarity with simple machines (e.g., levers and buttons) such as those that can be utilized to move a component from a first position to a second position could be obtained through minimal education and experience with such simple mechanisms. Further, while the challenged claims include "lenses," the specification makes clear that the invention relies on existent lens technology.

25. Therefore, a POSA would have a minimum of two years of experience in implementing touchscreen and optics technology, along with relevant education (e.g., a bachelor's degree) in science or engineering. In addition to specific academic training, a POSA may draw upon appropriate industry experience.

## V. Claim Construction

26. I have been informed and understand that claims are construed from the perspective of a POSA at the time of the claimed invention (i.e., the effective filing date of the patent). I also understand that claims are construed in an IPR proceeding using the same claim-construction standard used by federal courts.

27. Under this standard, "the Office will construe patent claims . . . by taking into account the claim language itself, the specification, the prosecution

history of the patent, and extrinsic evidence, among other things, as briefed by the parties." 83 Fed. Reg. 51340, 51343 (Oct. 11, 2018), available at https://www.federalregister.gov/d/2018-22006/p-24.

28. Under the *Phillips* standard, "The 'words of a claim are generally given their ordinary and customary meaning,' which is 'the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.,* as of the effective filing date of the patent application.'" 83 Fed. Reg. at 51343 (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc)).

29. I understand that *Phillips* stated that the specification is "the single best guide to the meaning of a disputed term and . . . acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication." 83 Fed. Reg. at 51343 (quoting *Phillips* at 1321 (internal quotation marks omitted)).

30. I also understand that *Phillips* stated that the prosecution history "is another source of intrinsic evidence that can 'inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution.'" However, "the prosecution history 'often lacks the clarity of the specification and thus is less

useful for claim construction purposes.'" 83 Fed. Reg. at 51343 (quoting *Phillips* at 1317).

31. Finally, I understand that "Extrinsic evidence, such as expert testimony and dictionaries, may be useful in educating the court regarding the field of the invention or helping determine what a person of ordinary skill in the art would understand claim terms to mean." 83 Fed. Reg. at 51343 (quoting *Phillips* at 1318-19). I also understand, however, that "extrinsic evidence in general is viewed as less reliable than intrinsic evidence." 83 Fed. Reg. at 51343 (quoting *Phillips* at 1318).

32. In the opinions I have expressed in this declaration, I will simply apply the ordinary and customary meaning of those terms, which may be further addressed in my discussion of particular claims. In reaching my conclusions regarding the meaning of the claim terms, I considered the specification and its prosecution history.

## VI. Overview of the Prior Art

### A. Kondo

33. Kondo's patent proposes a method of remote control for a "capacitive touch panel" (1506 in ¶0023) by "provid[ing] an attachment that achieves remote control input to a *touch panel mounted on* an electronic device." (Kondo's PROBLEM section; emphasis added). Kondo correctly identifies the type of

touchscreen technology that is commonly used on smartphones as "projected-capacitive" (¶0024). However, the entire remainder of Kondo's patent describes and is designed around a different form of touchscreen technology, that of surface-capacitive.

34. This contention is supported in multiple ways throughout the patent. In ¶0024, Kondo describes how a capacitive touchscreen works, as follows:

The user touching the panel causes the human body (contact object) to act as

> the impedance imparting body (capacitor or the like capacitance). While in-phase and same-potential alternating currents are applied to the four corners of the touch panel 1506, when a finger or the like touches the touch panel 1506, the current changes in accordance with the impedance of the human body. Furthermore, the contact coordinates in the coordinate system of the touch panel 1506 can be calculated from the ratio of the currents detected at the four corners.

EX1003, ¶0024.

35. This is an accurate description of how a surface-capacitive touchscreen works. An appropriate reference can be found in the 55-page "Touch Displays" chapter in the 1,800-page "Handbook of Digital Imaging," published by John Wiley & Sons, Ltd. in March 2015, written in 2013-2014. (https://onlinelibrary.wiley.com/doi/full/10.1002/9781118798706.hdi067)

36. In addition, Kondo refers to this current-based method of touch-location detection in ¶0048, as follows: "Therefore, the touch panel 1506 can

detect a current value corresponding to this impedance and recognize that a touch operation has been performed at the virtual button positions W31 to W34." This is different from the touch-location method used in a projected-capacitive touchscreen, which is based on detecting a change in the mutual capacitance between multiple drive and sense (X-Y) electrodes. (The same Wiley textbook referenced in the previous paragraph also includes a comprehensive description of projected-capacitive touchscreen technology.)

