

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NINTENDO CO., LTD. and
NINTENDO OF AMERICA INC.,
Petitioners,

v.

GAMEVICE, INC.,
Patent Owner.

Case No. IPR2023-00643
U.S. Patent No. 10,391,393 B2

DECLARATION OF PROF. ALEXANDER H. SLOCUM

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I, Alex H. Slocum, declare as follows:

I. INTRODUCTION

1. My name is Alexander H. Slocum, and I have been retained by counsel for Patent Owner Gamevice, Inc. as an expert witness to provide assistance regarding U.S. Patent No. 10,391,393 B2 (“the ’393 Patent”) in this proceeding before the Patent Trial and Appeal Board (Board) of the United States Patent and Trademark Office (USPTO). Specifically, I have been asked to consider the validity of claims 1-7 of the ’393 Patent (the “Challenged Claims”) in view of prior art, anticipation and obviousness considerations, and understanding of a person of ordinary skill in the art at the time of the invention (“POSITA”) as it relates to the ’393 Patent. I have personal knowledge of the facts and opinions set forth in this declaration and believe them to be true. If called upon to do so, I would testify competently thereto.

2. I am being compensated for my time at my standard consulting rate of \$800/hour for my work on this proceeding. I am also being reimbursed for expenses that I incur during the course of this work. My compensation is not contingent upon the results of my study, the substance of my opinions, or the outcome of any proceeding involving the Challenged Claims. I have no financial interest in the outcome of this matter or on the pending litigation between the Nintendo Petitioners and Gamevice.

3. In forming my opinion in this declaration, I have considered the '393 Patent, its file history, the references cited by Nintendo in the Petition, and my investigation and study of relevant materials, including those cited herein. I have also applied my four decades of education, research and experience in the mechanical engineering field, which has informed my understanding of comparing the Challenged Claims to the prior art.

4. This declaration represents only those opinions I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information and on my continuing analysis of the materials already provided. Further, 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 proceeding is ongoing and I will continue to review any new material as it is provided. I may rely upon these materials, my knowledge and experience, and/or additional materials to rebut arguments raised by Nintendo.

II. QUALIFICATIONS AND EXPERIENCE

5. I am a tenured full professor of Mechanical Engineering in the School of Engineering at Massachusetts Institute of Technology ("MIT"). I received a Bachelor of Science in Mechanical Engineering from MIT (1982), a Masters of Science in Mechanical Engineering from MIT (1983), and a Ph.D. in Mechanical

Engineering from MIT (1985). I joined the mechanical engineering faculty of MIT in 1991. I am an elected member of the National Academy of Engineering and have numerous product development and design awards as documented in my *curriculum vitae*. From 1982 to 1986, I worked as a mechanical engineer for the National Institute for Standards and Technology (NIST, which was then called the “National Bureau of Standards” or NBS) under the United States Department of Commerce. From 1985 to 1989, I was an Assistant Professor of Civil Engineering at MIT. From 1989 to 1990, I was a visiting professor of mechanical engineering at the Cranfield Institute of Technology. Since 1991, I have been and continue to be a professor of mechanical engineering at MIT.

6. I am a member of the National Academy of Engineering (“NAE”) and am active in several engineering societies and have received many awards and professional honors. I consult extensively with industry on the development of new products and I have also helped start several successful companies.

7. My principal research interest is precision engineering and precision machine design. I currently serve as the director of the Precision Engineering Research Group at MIT (pergatory.mit.edu). Precision engineering addresses the design of consumer products, machines, devices, fixtures, and other structures that have critical tolerances, and are repeatable and stable over time. For over 25 years, I have been focused on the design and development of precision machines, medical

devices and other products, often specifically on coupling and interconnection of components in those products. In particular, I am an acknowledged world expert on precision couplings and connections between mechanical elements and maintain a free resource website for industry and academia that includes many papers and spreadsheet-based engineering calculation tools related to the design of couplings.¹

8. I have written two books on design, “Precision Machine Design,” and the free online textbook “FUNdaMENTALs of Design”, as well as a section of another book on design, and approximately 318 papers published in refereed journals and in proceedings of refereed conferences and have supervised over 200 student theses. I have also taught many courses in design. A complete list is provided in Appendix A as part of my curriculum vitae.

9. Through many years of research, teaching, and consulting, I have gained extensive experience and expertise in machine design, mechanisms, and systems for various purposes, as well as other disciplines in the field of mechanical engineering, such as electronic controllers for various machines.

10. I am listed as an inventor on over 180 United States patents; and having done product development, research, and teaching in mechanical engineering

¹ See, e.g., <http://web.mit.edu/2.75/fundamentals/FUNdaMENTALS.html> and www.kinematiccouplings.org.

applications for much of my career, I have an extensive background and understanding of the principles and processes involved with systems design including ergonomic considerations where user interfaces must withstand rough handling.

11. Over the past thirty-plus years and apart from my work in this case, I have reviewed hundreds of technical reports, as well as papers for journal publications involving hundreds of different designs and disclosures and hundreds of different patents.

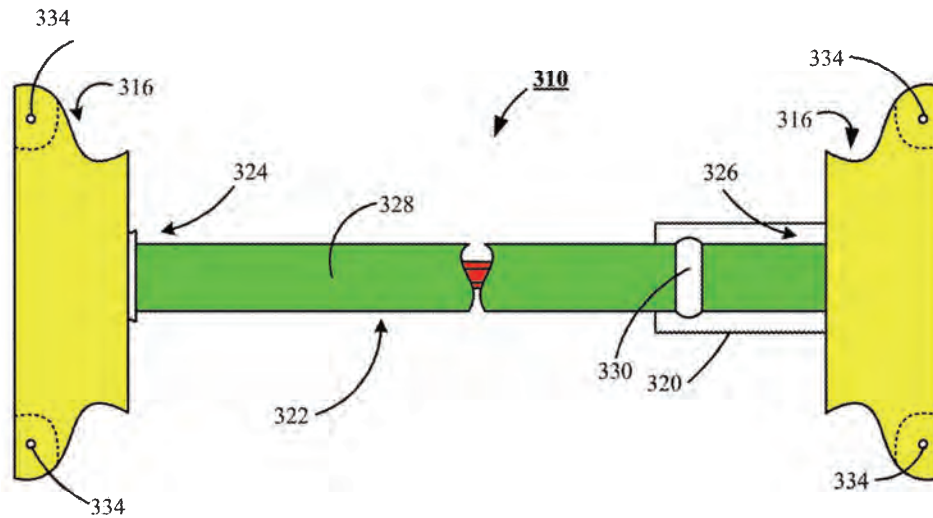
12. Similarly, I was the director of MIT's Experimental Study Group (ESG) from Sept. 2004 to June 2012 and our space in addition to classrooms had a large lounge and full kitchen area. I often made spaghetti dinners (usually Wednesday evenings) and while cooking and then later hanging out with the students would observe how physical students would be with the controllers, although I do not recall exactly what games or controllers they were using.

13. My *curriculum vitae*, including a list of all my publications is attached hereto as Appendix A. Based on my education and experience, I believe that I am qualified to opine on the subjects at hand.

III. OVERVIEW OF THE '393 PATENT

14. The '393 Patent relates to a combination game controller and information input device directed to controlling electronic games and entry of

15. As shown in Figs. 17 and 18 below, each of the confinement structures 316 has a cradle 336 (annotated in yellow). Each cradle 336 has a lip that prevents computing device 302 that is held between the confinement structures 316 from coming out in the direction of the user.



'393 Patent, Fig. 17 (annotated)

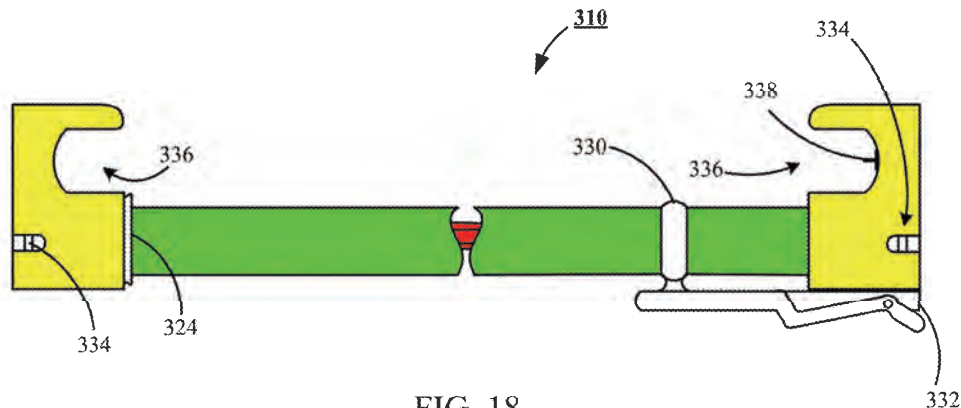


FIG. 18

'393 Patent, Fig. 18 (annotated)

16. With reference to Figs. 16-18, a structural bridge 322 (annotated in green) secures the pair of confinement structures to each other. *Id.*, 9:60-62. Structural bridge 322 includes a conduit 328 that provides space to accommodate a wired connection 314 (annotated in red). *Id.*, 9:29-33, 9:60-10:7. Further, as shown in Fig. 16, a pair of control modules 252 (annotated in orange) are secured to the confinement structures 316. *Id.*, 9:42-53.

IV. LEVEL OF ORDINARY SKILL IN THE ART

17. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a person of ordinary skill in the art (“POSITA”) at the time of the invention, which I understand to be February 2, 2015. I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the types of problems encountered in the field; the teachings of the prior art, and the sophistication of the technology at the time of the alleged invention. I understand that a POSITA is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a POSITA would also have knowledge from the teachings of the prior art, including the art cited below.

18. Taking these factors into consideration, on or before February 2, 2015, a POSITA at the time of the effective filing date of the ’393 Patent would have had an undergraduate degree in mechanical engineering and two years of industry or research experience in mechanical assemblies and hand-held consumer devices or other technology involving a physical device that allows humans to interface with electrical devices, where additional relevant experience can compensate for a lack of relevant education, and *vice versa*.

19. My definition considers the fact that the claims at issue here are directed primarily at the mechanical aspects of the invention and how the physical components are connected or interface with each other. These claims do not directly address the software aspects of video games. Rather, they are concerned with the configuration and mechanical design of physical devices that allow a person to send signals to a computing device that will ultimately be used to operate the video game. This is standard mechanical engineering design but is not something that would be typically done by people designing the video games themselves. I believe that a POSITA would not need specific prior experience with video game controllers, but that more general experience designing hardware devices that allow humans to interface with handheld electronic devices, which are used in many fields, including medical and industrial devices, would be sufficient to reach an ordinary level of skill in the art.

20. Moreover, in my opinion, POSITAs would have an understanding of the manner in which normal users generally operate game controllers. In this regard, I have significant experience observing gamers in action, including prior to the February 2, 2015, effective filing date of the '393 Patent's claims: My wife ran a FIRST robotics team from 2005 to 2019 which was based in our house, and I was the engineering/manufacturing helper and advisor. My basement included a large area for building including a full manual machine shop and woodworking equipment.

Upstairs the kitchen/dining/living area is where the high school students would hang out to relax, and this often included gaming. Although I do not recall exactly what games or controllers they were using at the time, I observed how physical they would be with the controllers, as if they were wrestling with the controls to make the game do what they wanted. In my opinion, POSITAs with their industry or research experience would also have this understanding of the manner in which normal users operate controllers.

21. In International Trade Commission Investigation No. 337-TA-1197 (which addressed the '393 patent), the Administrative Law Judge said that “a person of ordinary skill in the art for the '393 patent [has] an undergraduate degree in mechanical engineering and two years of industry or research experience in video game, game-controller, and/or remote-controller technology, where additional relevant experience can compensate for a lack of relevant education, and *vice versa*.” Ex. 1018, 27. I agree with most of the ITC’s definition, in particular the requirement of a mechanical engineering degree. My proposed definition clarifies what I understand is meant by “remote-controller technology,” *i.e.*, a physical device that allows humans to interface with an electrical device.

22. As for Mr. Kitchen’s definition, *see* Ex. 1002, ¶¶ 39-41, I think it is more appropriate to require the POSITA to have a mechanical engineering degree, as opposed to also permitting an electrical engineering degree, a computer

engineering degree, or design or development experience with interactive products like video games, unless the person once employed in the industry specifically worked on physical interface design of devices for two or more years. As I explained earlier, these claims deal mostly with mechanical engineering concepts and terminologies, with some basic electrical engineering or computer science issues (for example, as to the meaning of “computing device” or “electrical” and “electronic” communication), all of which would be well within the grasp of an experienced mechanical engineer. In contrast, someone with only a computer science degree or someone who designed video games (as opposed to the physical aspects of video game controllers) would be less familiar with the various mechanical terms used in the patent specification and claims, like “attachment stay 448” (*see, e.g.*, ’393 patent, 12:45-46), “soft draw latch” (*see, e.g., id.*, 9:56), “fastening detent 264” (*see, e.g., id.*, 8:40), “spring activated catch 268” (*see, e.g., id.*, 8:44-45), and “boss 430” (*see, e.g., id.*, 12:7).