37. Kondo is describing a surface-capacitive touchscreen, *not* a projected-capacitive touchscreen. A POSA in the field of touchscreens at the time of the '184 patent would be aware of these two distinct types of capacitive touchscreens, and would recognize Kondo's description of the technology as a surface-capacitive touchscreen. The POSA would get further verification of the touchscreen technology used in Kondo's patent from Kondo's emphasis on the need for protection against static electricity, which is unique to surface-capacitive touchscreens (projected-capacitive touchscreens do not have this issue). This emphasis includes the following five references:

- ¶0012: "…*static electricity* can be prevented from building up on the exterior, preventing malfunction of the remote touch circuit."
- ¶0033: Kondo expresses concern that a smartphone can be damaged by static electricity: "The device holding plate 44 is a plate material that secures

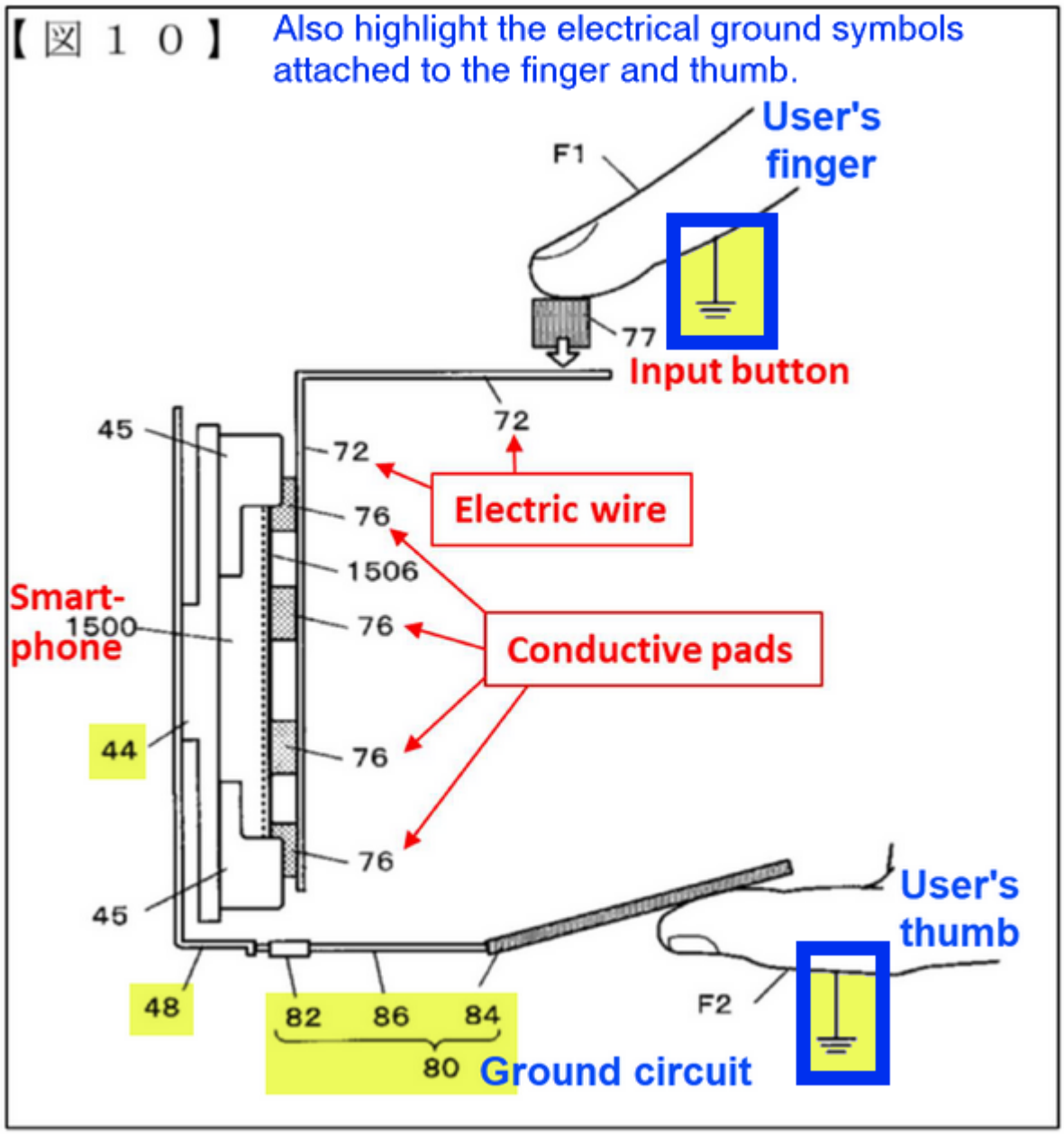
the smartphone 1500, and is made of a material that is conductive or that dissipates *static electricity*."

- ¶0036: "The holding side ground circuit part 48 is a *static electricity* diffusion film attached to the inner surface of the recessed part 43, of which the tip end extends to the mating surface between the holding part 4 and the attachment main body 8. As long as the device holding plate 44 is secured to the cover part 42, the holding side ground circuit part 48 abuts on the outer surface of the device holding plate 44 and removes *static electricity* from the main body of the smartphone 1500 via the device holding plate 44."
- In ¶0039, when describing the "electrical wire 72" (actually a flex cable) that connects the conductive pad 76 to the button 77, Kondo is again concerned about static electricity: "The electrical wire part 72 is formed by sealing conductive lines 74 formed of a material that is conductive or that dissipates *static electricity* on a flexible sheet 73 formed of an antistatic material with excellent bending properties."
- In ¶0042, the plastic part that surrounds the button 77 ("gripping part 9") is also described as being made of antistatic material: "Moreover, the gripping part 9 is made of a non-conductive *antistatic* material."

38. The use of "non-conductive antistatic material" is fundamentally flawed. A material is "antistatic" only because it is conductive. It must be at least weakly conductive to be considered an antistatic material.

39. Yet another indication that Kondo is designing his remote touch circuit around a surface-capacitive touchscreen can be found in his attempt to provide a reference ground for the user. Kondo describes a "ground circuit 80" (¶0038, illustrated in Figure 10, below) that in total is made up of the following parts (highlighted in yellow in Figure 10):

- 44 – Conductive device (smartphone) holding plate (¶0033), connected to 48
- 48 – Holding side ground circuit static electricity diffusion film (¶0036), connected to 82
- 82 – Spring connection terminal (¶0045), connected to 86
- 86 – Ground wire (¶0044), connected to 84
- 84 – Conductive ground sheet (¶0046), on the bottom part of the attachment main body 8
- In Fig. 10, the electrical ground symbol ( ) attached to finger F1
- In Fig. 10, the electrical ground symbol ( ) attached to thumb F2




EX1003, Fig 10 (red annotations by Petitioner, blue annotations and yellow highlights by Patent Owner).

40. The purpose of these parts is described in ¶0047, as follows: "When the holding part 4 is closed, *the main body of the smartphone 1500 is electrically conductively connected and grounded to the human body* that is the user through

the device holding plate 44, holding side ground circuit 48, and attachment main body side ground circuit 80". By providing an electrically conductive path between the hand (specifically, the thumb in ¶0046) of the human that's holding the bottom part of the VR viewer and a conductive plate (44) holding the smartphone, Kondo is attempting to provide a reference ground for the surface-capacitive touchscreen.

41. One of the unique characteristics of a surface-capacitive touchscreen that differentiates it from projected-capacitive is its use of a low-impedance signal return path through the user's finger back to the surface capacitive touchscreen's signal reference. That signal reference is commonly called "reference ground" or "ground," though it need not be a truly low-resistance connection to the earth. A stable reference ground is critically important in a surface-capacitive touchscreen because it establishes the baseline reference current for the "no-touch" condition. Also, the human body capacitance (or electrically grounded stylus) that induces a touch in a surface-capacitive touchscreen is referenced to the touchscreen electrical ground, not some generalized earth ground or "rest-of-the-world" ground. This is a very different situation than in a projected-capacitive touchscreen, where the non-active electrodes provide a reference level for capacitive measurement of the active electrodes. No "reference ground" is needed in a projected-capacitive touchscreen.

42. As any smartphone user in 2014 would know, the touchscreen of a smartphone works whether the user is gripping the phone chassis with one hand and touching the touchscreen with one finger of the other hand, or touching only the screen with only one fingertip. A typical smartphone user would also know that the touchscreen operates whether the user is grounded, or if they are not grounded (*e.g.*, sitting in a plastic chair). A POSA would also know what the lay user knows in this case.

43. A POSA at the time of the ’184 patent would know with certainty that it was not possible to integrate a surface-capacitive touchscreen into a mobile consumer-electronics device such as a smartphone. All smartphones capable of providing display capability sufficient for use in a VR viewer at that time used projected-capacitive touchscreens. A POSA at that time who was considering combining Kondo’s and Chu’s patents would therefore be faced with combining designs created for two different and incompatible touchscreen technologies. This would significantly increase the difficulty and decrease the likelihood of the combination being achieved.

## VII. Obviousness Analysis of Challenged Claims

### A. Claim 12

44. A POSA would not have been motivated to combine Kondo with Chu as Petitioner proposes.

45. As described above, a POSA would understand that Kondo's touch panel 1506 is a surface-capacitive touchscreen. A POSA would know that a surface-capacitive touchscreen such as Kondo's touch panel 1506 would not be used in personal mobile devices. Because of the electrical requirements of both the touchscreen and the control circuit, there would be no reason for a POSA to create a surface-capacitive touchscreen that would fit within and be powered by a personal mobile device.