23. Before February 2, 2015, my level of skill in the art was at least that of a POSITA, under either my definition or Mr. Kitchen definition. Under either definition, 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. In this declaration, when discussing what a reference discloses or suggests, I am describing what I believe a

POSITA at the time of the invention would have understood as being disclosed or suggested by the reference.

V. MATERIALS CONSIDERED AND RELIED UPON

24. In reaching the conclusions described in this declaration, I have considered and relied upon the documents identified in Nintendo's petition and/or Mr. Kitchen's declaration, including the '393 Patent, its prosecution history, and the cited prior art references, as well as on the documents I cite herein. These documents comprise patents, related documents, and printed publications. Each of these documents is of a type that experts in my field would have reasonably relied upon when forming their opinions.

25. I have also relied on my education, training, research, knowledge, and personal and professional experience in the relevant technologies and systems that were already in use prior to, and within the timeframe of the priority date of the claimed subject matter in the '393 Patent, which is February 2, 2015.

VI. RELEVANT LEGAL STANDARDS

26. I am not a lawyer and do not provide any legal opinions, but I have been advised that certain legal standards are to be applied by technical experts in forming opinions regarding meaning and validity of patent claims. I have applied the legal

standards described below, which were provided to me by counsel for the Patent Owner.

27. It is my understanding that assessing the validity of a U.S. patent based on a prior art analysis requires two steps. First, one must construe the terms of the patent claims to understand what meaning a POSITA would have given the terms. 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 teachings of the prior art are viewed through the eyes of a POSITA at the time the invention was made. My analysis as to what constitutes a relevant a POSITA is set forth above.

A. Anticipation

28. I understand that a patent claim is invalid as “anticipated” if each and every limitation of the claim, properly construed, is found, either expressly or inherently, in a single device or method that predates the claimed invention, or is described in a single previous publication or patent that predates the claimed invention. I understand that, in patent law, these previous devices, methods, publications, or patents are called “prior art.” I understand that in order to anticipate a claim, a prior art reference must do more than merely disclose each element of the claim, but rather the prior art reference must disclose all of the elements of the claimed invention arranged as is recited by the claim.

29. I also understand that in order for a prior art reference to anticipate a claim of a patent, the reference must enable one of ordinary skill in the art at the time of the invention to practice the claim without undue experimentation. I understand that factors to be considered in determining whether the reference would require undue experimentation include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims.

B. Obviousness

30. I understand that a patent claim that comprises several elements is not proved obvious by simply showing that each of its elements was independently known in the prior art. Instead, I understand that a patent claim is invalid as obvious only if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious at the time of the claimed invention to a POSITA. I understand that the following factors must be evaluated to determine whether a claim is obvious: the scope and content of the prior art; the difference or differences, if any, between the claim of the patent and the prior art; and the level of ordinary skill in the art at the time the claimed invention was made. In determining the differences between the prior art and the claims, the question is

not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.

31. I understand that the decision-maker must be careful not to determine obviousness using the benefit of hindsight and that many true inventions might seem obvious after the fact. I understand that the decision-maker should consider obviousness from the position of a POSITA at the time the claimed invention was made, and that the decision-maker should not consider what is known today or what is learned from the teaching of the patent.

32. Also, I understand that obviousness grounds cannot be sustained by mere conclusory statements. Rather, it is necessary to provide some articulated reasoning with rational underpinning to support the legal conclusion of obviousness. I understand that exemplary rationales that may support the legal conclusion of obviousness include: (A) Combining prior art elements according to known methods to yield predictable results; (B) Simple substitution of one known element for another to obtain predictable results; (C) Use of known technique to improve similar devices (methods, or products) in the same way; (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (E) “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; (F) Known work in one field of endeavor 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 are predictable to one of ordinary skill in the art; and (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

33. In my evaluation of whether any Challenged Claim of the '393 Patent would have been obvious, I considered whether the Petition, or any evidence submitted in this proceeding, presented an articulated reason with a rational basis that would have motivated a POSITA at the time of the invention to combine the elements or concepts from the prior art in the same way as in the claimed invention.

34. I also understand that to render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention without undue experimentation. I previously listed the factors that I understand are to be considered in determining whether the prior art would require undue experimentation. I understand that if an obviousness case is based on a non-self-enabled reference, and no other prior art reference or evidence would have enabled a skilled artisan to make the claimed invention, then the invention cannot be said to have been obvious.

C. Dependent claims

35. I understand that a dependent claim incorporates each and every limitation of the claim from which it depends. Thus, my understanding is that if a prior art reference fails to anticipate an independent claim, then that prior art reference also necessarily fails to anticipate all dependent claims that depend from the independent claim. Similarly, my understanding is that if a prior art reference or combination of prior art references fails to render obvious an independent claim, then that prior art reference or combination of prior art references also necessarily fails to render obvious all dependent claims that depend from the independent claim.

VII. RESPONSE TO MR. KITCHEN'S MOTIVATION TO COMBINE ARGUMENTS

36. I have reviewed Section IX of Mr. Kitchen's declaration, in which he generally argues that a POSITA would have been motivated to combine the teachings from the references he cites with each other. *See* Ex. 1002, ¶¶ 133-139. I have reviewed his arguments and do not agree with them for the reasons below.

37. Mr. Kitchen jumps to the illogical conclusion that because there are several prior art references in the field of handheld gaming computing devices, a POSITA would have recognized that an innovation or improvement taught in one of them would likely apply to and improve others. This is not necessarily true. In my opinion, the opposite is just as likely, *i.e.*, prior art references that take different

overall design approaches to each other could just as likely degrade each other's designs if a POSITA attempted to combine their teachings. In other words, a hybrid combination of two different design approaches can just as likely inherit the disadvantages of each rather than just their advantages. Furthermore, the disadvantages may compound each other, or what was a beneficial feature on one device may become a disadvantage when imported into another. This is particularly true when it comes to combining surfaces meant to confine. For a POSITA to go forward with such a hybrid combination would require extensive and iterative design engineering and user testing.

38. In this case, Mr. Kitchen identified a market need for gaming controllers that could operate together with a greater selection of mobile devices. But each of the prior art references that he cites already addresses that need using different design approaches.

39. For example, in a first approach, one of the components of the gaming controller is designed to be simple and accommodate one computing device of a specific size, and different versions of that component can be cheaply made to support computing devices of different sizes. For example, Willer designed its hand grippable housings 102 and 104 to work with a simple adaptor 210 designed to accommodate a computing device 10 of a specific size (*see* Willner, Fig. 4), but different versions of adaptor 210 may be made inexpensively with dedicated tooling

to support computing devices of different sizes. Similarly, Schoenith designed its left- and right-side panels 3 and 4 to work with a simple cradle 20 designed to accommodate a smart device 30 of a specific size (*see* Schoenith, Fig. 3), and different versions of cradle 20 may be made cheaply to support smart devices 30 of different sizes. As even Mr. Kitchen admits, Schoenith recognized the possibility of using its controller with mobile devices having different sizes, which is easily accomplished using cradles 20 having different sizes. *See* Ex. 1002, ¶¶ 138, 243 (citing Ex. 1005, 4:36–39).

40. In a second contrasting approach, one of the components of the gaming controller is designed to be adjustable so that it can, by itself, accommodate computing devices of different sizes. An example of this design approach is Park, in which bridge (30, 40) is adjustable to accommodate mobile phones (1) of different lengths. Similarly, in Kessler, extension mechanism 82 is adjustable to accommodate smart phones 70 of different lengths.

41. The design of an adjustable component is typically more complex than a simple, fixed component utilized in a first design approach. Attempting to combine the teachings of an adjustable-component design into a fixed-component design thus risks importing the disadvantages of the adjustable component into the fixed-component design.

42. For example, with respect to Grounds 1 and 2, attempting to combine the teachings of Park's adjustable bridge (30, 40) into Willner's fixed-sized adaptor 210 design or Schoenith's fixed-size cradle 20 design only imports the disadvantages of an adjustable bridge into Willner's and Schoenith's otherwise acceptable designs. The adjustability of Park's bridge (30, 40) brings with it increased cost (multiple parts) and an inherently more compliant bridge structure than Willner's adaptor 210 or Schoenith's cradle 20 that are designed specifically for a computing device of a particular size. As I explain below, when the bottom of Willner's adaptor 210, the retaining lips on the front side of adaptor 210, and the retaining crossbar running across the front of adaptor 210 are removed, and the back of Willner's adaptor 210 is replaced with Park's adjustable bridge (30, 40), Willner's adaptor 210 transforms from a rigid channel to a more compliant, thinner, cross-section structure (typically the stiffness of a beam is proportional to the cube of the height). Similarly, when the bottom of Schoenith's cradle 20 is removed, and the back of Schoenith's cradle 20 is replaced with Park's adjustable bridge (30, 40), Schoenith's cradle 20 transforms from a rigid channel to a more compliant, thinner, structure.

43. Similarly, with respect to Ground 3, attempting to combine the teachings of Kessler's extension mechanism 82 into Schoenith's fixed-size cradle 20 design only imports the disadvantages of Kessler's extension mechanism 82 into Schoenith's otherwise acceptable design. The adjustability of Kessler's extension

mechanism 82 brings with it increased cost (multiple parts) and a more compliant bridge structure than Schoenith's cradle 20 that is designed specifically for a smart device of a particular size. When the bottom of Schoenith's cradle 20 is removed, and the back of Schoenith's cradle 20 is replaced with Kessler's extension mechanism 82, Schoenith's cradle 20 transforms from a rigid channel to a more compliant, thinner, structure.

44. Park and Kessler both teach extendable mechanisms, but these will inherently have some play in them due to the need for clearances for manufacturing and assembly. Being thinner, they will inherently be more compliant than a taller structure. The result is an adjustable mechanism, as taught by Park or Kessler, which while perhaps desirable to some because it is adjustable, will inherently be more expensive (more parts and assembly costs) and more compliant (more likely to flex and open up and release the computing device).

45. From the perspective of a POSITA, a simpler, more effective, solution for making Willner or Schoenith operable with a greater selection of mobile devices would be to create adaptors and cradles of different sizes, rather than attempting to incorporate Park's or Kessler's adjustability into Willner's or Schoenith's designs. As Mr. Kitchen admits, Schoenith notes that different sized cradles could be used to accommodate different sized devices. *See* Ex. 1002, ¶¶ 138, 243 (citing Ex. 1005, 4:36–39). As another example, a POSITA would have commonly found phone cases

of different sizes made for specific mobile phones, but it would have been unusual to find a phone case that is adjustable to different sizes of phones. In my opinion, a POSITA at the time of the invention could not have incorporated Park's or Kessler's adjustable bridges into Willner's or Schoenith's designs without engaging in undue experimentation, and therefore these combinations would not have been obvious to a POSITA.

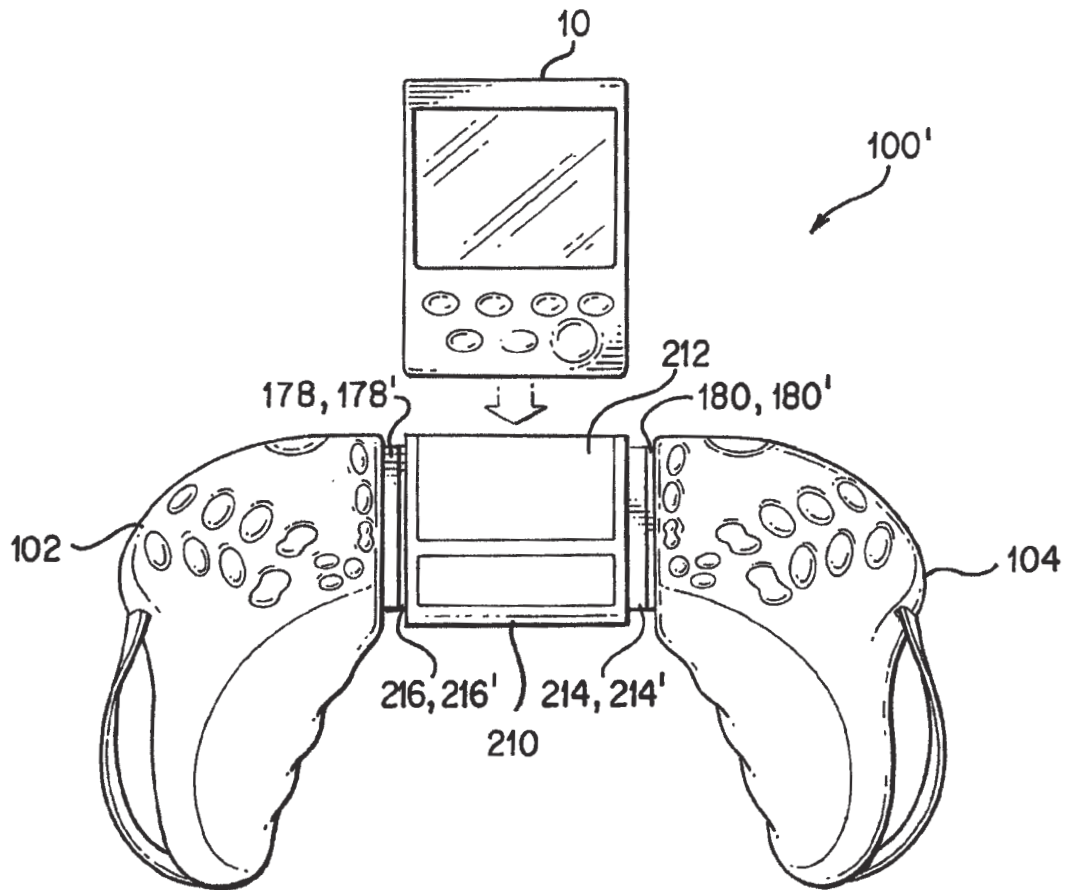
46. In general, in this field of endeavor, if it can even be done successfully, I believe that a POSITA would require extensive and undue experimentation to create a hybrid combination of references that follow different design approaches.

VIII. GROUND 1: OBVIOUSNESS OF CLAIMS 1-7 IN VIEW OF WILLNER AND PARK

A. Overview of the Cited Art

1. Willner (Ex. 1003)

47. Willner describes a “hand grippable combined keyboard and game controller system 100 which can communicate with . . . a palm/tablet sized computing device 10 which is received within an adaptor 210.” Ex. 1003, ¶ [0050]. As shown in Willner, Fig. 4 (reproduced below), the palm/tablet sized computing device 10 is oriented in portrait mode when it is inserted from the top into opening 212 of adaptor 210. *Id.*



Willner, Fig. 4

48. To explain how a POSITA would understand the three-dimensional structure of Willner's single-piece, integrated adaptor 210, I constructed a computer-aided design (CAD) model using SolidWorks™ illustrating some relevant structural aspects of adaptor 210.

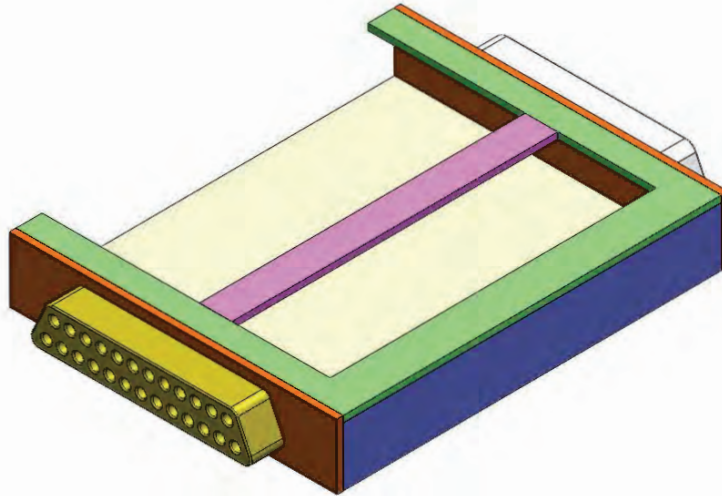


Figure 1: Willner's adaptor 210 (3-D structure)²

49. As shown in the figure above, a POSITA would understand that adaptor 210 has sides (annotated in **orange**). Additionally, a POSITA would understand that adaptor 210 has a back (annotated in **yellow**), retaining lips on the front side of adaptor 210 (annotated in **green**), a retaining crossbar running across the front of adaptor 210 (annotated in **pink**), and a bottom (annotated in **blue**). These four additional structural elements work together with the sides of adaptor 210 to retain computing device 10. In my opinion, a POSITA would understand that without these

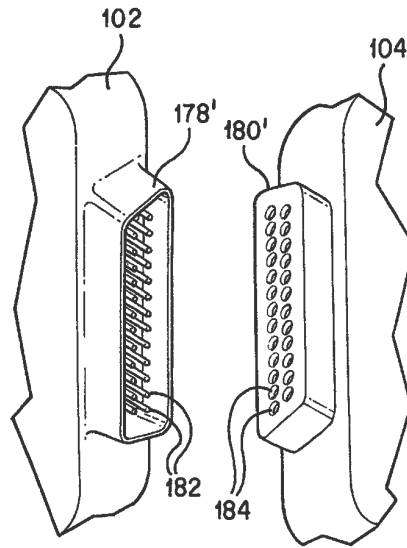
² The SolidWorks™ models in this declaration are not intended to be precisely to-scale but roughly on the same order of scale as depicted in the cited references.

They are intended to illustrate a POSITA's understanding of the structural components, and to be proportioned such that they could be built and tested as would be done by a POSITA seeking to practice the art.

additional four structural elements, Willner's adaptor 210 cannot retain computing device 10 during normal user operation.

50. Moreover, Willner's adaptor 210 does not provide any compressive load on computing device 10; it merely "receive[s]" computing device 10 through opening 212 from the top side. *Id.*, ¶ [0050] (emphasis added); *see id.*, ¶ [0052] (discussing a switch 218 can provide an enabling signal responsive to "receipt of the computing device 10 within the opening 212 of adaptor 210") (emphasis added); '393 Patent, 10:11-19 ("the application of sufficient compressive load being placed on the computing device 302 to securely hold the computing device between the pair of confinement structures 316"). In my opinion, even with the structural elements of the adaptor 210 discussed above, computing device 10 can come loose from adaptor 210 during normal user operation.

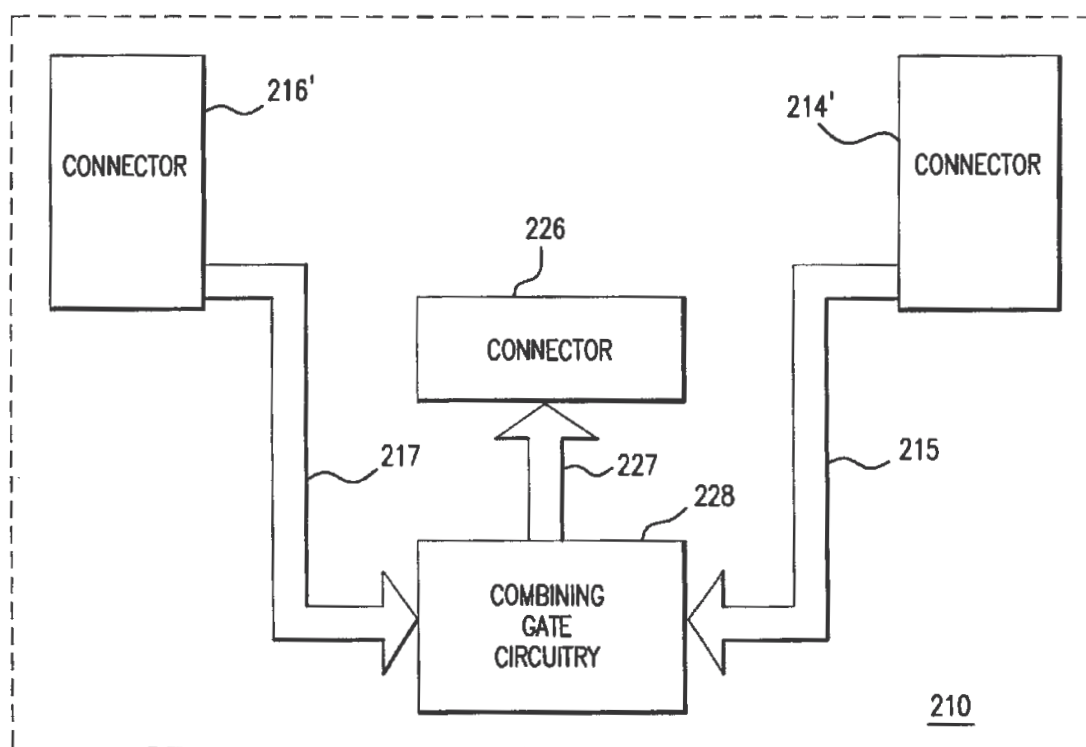
51. On both of its sides, adaptor 210 has 25-pin D-subminiature ("DB-25") connecting portions 216, 216' and 214, 214' integrated into adaptor 210. Connecting portions 216, 216' and 214, 214' couple to corresponding DB-25 connecting portions 178, 178' and 180, 180' of hand grippable of housings 102 and 104 respectively. Willner, Fig. 3C, reproduced below, shows the corresponding DB-25 connecting portions 178' and 180' of the hand-grippable housings 102 and 104 respectively, and Fig. 4 above shows the DB-25 connecting portions of adaptor 210 "matingly engage" with those of housings 102 and 104. *Id.*, ¶ [0050].



Willner, Fig. 3C

52. Willner does not anywhere discuss using screws or snap-fit connectors to secure any components. A POSITA reviewing Willner, Fig. 4, would recognize that Willner's design for its adaptor 210 and housings 102 and 104 does not provide space enough to incorporate screws adjacent to connecting portions 216, 216' and 214, 214' or connecting portions 178, 178' and 180, 180' of hand grippable of housings 102 and 104. Instead, Willner only has "a releasable coupling" between the DB-25 connecting portions themselves that "permits the [components] to be integrally joined, when so desired, and subsequently easily separated." *Id.*, ¶ [0046]; *see id.*, Abstract ("the complementary connecting portions allowing the two housings (102 and 104) to be releasably joined together, or alternately releasably coupled to an adaptor (210)").

53. Willner's adaptor 210 can provide a "hard wired connection" to computing device 10 via "a docking connector [226] within the adaptor 210 which mates with a corresponding connector of the computing device 10." *Id.*, ¶ [0051]. As shown in Fig. 8, the DB-25 connecting portions 216' and 214' of adaptor 210 are coupled through buses 217 and 215 respectively within adaptor 210 to the computing device docking connector 226.

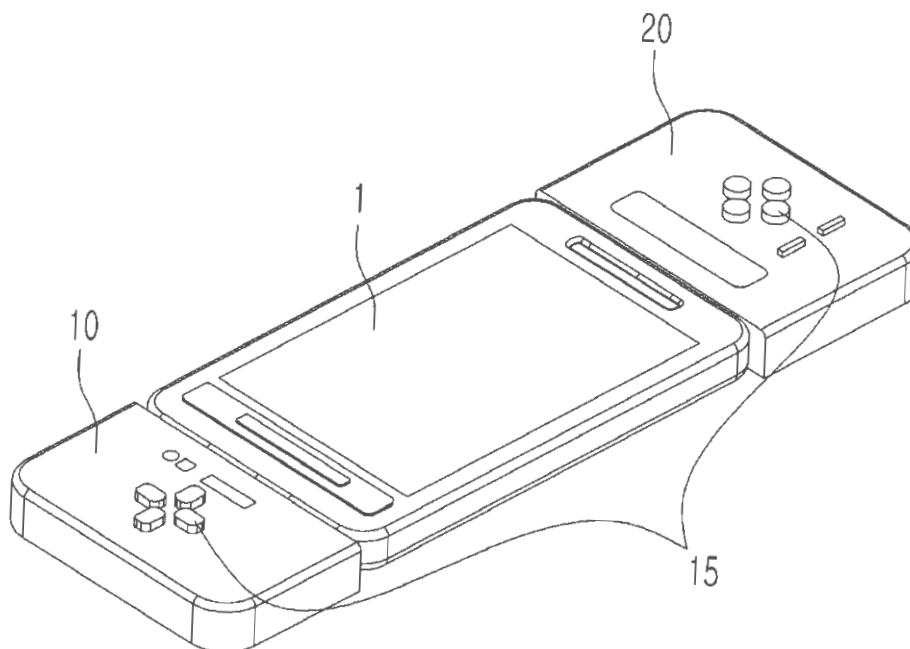


Willner, Fig. 8

2. Park (Ex. 1004)

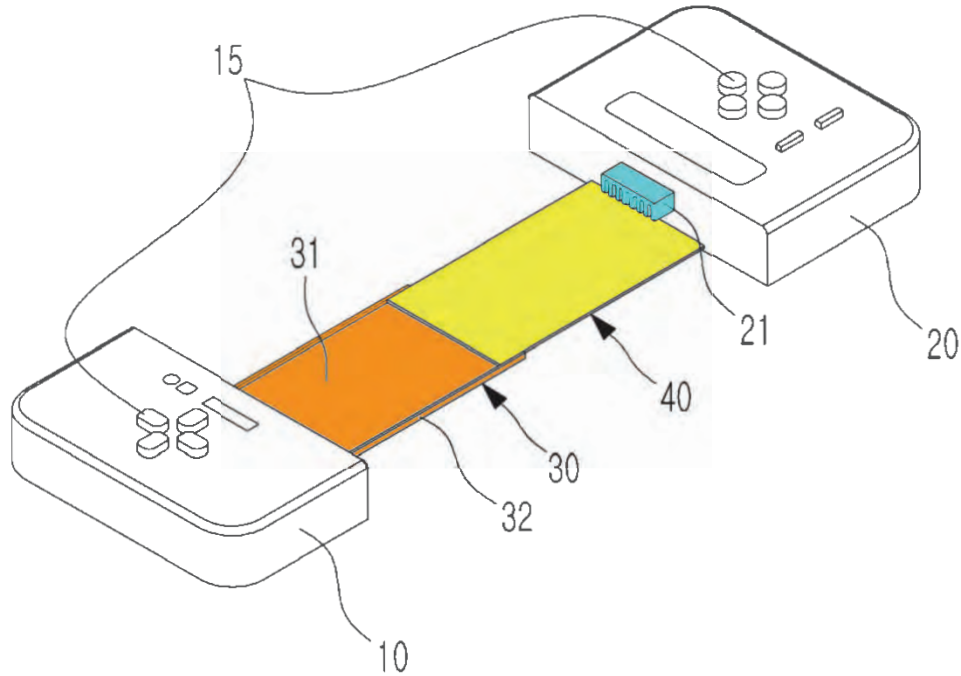
54. In his declaration, Mr. Kitchen relies primarily on Park's structures depicted in Figs. 1-3. *See, e.g.*, Ex. 1002, ¶¶ 121-123, 149. As shown in Park, Fig. 3,

reproduced below, a mobile phone (1) is mounted in landscape orientation between the sidewalls of Park's controller bodies (10) and (20).