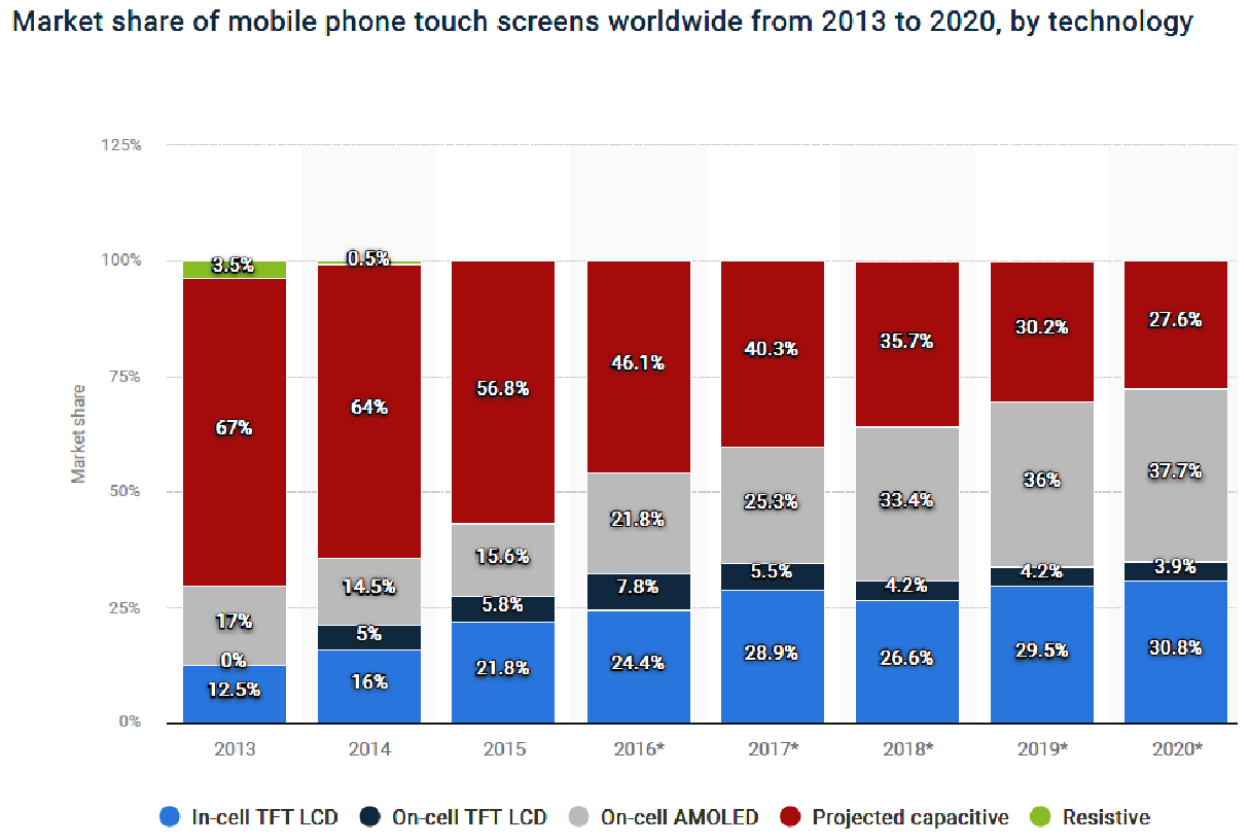
46. Moreover, it would not be clear to a POSA that Kondo's design would work with a surface-capacitive touchscreen because the total impedance between the human-touchable button and the conductive pad that touches the touchscreen may be so high that insufficient capacitive coupling from the user is provided to register as a touch. Since surface-capacitive technology is typically used in ATMs, ticketing machines, kiosks, point-of-sale terminals, arcade games, and factory automation applications (all devices that are designed for a user to directly contact the screen with exactly one finger or stylus), there was no demand for *remote*-touch capability for surface-capacitive screens. A POSA would not have been motivated to utilize Kondo's surface-capacitive touch panel 1506 as the mobile device recited in the challenged claims of the '184 patent. The inability of surface-capacitive touchscreens to identify and report two touch events makes them unsuitable for use in multi-touch user interfaces. Practically all smartphones in

2014 were based on multi-touch user interfaces (*e.g.*, those utilizing projected-capacitive touchscreens). A POSA would not have been motivated to utilize Kondo's surface-capacitive touch panel 1506 as the mobile device recited in the challenged claims.

47. Petitioner's proposed combination also fails for additional reasons. Kondo only discloses embodiments in which the touch pads are in constant contact with the touchscreen after insertion of the touchscreen device into the headset. A POSA who understands that Kondo is using a surface-capacitive touchscreen would have no particular motivation to change Kondo's input mechanism to a non-contact system like Chu. In fact, a POSA would be motivated against modifying Kondo in that way because adding moving parts would make the remote touch system more complicated and expensive for no technical or user benefit. It would cost more and be less reliable. For this additional reason, a POSA would not have been motivated to modify Kondo in the manner Petitioner proposes.

48. Petitioner asserts that a POSA would have been motivated to modify Kondo to use Chu's input mechanism so that it would work with resistive touchscreens. However, Kondo makes no mention of resistive touchscreens, and a POSA would also have known that, at the time of the invention of the '184 patent,

resistive touchscreens comprised little, if any, market share. In 2013 only 3.5% of mobile phones used resistive touchscreens and by 2015 none did. Ex. 2046.[1]




Ex. 2046. Market share of smartphones by touch sensor type.

49. What few resistive touchscreens were available on the market were used on low-cost mobile devices that would not have had the graphic processing power or display resolution that was necessary for a mobile device to be used with

[1] The information found in Exhibit 2046 is available at the following URL: https://www.statista.com/statistics/616468/mobile-phone-touch-technology-share-worldwide/. I visited this web page and found that it includes the information included in Ex. 2046, including specifically the chart pasted below.

a VR headset, further evincing the complete lack of motivation to combine. Indeed, Google's own Android specification from 2016-2017 sets forth specific hardware requirements for a smartphone to be VR ready, all of which were completely incompatible with resistive touchscreens at the time. (Ex. 2048 at 74-75.) Moreover, the Durovis Dive 5 was a VR viewer for use with a smartphone. Durovis's website lists compatible smartphones. EX2064. Of the compatible devices released in 2014 or earlier, publicly available information indicates that none of them used resistive touchscreens (e.g., they are specifically described as having capacitive touchscreens or they are described as having glass screens, which would be inconsistent with a resistive touchscreen). EX2065. (For a few of these phones, the information cited in EX2065 comes from Wikipedia rather than a site such as GSM Arena, a well-known website providing specifications on phones. However, in these cases, other contemporary phones by the same manufacturer (and often in the same series) were identified by GSM Arena as having glass screens, consistent with the Wikipedia entries for these few phones).