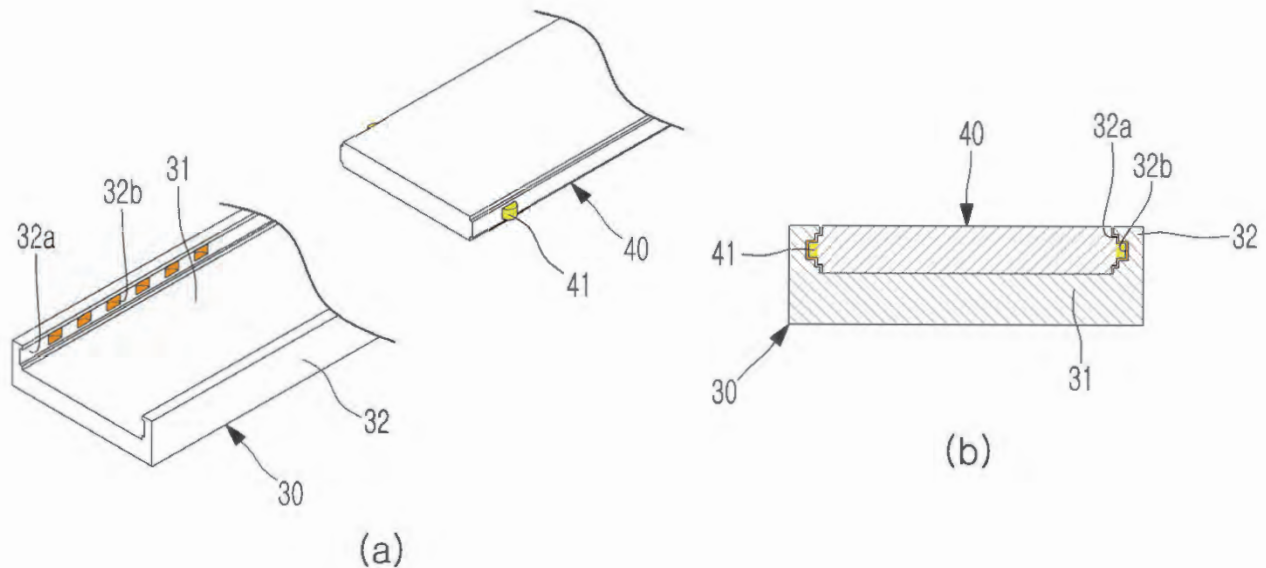
Park, Fig. 3

55. As shown in Fig. 1 below (annotated), Park's bridge (30, 40) (annotated in orange and yellow, respectively) connects to controller bodies (10) and (20) at the bottom of their sidewalls. Park's bridge (30, 40) is made by joining a first panel (30) (annotated in orange) and a second panel (40) (annotated in yellow). Park discloses that the first panel (30) is made of elastic material. Ex. 1004, ¶ [0034].



Park, Fig. 1 (annotated)

56. As shown in annotated Figs. 2(a)-(b) below, to join panels (30) and (40) together to form bridge (30, 40), first panel (30) has side walls (32), and recessed guide grooves (32a) and catching holes (32b) (annotated in orange). *Id.*, ¶ [0033]. Second panel (40) has small protrusions (41) (annotated in yellow) that catch corresponding catching holes (32b) (annotated in orange). *Id.*, ¶¶ [0033], [0039].



Park, Figs. 2(a)-(b) (annotated)

57. As Park itself admits, the arrangement described above that Mr. Kitchen relies on in his declaration does not properly retain mobile phone (1) between controller bodies (10) and (20) during normal user operation. According to Park itself, “as the mobile phone is not sufficiently in contact with the device according to the present invention when using the above configuration, the mobile phone (1) may come loose during gaming or become detached in severe cases, hindering comfortable and stable operation of a game.” *Id.*, ¶ [0041]. In other words, Park admits that this configuration does not allow mobile phone (1) to be seated for stability in the device. *See id.*, ¶ [0042].

58. Like Willner, Park does not anywhere discuss using screws or snap-fit connectors to secure any of its components together. In particular, a POSITA would understand that Park’s bridge (30, 40) is not designed to be secured to another component using screws or snap-fit connectors.

59. Park's bridge (30, 40) includes a connecting cable (not depicted) extending along the inside of bridge (30, 40) that electrically connects first body (10) and second body (20). *Id.*, ¶¶ [0026], [0036].

B. A POSITA would not have been motivated to combine Willner and Park as Mr. Kitchen contends

60. I have reviewed Mr. Kitchen's declaration, in which he proposes to selectively combine portions of Willner's adaptor 210 with Park's adjustable bridge (30, 40). Using SolidWorks™, I prepared a series of 3-D illustrations to show the modifications that Mr. Kitchen proposes to Willner's adaptor 210.

61. First, as shown in Figure 2 below, Mr. Kitchen proposes to break apart Willner's single-piece adaptor 210 with integrated DB-25 connecting portions 216, 216' and 214, 214', keeping only the left- and right-facing sidewalls (orange) of adaptor 210 and the DB-25 connecting portions 216, 216' and 214, 214' (yellow).

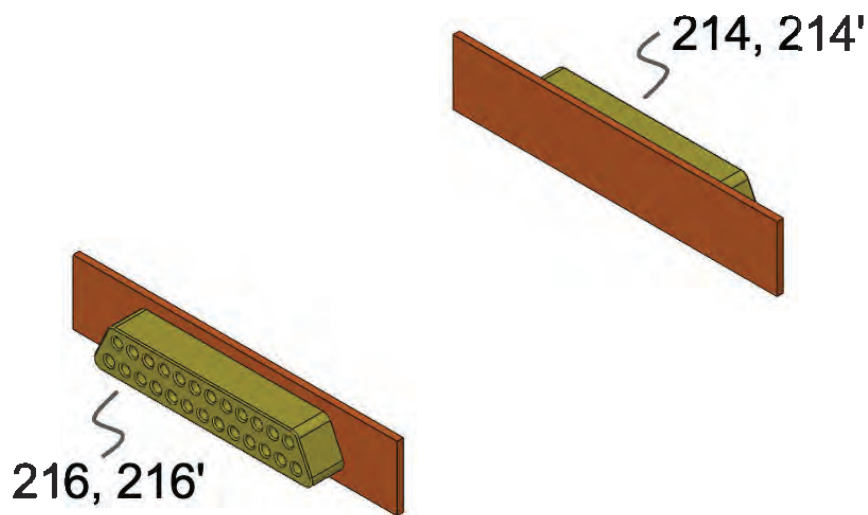


Figure 2: Structure of Willner's adaptor 210 that Mr. Kitchen proposes to keep

62. Mr. Kitchen proposes to discard the remaining structure of adaptor 210. As shown in Figure 3 below, this includes the back (annotated in **yellow**), the retaining lips on the front side (annotated in **green**), the retaining crossbar running across the front (annotated in **pink**), and the bottom (annotated in **blue**). *See* Ex. 1002, ¶¶ 148, 154, 167, 199.

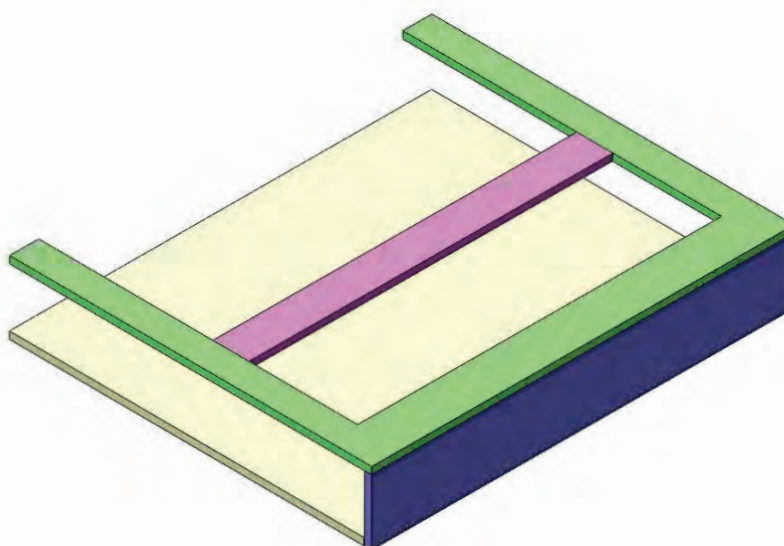


Figure 3: Structure of Willner's adaptor 210 that Mr. Kitchen proposes to discard

63. Mr. Kitchen then proposes to replace only the back (annotated in **yellow**) with Park's adjustable bridge (30, 40). *See id.* Figure 4 below provides a CAD model I created in an effort to show what I believe Mr. Kitchen was arguing could be done by a POSITA.

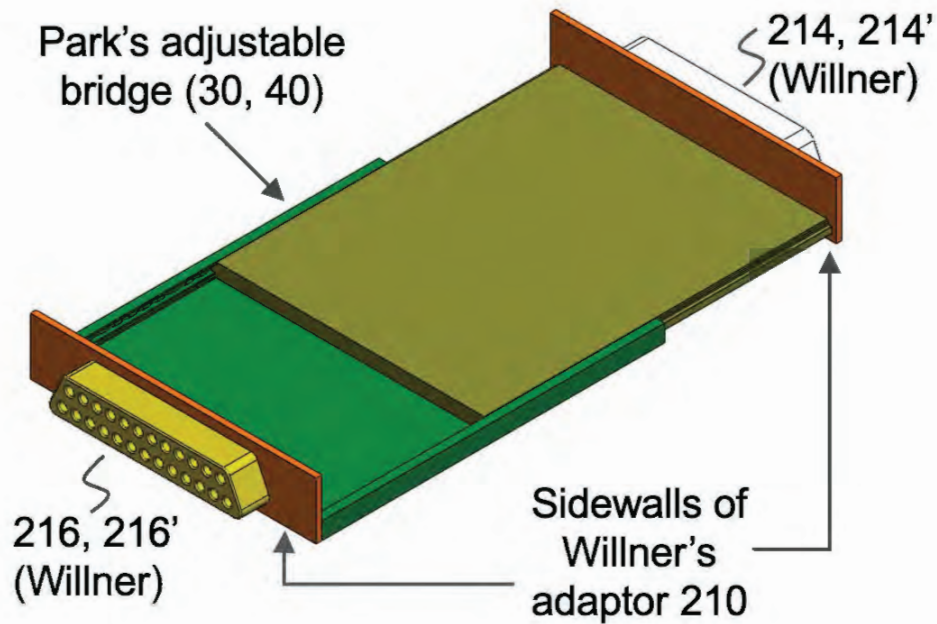


Figure 4: Mr. Kitchen's proposed combination of selective elements of Willner's adaptor 210 with Park's adjustable bridge (30, 40)

64. In addition to the reasons that I described above in Section VII, in my opinion a POSITA considering Willner's and Park's teachings, taken as a whole, would not have been motivated to make the combination that Mr. Kitchen proposes, for three additional reasons.

65. First, Mr. Kitchen's proposed modification of Willner's adaptor 210 with the teachings of Park's adjustable bridge (30, 40) would frustrate Willner's basic purpose of retaining its computing device 10 in position between its hand grippable housings 102 and 104, *e.g.*, from coming out in the direction of the user. Thus, in my opinion, a POSITA would not be motivated to make the proposed combination.

66. As part of his proposed combination, Mr. Kitchen proposes to entirely discard four different structures from Willner's adaptor 210, as shown in Figure 3 above—the back (annotated in **yellow**), the retaining lips on the front side (annotated in **green**), the retaining crossbar running across the front (annotated in **pink**), and the bottom (annotated in **blue**). These four structures work together with the sides of adaptor 210 to retain Willner's computing device 10 in position. In my opinion, a POSITA would understand that without these structural elements, Willner's adaptor 210 cannot retain computing device 10 in position during normal user operation.

67. Replacing only the back of Willner's adaptor 210 with the teachings of Park's adjustable bridge (30, 40) as Mr. Kitchen proposes, does not remedy the problem of retaining computing device 10 in position during normal user operation, *e.g.*, from coming out in the direction of the user. In other words, Mr. Kitchen's proposed combination shown above in Figure 4 suffers from the same deficiency that it cannot retain Willner's computing device 10 in position during normal user operation.

68. Indeed, this deficiency that Mr. Kitchen's proposed combination suffers from is the same deficiency that Park expressly points out in its disclosure: "[A]s the mobile phone is not sufficiently in contact with the device according to the present invention when using the above configuration, the mobile phone (1) may come loose during gaming or become detached in severe cases, hindering

comfortable and stable operation of a game.” Ex. 1004, ¶ [0041]. In other words, Park points out, this configuration does not allow mobile phone (1) to be seated for stability in the device. *See id.*, ¶ [0042]. Park attempts to solve its identified problem by introducing a cushioning pad (60) on the face of the first controller body (10), as well as a connecting assembly with an air tube (110), contact sensor (112), fan (120), air offtake pipe (130), check valve (140), and controller (150). *See id.*, Figs. 4-5, ¶¶ [0043]-[0062]. In his proposed combination, Mr. Kitchen fails to include any of these components that Park attempts to solve its problem with.