50. In EX2046, "in-cell" and "on-cell" refer to the location of the projected capacitance sensor electrodes within the display-touchscreen stack. The red category is discrete projected capacitive sensors, in which the touch sensor is manufactured separately from the display. All of the categories except "Resistive" are types of projected-capacitive touchscreen constructions.

51. A further reason for avoiding the use of resistive touchscreens is their poor optical properties. A resistive touchscreen has an air gap between two conductive layers. A touch is indicated by bringing those two layers into contact with one another, making an electrical connection. Optically, this is two partial mirrors facing each other with a variable gap between them. Light bounces back and forth in this gap, creating offset images that interfere with the image from the display. In a virtual reality viewer, stereoimaging relies on slightly offset images to convey 3-dimensional depth information to the user. The images being further offset by the gap present in a resistive touchscreen would disrupt the ability to properly convey the 3D stereo image. A POSA with experience in the field of optics, as Petitioner proposes, would reject the resistive touchscreen, and therefore would not consider the resistive touchscreen relevant for Patent Owner's claimed invention.

52. Resistive touchscreens, like surface-capacitive touchscreens, are designed to process a single input location. They are not able to process the multi-touch gestures. Starting in 2007 (and continuing to present), multi-touch capability has been a requirement for use in smartphones, particularly those using the Apple iOS and Google Android operating systems, which have dominated the consumer market. Without the ability to process multi-touch gestures, resistive and surface-capacitive touchscreens would be able to support only one user input at a time. A

POSA seeking to enable more than one touch control in a VR viewer based on a smartphone would reject resistive and surface-capacitive touchscreens.

53. In other words, while capacitive and resistive touchscreens were generally known, the smartphone market was entirely dominated by projected capacitive touchscreens, almost to the complete exclusion of resistive touchscreens (with those limited resistive touchscreen devices incapable of operating for purposes of virtual reality viewing). Adding a resistive touchscreen to a smartphone was not simply a matter of switching out one comparable technology for another; it was directly contrary to the accepted approach of the entire market segment. Given this landscape, a POSA in 2014 would have had no reason to consider resistive touchscreens at all. Thus, a POSA seeking to use touchscreen-enabled mobile devices in 2014 would not be motivated to consider resistive or surface-capacitive touchscreens for use in a VR viewer based on a smartphone.

**B. Claim 16**

54. Claim 16 depends from claim 12 and includes each of its limitations. Therefore, Petitioner fails to establish that the proposed combination teaches or suggests all elements of claim 16 for the reasons discussed regarding claim 12.

### C. Claim 17

55. Claim 17 depends from claim 12 and includes each of its limitations. Therefore, Petitioner fails to establish that the proposed combination teaches or suggests all elements of claim 17 for the reasons discussed regarding claim 12.

### D. Claim 18

56. Claim 18 depends indirectly from claim 12 and includes each of its limitations. Therefore, Petitioner fails to establish that the proposed combination teaches or suggests all elements of claim 18 for the reasons discussed regarding claim 12.

## VIII. Oath

57. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further 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 and that such willful false statements may jeopardize the results of these proceedings.

58. I declare under penalty of perjury that the foregoing is true and correct.

Executed on 1/30, 2024

Bob Mackey

APPENDIX A

# Bob L. Mackey

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San Jose, California

## Summary of Experience and Qualifications

- Launched several different product lines that resulted in hundreds of millions of units each and $100M to over $1B in revenues.
- Twenty-plus years of extensive research, development, and management experience developing advanced materials and processes for electronics.
- Substantial advances were made in polymer materials, electronic materials, design methods, manufacturing processes, and measurement techniques.
- Quick, incisive approach to problem-solving and decision-making
- Several new technologies developed from conception through profitable mass production Communicates clearly and confidently with expert colleagues as well as laypersons
- Innovations with track record of invention and patenting of novel ideas with proven value
- Management experience in research, development, and manufacturing
- Skilled in a broad range of chemical research techniques: organic, inorganic, polymer, physical
- Extensive experience in CVD, PVD, plasma, evaporation, lithography, etching, and wet processing
- Analytical techniques – spectroscopies, microscopies, walking the line and listening to operators
- Excellent mechanical engineering, construction, and testing skills
- Troubleshooting and Root Cause analysis – I can figure out why something doesn't work
- Ability to apply knowledge and methods from diverse fields in innovative ways
- Extensive experience developing suppliers in Asia: Japan, Korea, Taiwan, China, and Thailand
- Design and construction of high-performance composite aircraft and control systems
- Managing teams of up to 20 direct reports or many hundreds in contract manufacturing
- Highly energetic, productive nature yields quick results

## Work Experience

### Intellectual Property Strategy Consulting, 2020 - Present

- Identify and implement IP development strategies in technology startups
- Meet with development teams and inventors to capture inventions

- Foster a culture of innovation and documenting of inventions
- Patent key inventions to develop and protect company value
- Draft patent applications
- Advise on technology acquisition decisions
- Evaluate patent portfolios in corporate acquisitions

## Aircraft Development Lead, ZeroAvia, 2020 - 2022

- Managed development of hydrogen fuel cell powered electric aircraft
- Facilities management for construction of aircraft development and research center
- Technical Lead on $100M+ development proposals

## Distinguished Engineer, IDEX Biometrics, 2019

- Consulting on launch of worldwide biometrics development
- Developed materials and manufacturing processes for embedded-fingerprint credit cards

## Director of Architecture / Principal Scientist, Synaptics, 2002 - 2018

- Responsible for development of new technologies in a leading human-machine interface company
- Developed touchscreen product line leading to >$1 Billion in sales, including the first touchscreen cell phone in 2006. This required new materials, manufacturing processes, and suppliers
- Integrated touchscreen functionality into LCD and OLED display drivers, again resulting in a new product line with > $1 Billion in sales
- From 2014, Chief Architect for Biometric Products Division
- Launched fingerprint sensor product with over $100M revenue in first year
- Invented and applied for 40+ patents in sensor design
- Represented Synaptics at international conferences with dozens of invited presentations
- Recognized worldwide as a leading developer of transparent conductive materials, optical materials, and adhesives for consumer electronics
- Intellectual Property Committee - identified and developed inventions into patent applications and trade secrets
- Evaluated IP portfolios in support of acquisitions
- Supporting IP litigation in key cases, including:
  Synaptics v. Goodix, 2015, 3:15-cv-01742
  Synaptics v. Elantech, 2007, 3:07-cv-06434
  Synaptics v. Alps, 2005, resulting in cross license agreement and payment to Synaptics
  We also supported customers in certain high-profile cases, e.g. Apple v. Samsung.

## Co-Founder and President, Pure Flight, 1998-Present

- Design, build, and test personal aircraft, components, and systems
- Design and construction of extremely high performance soaring aircraft

- Invented and developed control systems for ultra-lightweight aircraft
- Driving high performance composite materials development for maximum strength and stiffness with minimum weight.
- Formation airshow performances
- Composite aircraft design, development, and fabrication services

## Senior Materials Scientist, Petalogic Corporation, 2001

- Managed project to develop an ultrafast, micron-scale, direct-modulation semiconductor laser
- Developed waveguide manufacturing process for on-chip optical communications
- Led efforts to transfer research innovations to controlled manufacturing processes

## Systems Architect, Geocast Network Systems, 1999 – 2000

- Developed a personal data network operating over digital television channels
- Built cutting-edge mobile test equipment for measurement of ATSC digital television signals
- Managed all engineering and procurement of disk drives for personal data server
- Drove improvement of disk drive acoustic performance with vendors

## Process and Integration Engineer, Candescent Technologies, 1996 – 2000

- Responsible for field emission display (FED) faceplate design and development
- Developed and applied optical models of field emission displays to improve contrast and brightness
- Increased process yield from <50% to over 90% in one year
- Scaled up production facilities from 100 mm to 150 mm to 320x340mm in the same year
- Invented several new processes and device structures which resulted in patents and improved displays

## Principal Investigator / Staff Scientist, Physical Dynamics, 1989 – 1990

- Proposed and secured funding for a Small Business Innovative Research (SBIR) program to develop improved circuit board designs for thermal management
- Developed a heat pipe design to remove 100 Watts of heat from each small circuit board in a standard military electronics module. This technology became common 10 years later in PCs

## Visiting Scientist, Los Alamos National Laboratory, 1986 – 1987

- Specified requirements for massively parallel computers for special classes of problems such as protein folding and computational fluid dynamics
- Examined a class of computationally difficult problems with a multidisciplinary group of scientists

### Staff Chemist, Maxwell Laboratories, Inc. 1986 – 1990

- Developed and tested liquid and polymer dielectric materials for high energy density capacitors
- Collaborated with 3M, Pennwalt, Sandia, and JPL to develop superior new dielectric materials
- Increased capacitor energy density 100-fold in four years
- Introduced electrical double-layer capacitor technology. Now called Supercaps or Ultracaps, this technology became a major new business unit for Maxwell and let to their acquisition by Tesla
- Designed and built automated equipment for polymer dielectric materials testing
- Guided a group of technicians in the capacitor and dielectric materials test group

### Research Technician, Jet Propulsion Laboratory 1985 – 1986

- Researched advanced high efficiency silicon solar cells for use on NASA spacecraft
- Developed high quality anti-reflective and passivating coatings for charge coupled devices (CCDs), including the CCD that was flown on the Hubble Space Telescope's Wide Field/Planetary Camera
- Designed neural network integrated circuits and software for challenging computational problems

## Education

### Ph.D. Program in Materials Science
### University of California, San Diego,1990-1996

Thesis: "The Chemical and Electronic Properties of the Diamond Surface"
Thesis advisors: Professor John E. Crowell, and Dr. James E. Butler (Naval Research Laboratory)

- Advanced research under Professor Crowell and Dr. Butler explored the surface chemistry of group IV semiconductors, including diamond, silicon, and germanium.
- Invented and developed innovative infrared optical techniques to measure surface and bulk electronic properties in situ.
- Discovered conductive states of pure diamond surfaces.