69. It is not surprising that Mr. Kitchen’s proposed combination suffers from the same deficiency identified by Park. In terms of the structures that purportedly retain the computing device 10, Mr. Kitchen’s proposed combination merely replaces the sidewalls of Park’s controller bodies (10) and (20) with the sidewalls of Willner’s adaptor 210. But the ultimate mechanical structure involved is equivalent between these two designs. Thus, the mechanical behavior of Mr. Kitchen’s proposed combination is the same as Park’s device, and they both suffer from the same deficiency identified by Park. That Mr. Kitchen’s proposed combination suffers from the same deficiency as admitted to in Park is easily verified by comparing the 3-D render that I created of his proposed combination with that of Park’s device, as shown below in Figure 5, to see that they are mechanically equivalent.

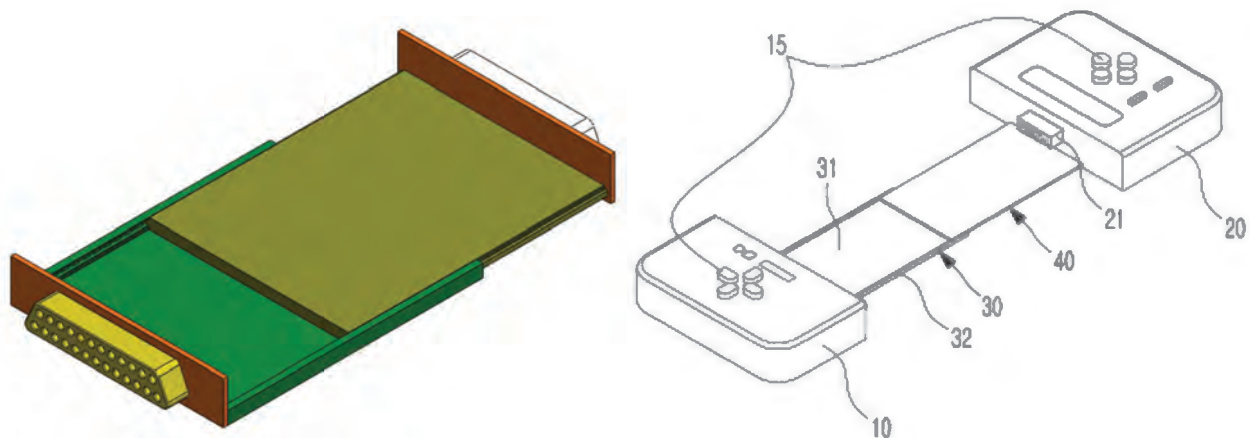


Figure 5: 3-D SolidWorks™ 3-D render of Mr. Kitchen's proposed combination, versus Park, Fig. 1

70. Indeed, Mr. Kitchen's proposed combination does not even include a structure like Park's connecting terminal (21) that may assist in mechanical retention of a specific computing device 10 (Mr. Kitchen discarded the bottom of Willner's adaptor 210 that would have included computing device docking connector 226).

71. In summary, Mr. Kitchen's proposed modification of Willner's adaptor 210 with the teachings of Park's adjustable bridge (30, 40) would frustrate Willner's basic purpose of retaining its computing device 10 in position between its hand grippable housings 102 and 104. Thus, in my opinion, a POSITA would not be motivated to make Mr. Kitchen's proposed combination.

72. Second, the combined teachings of Willner's adaptor 210 modified with those Park's adjustable bridge (30, 40), taken as a whole, do not enable a POSITA to make and use the claimed invention without undue experimentation. Specifically, in Mr. Kitchen's proposed combination of their teachings, Park's adjustable bridge (30, 40) connects between the sidewalls of Willner's adaptor 210.

But Park's bridge design is fundamentally flawed because, in attempting to make it easy for a user to reduce or expand its length through ratcheting action, Park fatally compromises its ability to retain a mobile device between its controller bodies during normal user operation.

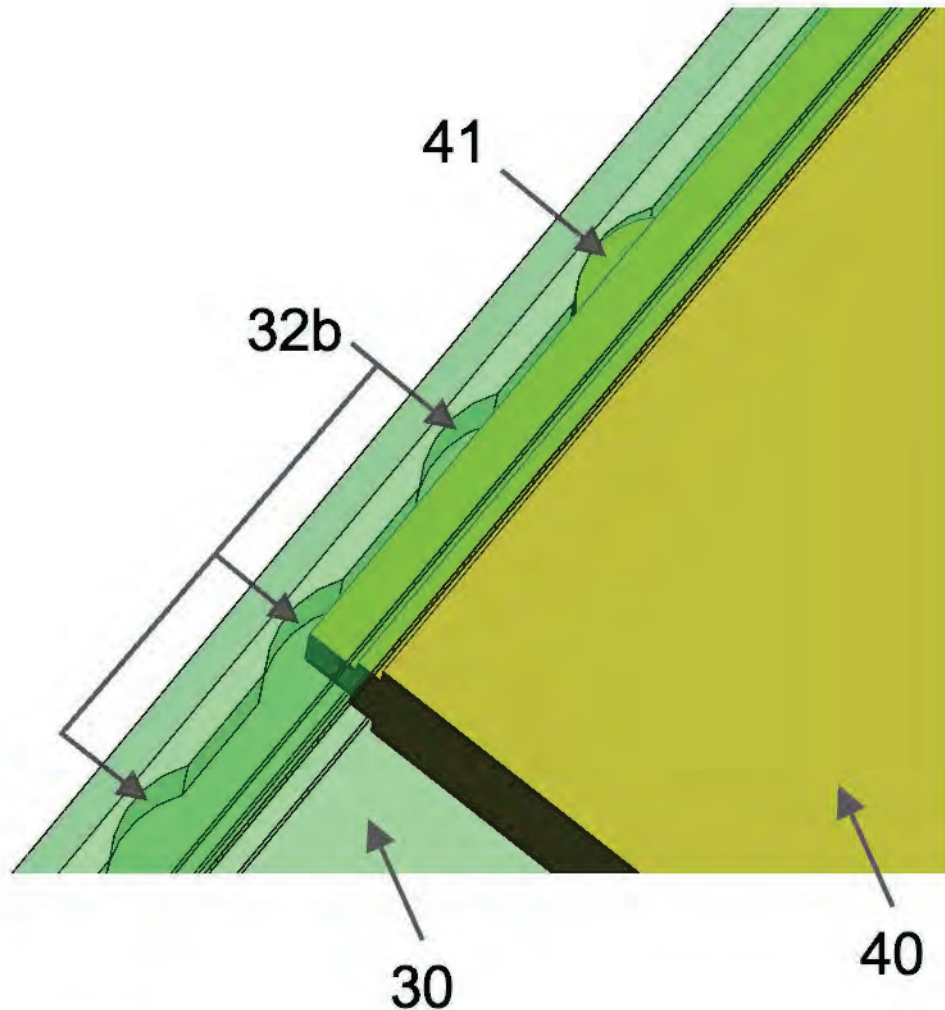


Figure 6: Close up 3-D render of Park's adjustable bridge

73. With reference to the close-up 3-D render of Park's ratcheting mechanism shown above in Figure 6, as a user pulls or pushes on Park's bridge elements (first panel (30) and second panel (40)), the protrusions (41) disengage

from the catching holes (32b) until a new discrete position is reached, and then the protrusions (41) snap back into the catching holes (32b). This snap action is made possible by the fact that the first panel (30) is wide, flat, and made of elastic material. Ex. 1004, ¶ [0034]. Thus, when the ramp force action of the protrusions (41) on the catching holes (32b) is applied, it creates a bending moment to curve the first panel (30) thereby increasing its width at the level of the protrusions (41). This curvature facilitates the ratcheting action. However, in this design there is no positive mechanical retention of the protrusions (41) in the catching holes (32b). Therefore, during normal operation the user is likely to apply pull forces that cause the protrusions (41) to disengage from the catching holes (32b), resulting in Willner's computing device (10) coming out.

74. Third, in my opinion, a POSITA would require undue experimentation to connect Willner's adaptor 210 with Park's adjustable bridge (30, 40) using screws or snap-fit connectors within the design constraints imposed by Willner's system. Willner's design does not provide the physical space necessary to connect Park's adjustable bridge (30, 40) to Willner's adaptor 210 sidewalls via screws or snap-fit connectors that are properly sized to retain them together during normal user operation. Depending on how these screws or snap-fit connectors were oriented, they would interfere with Willner's hand grippable housings 102 and 104, with Willner's housing's connecting portions (178, 178', 180, and 180'), with Willner's adaptor

210's connecting portions (214, 214', 216, and 216'), and/or with Willner's computing device 10. In my opinion, a POSITA would require undue experimentation to re-design the connection of the sidewalls of Willner's adaptor 210 with Park's adjustable bridge (30, 40) using properly sized screws or snap-fit connectors without having them interfere with one or more of the above components.

75. In his declaration, Mr. Kitchen ignores these mechanical design issues entirely. He fails to articulate where or how to position the screws or snap-fit connectors to connect the sidewalls of Willner's adaptor 210 with Park's adjustable bridge (30, 40). *See* Ex. 1002, ¶¶ 209-210. He does not provide analysis to show the sizes of the screws or snap-fit connectors required to provide joints of requisite strength to sustain normal user operation. Nor does he discuss where such screws or snap-fit connectors would be positioned to securely retain Willner's adaptor 210 with Park's adjustable bridge (30, 40) during normal user operation without having them interfere with one or more of the above components. To the extent that Mr. Kitchen provides additional information on these design aspects, I reserve the right to supplement and/or amend my opinions in view of such additional information.

C. The combination of Willner and Park fails to disclose or suggest the claimed arrangement of the “pair of confinement structures”

76. With respect to “pair of confinement structures,” independent claim 1 of the '393 Patent recites, among other limitations, the following arrangement:

[*Claim limitation 1(b)(1)*] a pair of confinement structures, the pair of confinement structures interacting with the computing device and adjacent at least two opposing sides of the computing device, but not more than three sides of the sides of the computing device,

* * * * *

[*Claim limitation 1(d)(4)*] wherein each electronic game control module is a separate and distinct structure from each of their corresponding confinement structures, forming no structural portion of their corresponding confinement structures, . . .

77. During prosecution, the Examiner identified aspects of this claimed arrangement is his statement of reasons for allowance. *See* Ex. 1009, 25-26.

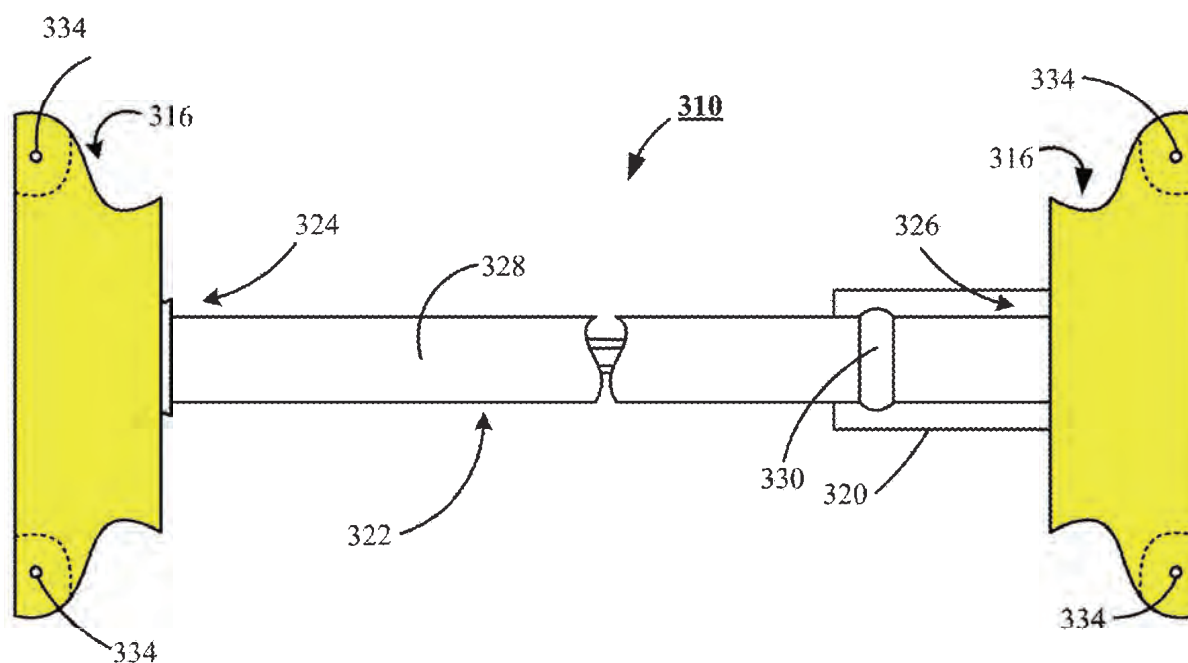
78. Under the claim construction of the United States District Court for the Northern District of California, which Mr. Kitchen and Nintendo have applied, the claim term “pair of confinement structures” is construed as: “physical component(s) that hold(s) a computing device.” Ex. 1028, 10-12; *see* Ex. 1002, ¶¶ 106, 108-110; Pet., 14-15.

79. In my opinion, under this construction of “pair of confinement structures,” the combination of Willner and Park, taken as a whole, fails to disclose or suggest this claimed arrangement to a POSITA.

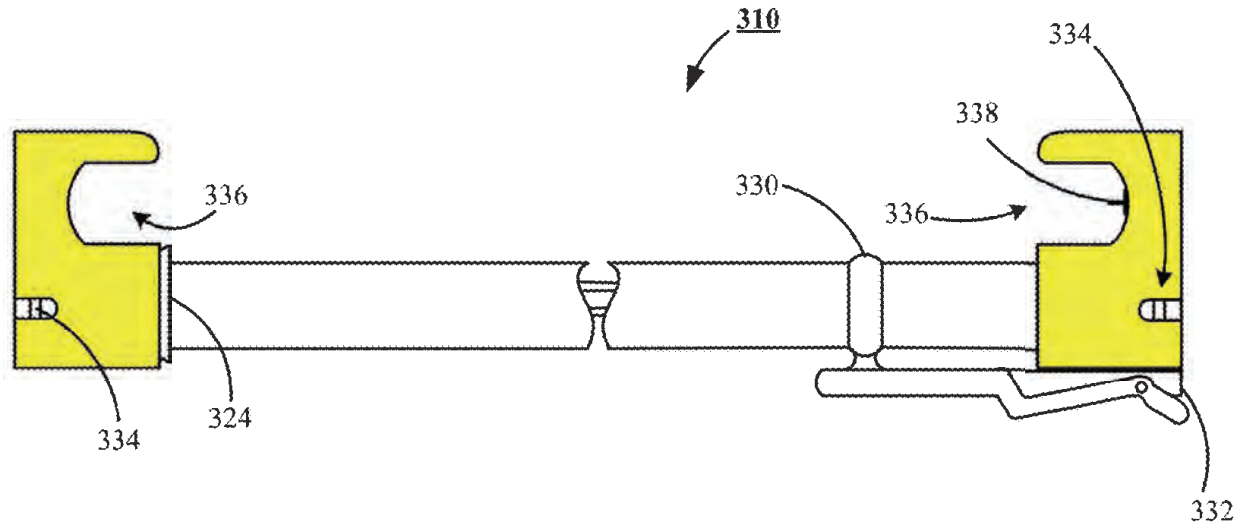
80. As an initial matter, for at least the reasons that I have discussed above in Section VII and Section VIII.B, a POSITA would not have been motivated to combine Willner and Park as Mr. Kitchen proposes.

81. Moreover, even if they could be combined, the teachings of Willner and Park, taken as a whole, fail to disclose or suggest this claimed arrangement to a POSITA. Specifically, in the proposed combination, the sidewalls of Willner's adaptor 210, which Mr. Kitchen purports are the claimed "pair of confinement structures" in his proposed combination, would not **hold** the computing device 10, *e.g.*, from coming out in the direction of the user (out of the page).

82. As shown in an example embodiment depicted in Figs. 17 and 18 of the '393 Patent, each of the confinement structures 316 includes a cradle 336 (annotated in yellow). As shown in Fig. 18, each cradle 336 (annotated in yellow) includes a lip that prevents a computing device 302 that is held between the confinement structures 316 from coming out in the direction of the user.

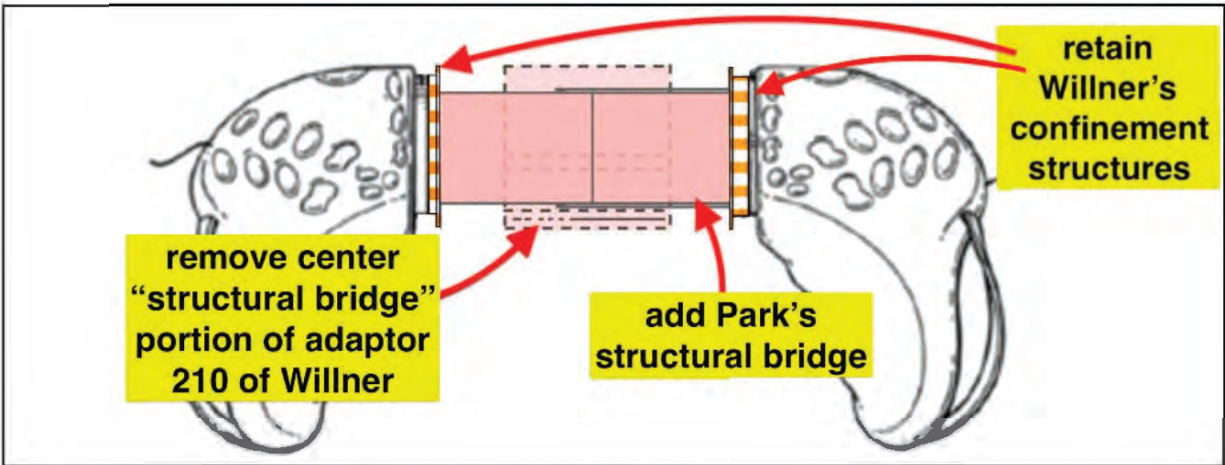


'393 Patent, Fig. 17 (annotated)



'393 Patent, Fig. 18 (annotated)

83. By contrast, in his analysis of the relevant claim limitations 1[b][1] and 1[d][4], *see* Ex. 1002, ¶¶ 146-157, 199, Mr. Kitchen fails to consider how the combination of Willner's adaptor 210 sidewalls and Park's adjustable bridge (30, 40) could hold Willner's computing device 10 from popping out in the direction of the user (out of the page). However, as can be seen from the illustration that Mr. Kitchen provides at Paragraphs 154 and 199 of his declaration (reproduced below), Mr. Kitchen's proposed combination of Willner's adaptor 210 sidewalls with Park's adjustable bridge (30, 40) does not provide any structure that would hold Willner's computing device 10 in position, *e.g.*, from coming out in the direction of the user (out of the page).



Possible modification of Willner to incorporate teachings of Park

Figure 7: Mr. Kitchen's proposed modification of Willner with Park

84. Mr. Kitchen implies that Park's adjustable bridge (30, 40) could compress the sidewalls of Willner's adaptor 210 to hold Willner's computing device 10. But without any retaining structure to prevent the computing device 10 from coming out in the direction of the user (out of the page), placing the computing device 10 above Park's bridge (30, 40) will cause Park's bridge (30, 40) to bow and tend to make the computing device 10 pop out in the direction of the user (out of the page).

85. I have discussed my opinion above in the context of a POSITA's motivation to combine Willner and Park, that Mr. Kitchen's proposed modification of Willner's adaptor 210 with the teachings of Park's adjustable bridge (30, 40) would frustrate Willner's basic purpose of retaining its computing device 10 in position between its hand grippable housings 102 and 104, *e.g.*, from coming out in

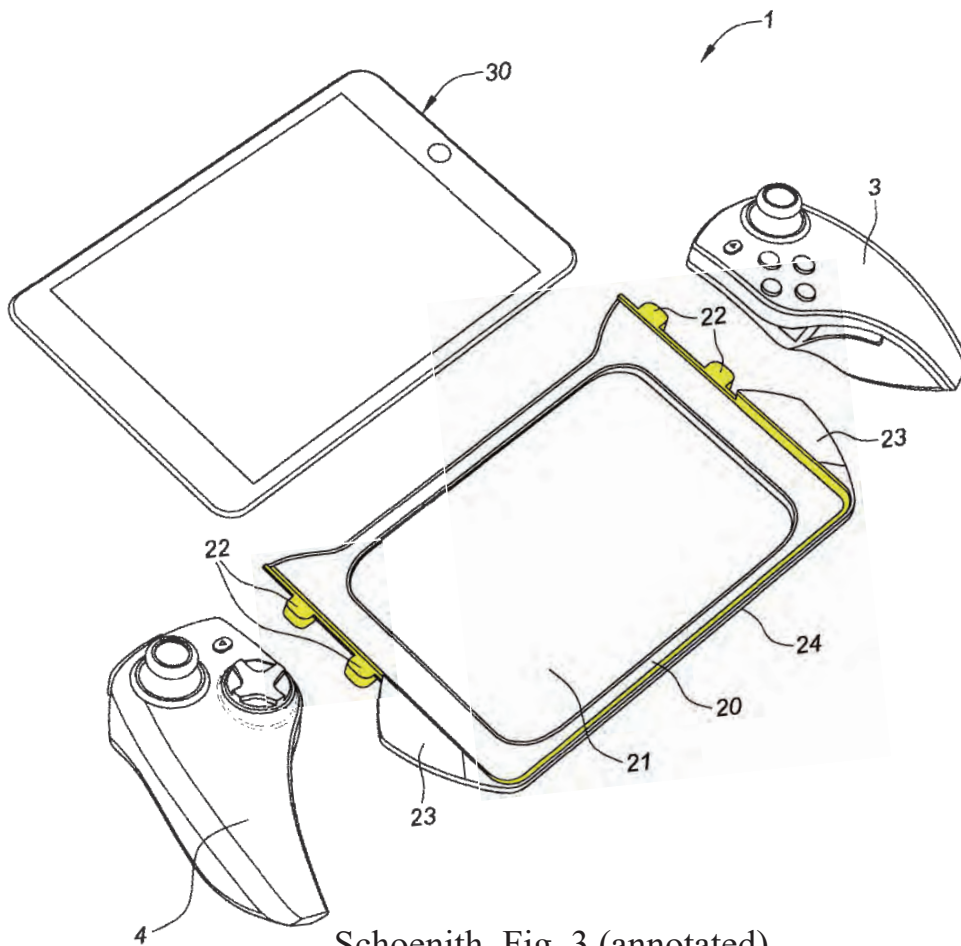
the direction of the user. I have also discussed my opinion that the design of Park's adjustable bridge (30, 40) is fundamentally flawed because, in attempting to make it easy for a user to reduce or expand its length through ratcheting action, Park fatally compromises its ability to retain a mobile device between its controller bodies during normal user operation. Those opinions are relevant to my analysis here, and I incorporate my discussion of those opinions here.

IX. GROUND 2: OBVIOUSNESS OF CLAIMS 1-7 IN VIEW OF SCHOENITH AND PARK

A. Overview of the Cited Art

1. Schoenith (Ex. 1005)

86. Schoenith describes a controller accessory that “can function with a variety of smart devices, such as digital media extenders, smart phones, and tablets: more specifically with iOS (iPhone OS) devices such as Apple TV®, iPad®, or iPad Mini.” Ex. 1005, 4:36-39. As shown in Schoenith, Fig. 3 (annotated below), the controller 1 has a right side panel 4, a left side panel 3, and a detachable cradle 20. “The controller, the right side panel and the left side panel are universal in the sense that the right side panel and the left side panel can be used with detachable cradles of various sizes, shapes, and configurations, accommodating a variety of smart devices.” *Id.*, 6:10-14.

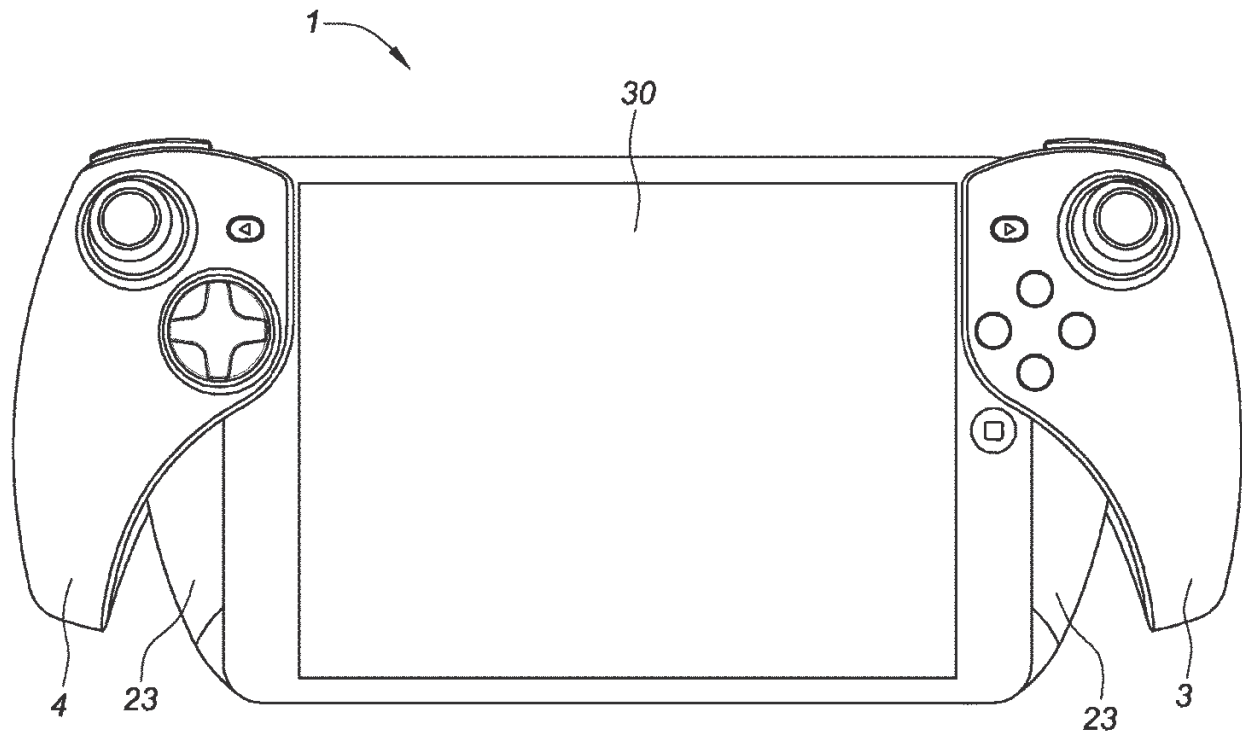


Schoenith, Fig. 3 (annotated)

87. As shown in Fig. 3 above, a smart device 30 (*e.g.*, an iPad) may be inserted so that it rests on cradle 20. “The cradle serves as a support for a smart device.” *Id.*, 6:15. “The cradle of all embodiments of this invention may have any size, shape, configuration, or a combination thereof so that the cradle can accommodate a smart device, such as iPhone®, iPad®, iPad Mini, or the like.” *Id.*, 6:15-19. “Preferably, the cradle is substantially planar and has the dimensions corresponding to dimensions of a specific smart device so that the cradle can accommodate the specific smart device.” *Id.*, 6:22-25. “Preferably, the cradle has shape and dimensions so that the smart device fits snugly against the cradle and can

be securely placed, inserted, slid, attached, and the like to the cradle without being able to change location within the cradle.” *Id.*, 6:25-29.