Fannie and John Hertz Foundation Fellowship
University of California Regent's Fellowship

## B.S. in Chemistry
## California Institute of Technology (Caltech) 1981-1985

- Synthetic organic chemistry research under Professor David A. Evans (now at Harvard). Developed a stereospecific Diels-Alder reaction for the synthesis of anti-nausea pharmaceuticals.
- Theoretical studies under Professor William A. Goddard III. Studied quantitative structure-activity relationships by modeling of the dihydrofolate reductase–methotrexate system.
- Achievement Rewards for College Scientist (ARCS) Foundation Scholarship

## University Work Experience

### Visiting Scientist, Naval Research Laboratory, Washington DC

- Discovered that the [110] face of diamond is electrically conductive.
- Invented a new spectroscopic techniques for measuring surface electrical conduction
- Designed, constructed, and maintained electronic and spectroscopic test equipment, ultrahigh vacuum systems, automated data collection, and laboratory computer networks
- Established the electronic properties of diamond surfaces

### Research Assistant, University of California, San Diego

- Designed and constructed original research tools for the study of germanium, silicon and diamond surface chemistry
- Developed pioneering optical methods for sensitive electronic materials characterization · Improved pre-production spectrometers and software for a major scientific instrument manufacturer

## Consulting and other Experience

### Board of Directors, Osocalis Distillery

Co-owner and Director of a small distillery making world-class brandies. My responsibilities include fundraising, business planning, marketing, communications, welding, and driving the forklift or truck. Osocalis brandies are now sold in 35 states.

### Various Technology Startup and Venture Capital Firms

Evaluated business plans and technical capabilities of startup firms on behalf of funding venture capitalists. Advised startup firms in the areas of materials, optics, chemistry, and intellectual property. As an advisor to Boards of Directors, I have guided technology development and manufacturing launch for a variety of new product lines.
Sample consulting customers: IDEX Biometrics, Covalent Metrology, ZeroAvia, SigmaSense, RDI Computers, Freer Logic, Curated Innovation

### DaSH-PA “Dead Simple Human Powered Airplane”

Participated in the design, construction, and flight testing of a simple human-powered aircraft

### Fire Arts

Designed, built, and constructed several large-scale pyrotechnic displays. Consulted on many more. In addition to controlling combustion chemistry, public safety and legal compliance are factors in getting approval for thousand-foot hundred-foot fire tornadoes or thousand-foot diameter fireballs.

### Fannie and John Hertz Foundation, Livermore, California

Designed and implemented an Internet mailing list and website, enabling communication between past and present Fellows and the Directors of the Foundation.

### House of Representatives, Washington, D.C.

Advised House Telecommunications Committee Chairman, Edward Markey, on technical aspects of satellite communications legislation.

## Scientific Presentations and Publications

“Oxygen adsorption on the (110)-Oriented Diamond Surface”, B. L. Mackey, J. E. Crowell, J. N. Russell, Jr., P. E. Pehrsson, and J. E. Butler, The Journal of Physical Chemistry B; 105(18); 3803-3812, 2001.

“Effect of Surface Termination on the Electrical Conductivity and Broadband Infrared Reflectance of a Diamond (110) Surface”, B. L. Mackey, J. N. Russell, Jr., J. E. Crowell, and J. E. Butler, Physical Review B, Rapid Communications, 52, p. R17009, 1995.

“Observation of a Conductive Diamond (110) Surface by Multiple Internal Reflection Infrared Spectroscopy”, B. L. Mackey, J. N. Russell, Jr., J. E. Crowell, and J. E. Butler, American Vacuum Society, oral presentation, 1995.

“The Effect of Hydrogen on the Electrical Conductivity of the Diamond (110) Surface”, B. L. Mackey, J. N. Russell, Jr., P. E. Pehrsson, J. E. Crowell, and J. E. Butler, Diamond Materials/1995, edited by J. P. Dismukes and K. V. Ravi, p. 455, The Electrochemical Society, Pennington, NJ, 1995.

“Infrared Evidence for an Electrically Conductive Diamond (110) Surface”, B. L. Mackey, J. N. Russell, Jr., J. E. Crowell, and J. E. Butler, American Vacuum Society, poster presentation, 1994.

“The Effect of Doping on the Infrared Reflection Spectra (IRRAS) of Thin Silicon Oxides”, B. L. Mackey, J. E. Crowell, M. Liehr, and K. J. Uram, American Vacuum Society, poster presentation, 1993.

“High Thermal Conductivity Electronic Substrate”, Final Report on a planar heat pipe design for thermal management in an Air Force electronics module. Air Force Small Business Innovative Research (SBIR) Project AF89-209, 1990.