88. Cradle 20 includes raised walls 24 (annotated in yellow) against which the smart device 30 leans when it is placed on cradle 20. *Id.*, 10:40-48, 11:18-22.



Schoenith, Fig. 9

89. As shown in Schoenith, Fig. 9 (reproduced above), the right and left side panels 3 and 4 overlap over the smart device 30 to prevent it from coming out in the direction of the user (out of the page).

2. Park (Ex. 1004)

90. I previously described Park with respect to Ground 1 and incorporate that discussion here.

B. A POSITA would not have been motivated to combine Schoenith and Park as Mr. Kitchen contends

91. I have reviewed Mr. Kitchen's declaration, in which he proposes to selectively combine portions of Schoenith's cradle 20 with Park's adjustable bridge (30, 40). Using SolidWorks™, I prepared a series of 3-D illustrations to show the modifications that Mr. Kitchen proposes to Schoenith's cradle 20.

92. First, as shown in Figure 8 below, Mr. Kitchen proposes to break apart Schoenith's single-piece cradle 20, keeping only the left- and right-facing raised sidewalls 24 (orange) of cradle 20. Mr. Kitchen proposes to discard the remaining structure of cradle 20.

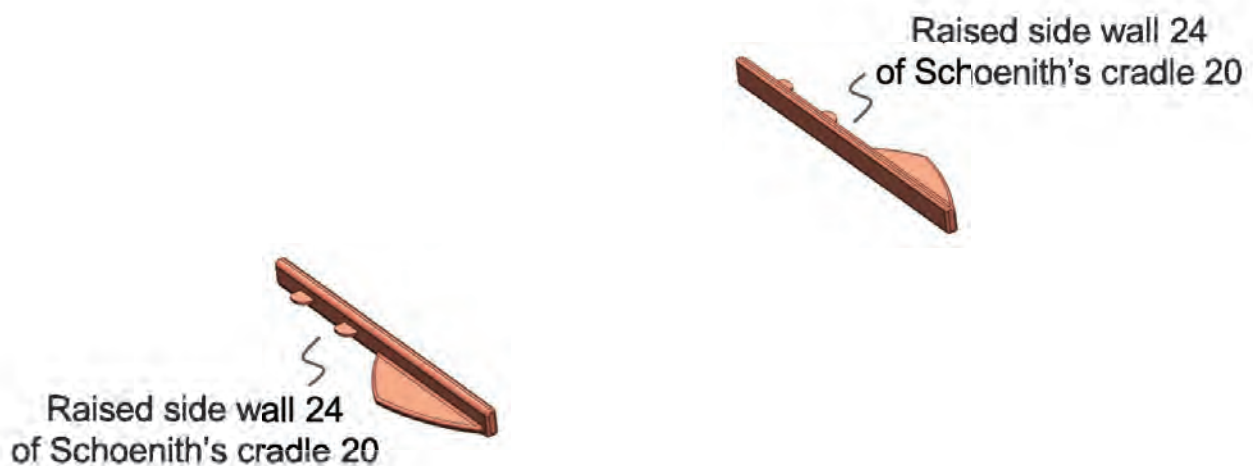


Figure 8: Structure of Schoenith's cradle 20 that Mr. Kitchen proposes to keep

93. Mr. Kitchen then proposes to replace the back of Schoenith's wider cradle 20 with Park's narrower adjustable bridge (30, 40). *See, e.g.,* Ex. 1002, ¶¶ 240, 270. Figure 9 below provides a 3-D CAD model that I created to illustrate Mr. Kitchen's proposed combination.

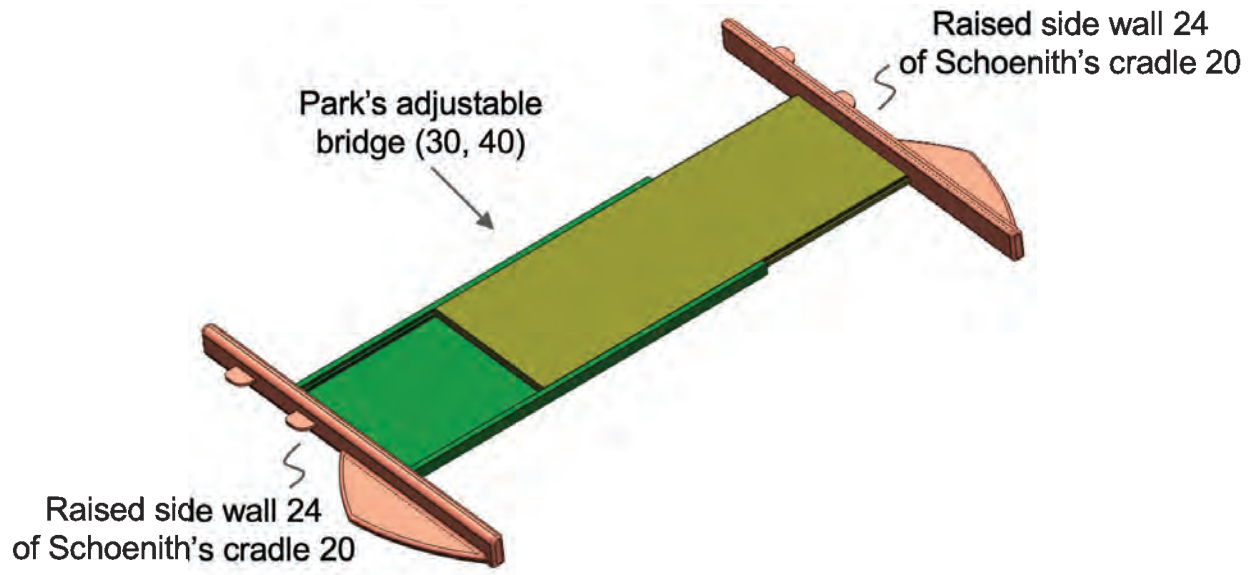


Figure 9: Mr. Kitchen's proposed combination of selective elements of Schoenith's cradle 20 with Park's adjustable bridge (30, 40)

94. Mr. Kitchen's proposed combination of portions of Schoenith's cradle 20 with Park's adjustable bridge (30, 40) would then serve as an assembly to which Schoenith's left and right side panels 3, 4 are attached, as shown in Figure 10 below.

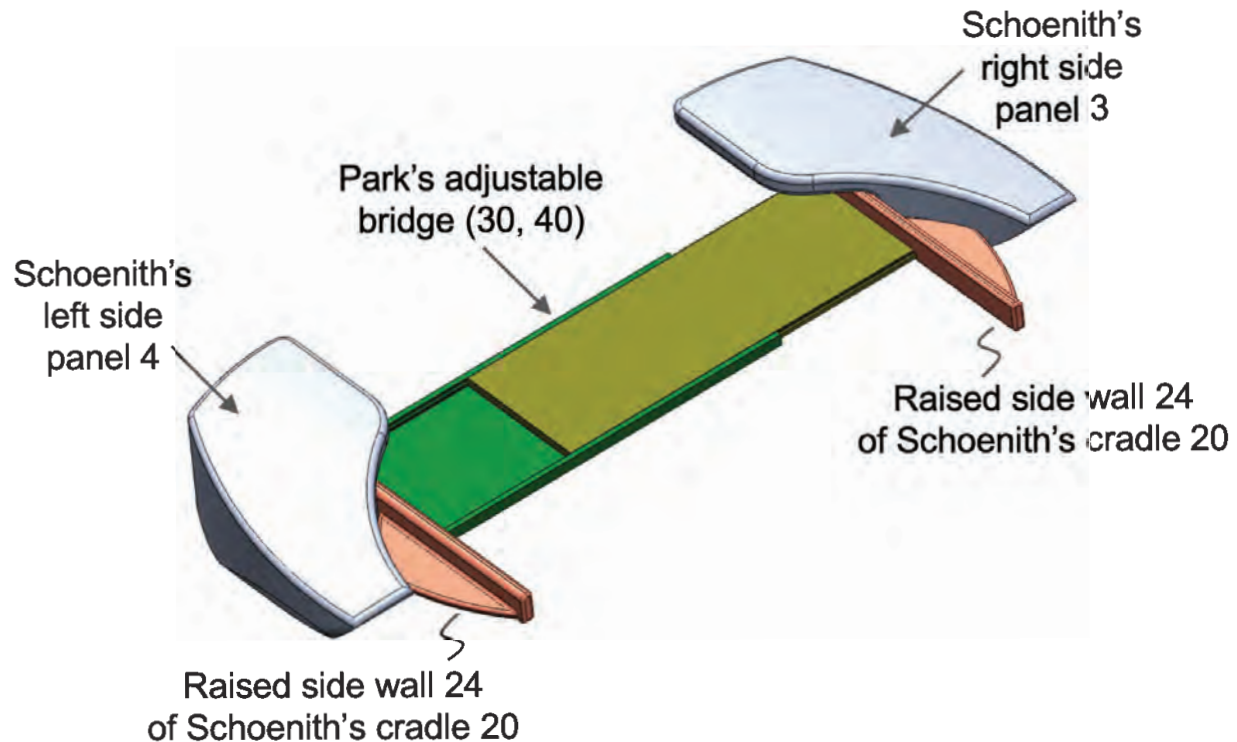


Figure 10: Mr. Kitchen's proposed combination of selective elements of Schoenith with Park's adjustable bridge (30, 40)

95. In addition to the reasons that I described above in Section VII, in my opinion a POSITA considering Schoenith's and Park's teachings, taken as a whole, would not have been motivated to make the combination that Mr. Kitchen proposes, for three additional reasons.

96. First, Mr. Kitchen's proposed modification of Schoenith's cradle 20 with the teachings of Park's adjustable bridge (30, 40) would frustrate Schoenith's basic purpose of retaining its smart device 30 (*e.g.*, an iPad) between its left and right side panels 3 and 4, because the smart device 30 would come out during normal use

and operation. Thus, in my opinion, a POSITA would not be motivated to make the proposed combination.

97. Mr. Kitchen's proposed combination shown above in Figure 10 suffers from the deficiency that it cannot retain Schoenith's smart device 30 in position during normal user operation due to its weak tilting moment capacity.