“Winning at Chelan”, in “Sky Adventures: Fantasies of Free Flight”, J. Palmieri, M. Palmieri, eds., Sky Dog Publications, Roanoke, Virginia, 1996.

Invited talks and classes at SID, IDTechEx, FineTech, SVC, and other scientific and industry conferences.

## Patented Inventions

60+ issued US Patents, with many foreign counterparts. Several patent applications pending.

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| 11,575,138 | Liquid hydrogen storage system as thermal battery |
| 11,308,309 | Fingerprint sensor having an increased sensing area |
| 10,955,603 | Method and system for optical imaging using point source illumination |
| 10,657,350 | Finger detection with auto-baseline tracking |
| 10,572,707 | Transparent fingerprint sensor pattern |
| 10,496,863 | Systems and methods for image alignment |
| 10,366,268 | Method and system for optical imaging using patterned illumination |
| 10,311,276 | Under display optical fingerprint sensor arrangement for mitigating moire effects |
| 10,289,891 | Optical biometric sensor having diffractive optical elements |
| 10,268,884 | Optical fingerprint sensor under a display |
| 10,229,304 | Finger detection with auto-baseline tracking |
| 10,185,866 | Optical fingerprint sensor package |
| 10,146,258 | Optical image sensor for display integration |
| 10,115,000 | Method and System for optical imaging using patterned illumination |
| 10,108,841 | Biometric sensor with diverging optical element |
| 9,946,917 | Efficient determination of biometric attribute for fast rejection of enrolled templates ... |
| 9,798,429 | Guard electrodes in a sensing stack |
| 9,785,818 | Systems and methods for image alignment |
| 9,760,758 | Determining which hand is being used to operate a device using a fingerprint sensor |

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| 9,235,309 | Mesh sensor design for reduced visibility in touch screen devices |
| 9,075,095 | Device and method for localized force sensing |
| 9,052,766 | Mesh sensor design for reduced visibility in touch screen devices |
| 8,854,333 | Polar sensor patterns |
| 8,643,624 | Capacitive sensing using a segmented common voltage electrode of a display |
| 8,493,348 | Capacitive sensing apparatus |
| 8,243,044 | Methods and systems for changing the appearance of a position sensor with a light effect |
| 8,189,339 | Flexible circuit assembly for a capacitive-sensing device |
| 8,120,371 | Object position sensing apparatus |
| 7,965,281 | Unambiguous capacitance sensing using shared inputs |
| 7,737,953 | Capacitive sensing apparatus having varying depth sensing elements |
| 7,735,383 | Balanced resistance capacitive sensing apparatus |
| 7,692,431 | Capacitive sensing apparatus designs |
| 7,688,080 | Variably dimensioned capacitance sensor elements |
| 7,548,073 | Capacitive sensing apparatus designs |
| 7,545,289 | Capacitive sensing using a repeated pattern of sensing elements |
| 7,490,407 | Method of patterning wall and phosphor well matrix utilizing glass |
| 7,463,246 | Capacitive sensing device |
| 7,433,167 | Strike ring based electrostatic discharge protection |
| 7,382,360 | Methods and systems for changing the appearance of a position sensor with a light effect |
| 7,382,139 | One layer capacitive sensing apparatus having varying width sensing elements |
| 7,218,124 | Capacitive sensing apparatus designs |
| 7,202,859 | Capacitive sensing pattern |
| 7,129,935 | Sensor patterns for a capacitive sensing apparatus |
| 7,090,554 | Fabrication of flat-panel display having spacer ... inhibiting secondary electron escape |
| 7,002,287 | Protected substrate structure for a field emission display device |
| 6,853,129 | Protected substrate structure for a field emission display device |
| 6,834,431 | Method of patterning wall and phosphor well matrix utilizing glass |
| 6,742,257 | Method of forming powder metal phosphor matrix and gripper structures in wall support |
| 6,741,027 | Protected substrate structure for a field emission display device |

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| 6,734,608 | Constitution and fabrication of flat-panel display and porous- ... spacer of flat-panel display |
| 6,691,404 | Fabricating of a flat-panel displace using porous spacer |
| 6,617,772 | Flat-panel display having spacer with rough face for inhibiting secondary electron escape |
| 6,562,551 | Gripping multi-level black matrix |
| 6,528,930 | Conductive Focus Waffle |
| 6,432,593 | Gripping multi-level structure |
| 6,403,209 | Constitution and fabrication of flat-panel display and porous... spacer of flat-panel display |
| 6,380,670 | Encapsulated flat panel display components |
| 6,322,937 | Method for Creating a Color Filter Layer on a Field Emission Display Screen Structure |
| 6,215,241 | Flat Panel Display with Encapsulated Matrix Structure |
| 6,176,754 | Method for forming a Conductive Focus Waffle |
| 6,113,708 | Cleaning of Flat-Panel Display |
| 6,135,841 | Use of Printer Head Techniques to Form Pixel Assemblies in Field-Emission Displays |
| 5,858,619 | Multi-level Conductive Matrix Formation Method |