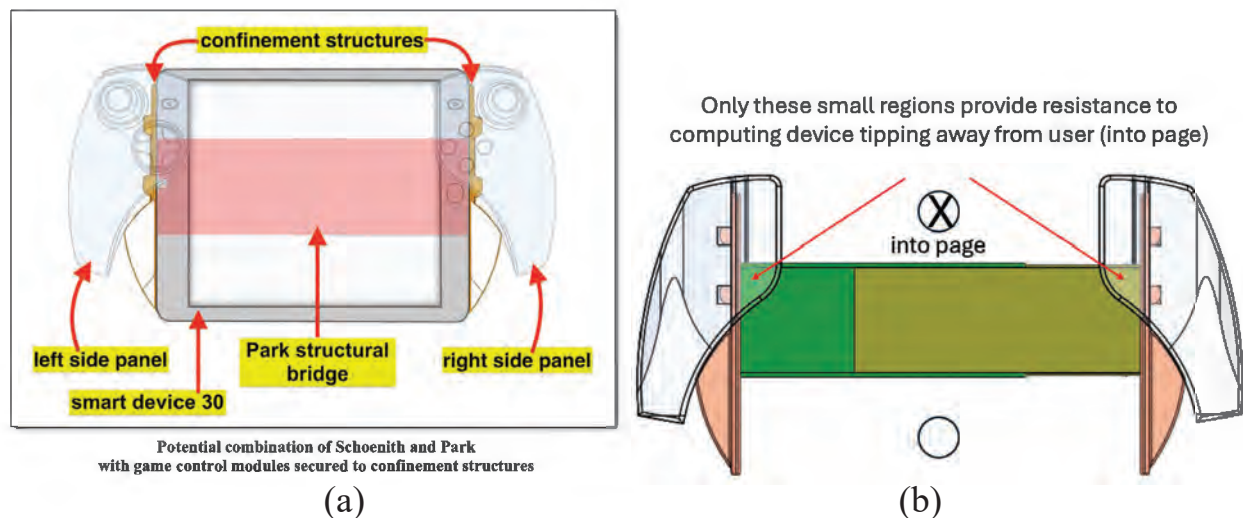


Figure 11: (a) Mr. Kitchen's proposed combination of Schoenith with Park;
(b) Deficiency of Mr. Kitchen's proposed combination

98. As illustrated above in Figure 11, Mr. Kitchen's replacement of Schoenith's wider cradle 20 with Park's narrower adjustable bridge (30, 40) would make smart device 30 (*e.g.*, a large iPad) prone to tipping into the page as shown, because Schoenith's panels 3 and 4 would overlap only a small portion of Park's narrower adjustable bridge (30, 40). As can be seen from Figures 11(a)-(b), the top of Schoenith's smart device 30 can pivot into the page about a fulcrum (axis of pivot) located at the top edge of Park's narrower adjustable bridge (30, 40). Because of the

small regions providing resistance to tipping, any restraining force would be close to the fulcrum, thus offering low tipping resistance. Thus, when for example a user during normal operation pulls Schoenith's side panels 3 and 4 towards the user, the inertial loads can cause the smart device 30 to tip forward (due to Newton's third law), as indicated in my Figure 11(b). The mechanics of resistance to tipping (tilt stiffness) is shown in Figure 12 below, where the resistance to tipping is proportional to *SQUARE* of the distance from the tipping point (fulcrum) to the restraining point.

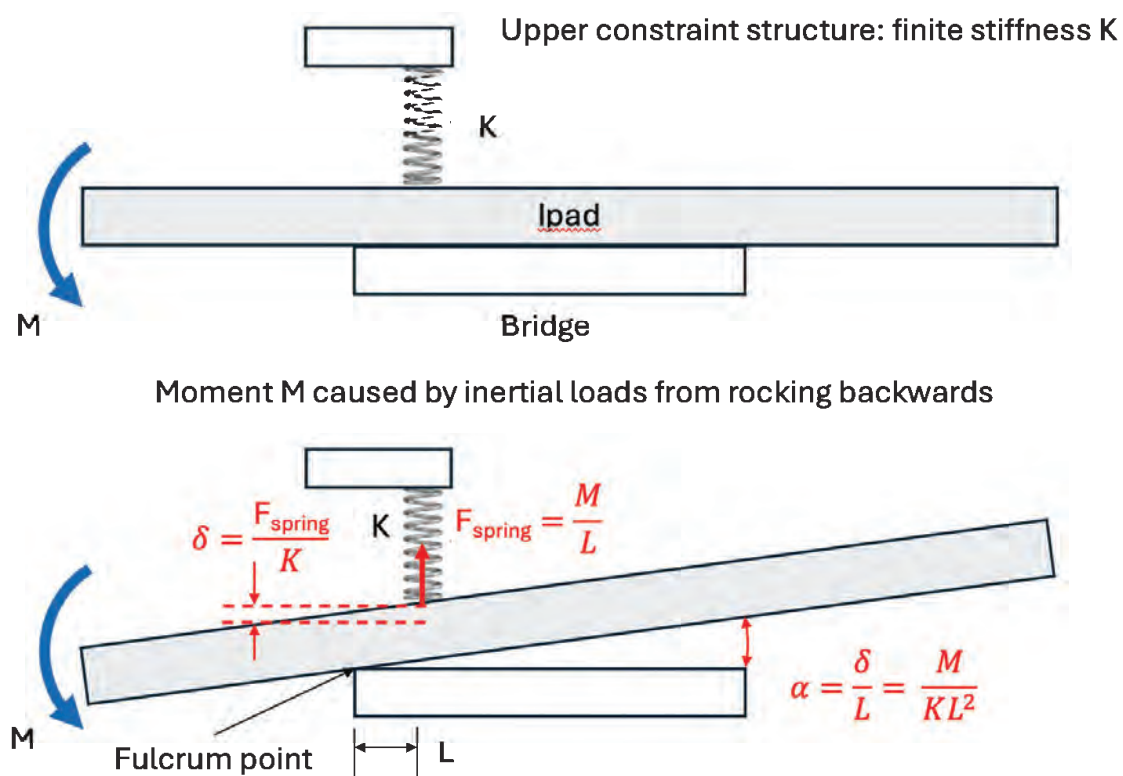


Figure 12: Mechanics of resistance to tipping (tilt stiffness)

99. This deficiency is further exacerbated by the deficiency that Park expressly discusses in its disclosure: “[A]s the mobile phone is not sufficiently in

contact with the device according to the present invention when using the above configuration, the mobile phone (1) may come loose during gaming or become detached in severe cases, hindering comfortable and stable operation of a game.” Ex. 1004, ¶ [0041]. In other words, Park discusses that routine game play subjects the device to forces that can prevent a mobile phone (1) from being seated in a stable manner in the device. *See id.*, ¶ [0042]. Park attempts to solve its identified problem by introducing a cushioning pad (60) on the face of the first controller body (10), as well as a connecting assembly with an air tube (110), contact sensor (112), fan (120), air offtake pipe (130), check valve (140), and controller (150). *See id.*, Figs. 4-5, ¶¶ [0043]-[0062]. In his proposed combination, Mr. Kitchen fails to include any of these components that Park attempts to solve its problem with.

100. In contrast to Mr. Kitchen’s proposed combination in which Schoenith’s panels 3 and 4 overlap only a small portion of Park’s narrower adjustable bridge (30, 40), in the example embodiment depicted in Figs. 16-18 of the ’393 Patent, there is 100% overlap of the bottom and top lips of confinement structures 316. Based on estimating the proportions of the components from the drawings that Mr. Kitchen provided in his declaration, I estimate that the arrangement in the ’393 Patent would offer ~7X greater resistance to tipping than Mr. Kitchen’s proposed combination (the tipping resistance (stiffness) is proportional to square of the length of the region constrained).

101. In summary, Mr. Kitchen's proposed modification of Schoenith's cradle 20 with the teachings of Park's adjustable bridge (30, 40) would frustrate Schoenith's basic purpose of retaining its smart device 30 between its side panels 3 and 4. Thus, in my opinion, a POSITA would not be motivated to make Mr. Kitchen's proposed combination.

102. Second, the combined teachings of Schoenith's cradle 20 modified with Park's adjustable bridge (30, 40), taken as a whole, do not enable a POSITA to make and use the claimed invention without undue experimentation. Specifically, in Mr. Kitchen's proposed combination of their teachings, Park's adjustable bridge (30, 40) connects between the raised side walls 24 of Schoenith's cradle 20. But Park's bridge design is flawed because, in attempting to make it easy for a user to reduce or expand its length through ratcheting action, Park compromises its ability to retain a mobile device between its controller bodies during normal user operation.

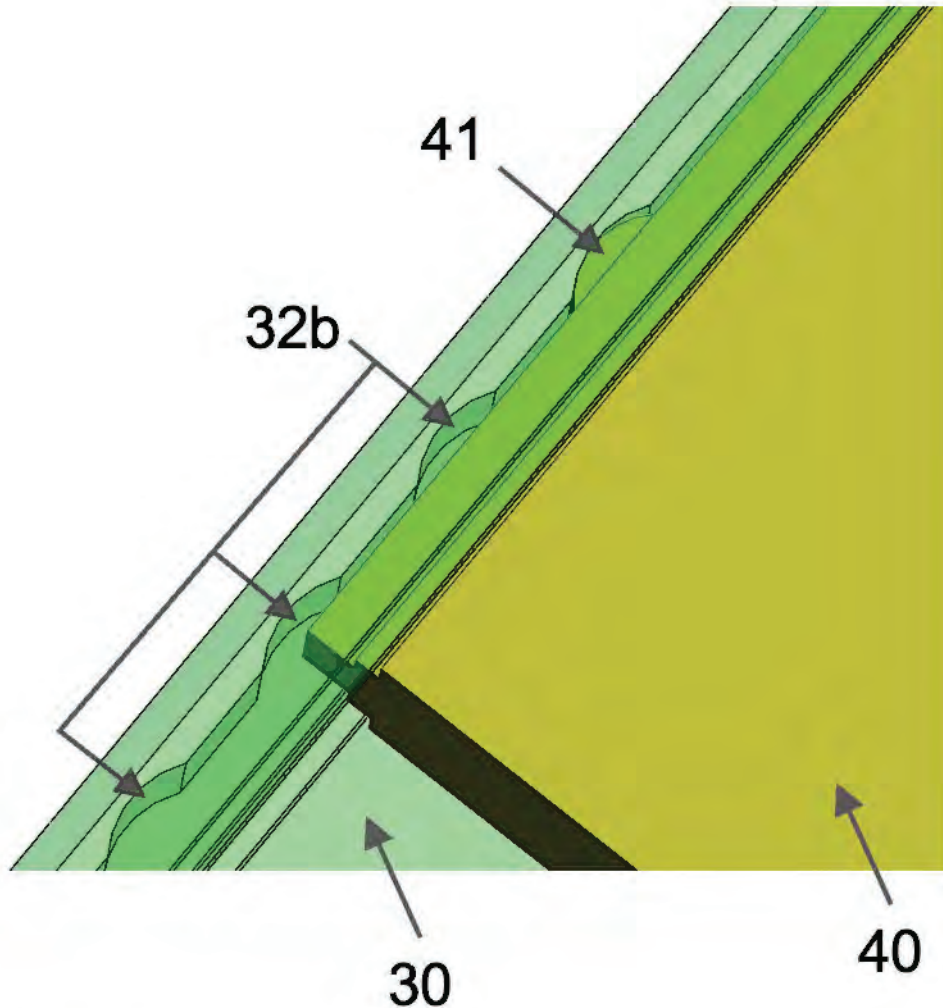


Figure 13: Close up 3-D render of Park's adjustable bridge

103. With reference to the close-up Solid Model image I created of Park's ratcheting mechanism shown above in Figure 13, as a user pulls or pushes on Park's bridge elements (first panel (30) and second panel (40)), the protrusions (41) disengage from the catching holes (32b) until a new discrete position is reached, and then the protrusions (41) snap back into the catching holes (32b). This snap action is made possible by the fact that Park's first panel (30) is wide, flat, and made of elastic material. Ex. 1004, ¶ [0034]. Thus, when the ramp force action of the protrusions

(41) on the catching holes (32b) is applied, it creates a bending moment to curve the first panel (30) thereby increasing its width at the level of the protrusions (41). This curvature facilitates the ratcheting action. However, in this design there is no positive mechanical retention of the protrusions (41) in the catching holes (32b). Therefore, during normal operation the user is likely to apply pull forces that cause the protrusions (41) to disengage from the catching holes (32b), resulting in the structural bridge to flex about an axis orthogonal to the spreading open to enable the ratchet action, and Schoenith's smart device 30 coming out.

104. Third, in my opinion, a POSITA would require undue experimentation to connect the raised side walls 24 of Schoenith's cradle 20 with Park's adjustable bridge (30, 40) using screws or snap-fit connectors within the design constraints imposed by Schoenith's system. Schoenith's design does not provide the physical space necessary to connect Park's adjustable bridge (30, 40) to the raised side walls 24 of Schoenith's cradle 20 via screws or snap-fit connectors that are properly sized to retain them together during normal user operation. Depending on how these screws or snap-fit connectors were oriented, they could interfere with Schoenith's side panels 3 and 4, and/or with Schoenith's smart device 30. In my opinion, a POSITA would require undue experimentation to re-design the connection of the raised side walls 24 of Schoenith's cradle 20 with Park's adjustable bridge (30, 40)

using properly sized screws or snap-fit connectors without having them interfere with one or more of the above components.

105. In his declaration, Mr. Kitchen ignores these mechanical design issues entirely. He fails to articulate where or how to position the screws or snap-fit connectors to connect the raised side walls 24 of Schoenith's cradle 20 with Park's adjustable bridge (30, 40). *See* Ex. 1002, ¶¶ 289-296. He does not provide analysis to show the sizes of screws or snap-fit connectors required to provide joints of requisite strength to sustain normal user operation. Nor does he discuss where such screws or snap-fit connectors would be positioned to securely retain the raised side walls 24 of Schoenith's cradle 20 with Park's adjustable bridge (30, 40) during normal user operation without having them interfere with one or more of the above components. To the extent that Mr. Kitchen provides additional information on these design aspects, I reserve the right to supplement and/or amend my opinions in view of such additional information.

C. The combination of Schoenith and Park fails to disclose or suggest the claimed arrangement of the “pair of confinement structures”

106. With respect to “pair of confinement structures,” independent claim 1 of the '393 Patent recites, among other limitations, the following arrangement:

[Claim limitation 1(b)(1)] a pair of confinement structures, the pair of confinement structures interacting with the computing device and adjacent at least two opposing sides of the computing device, but not more than three sides of the sides of the computing device,

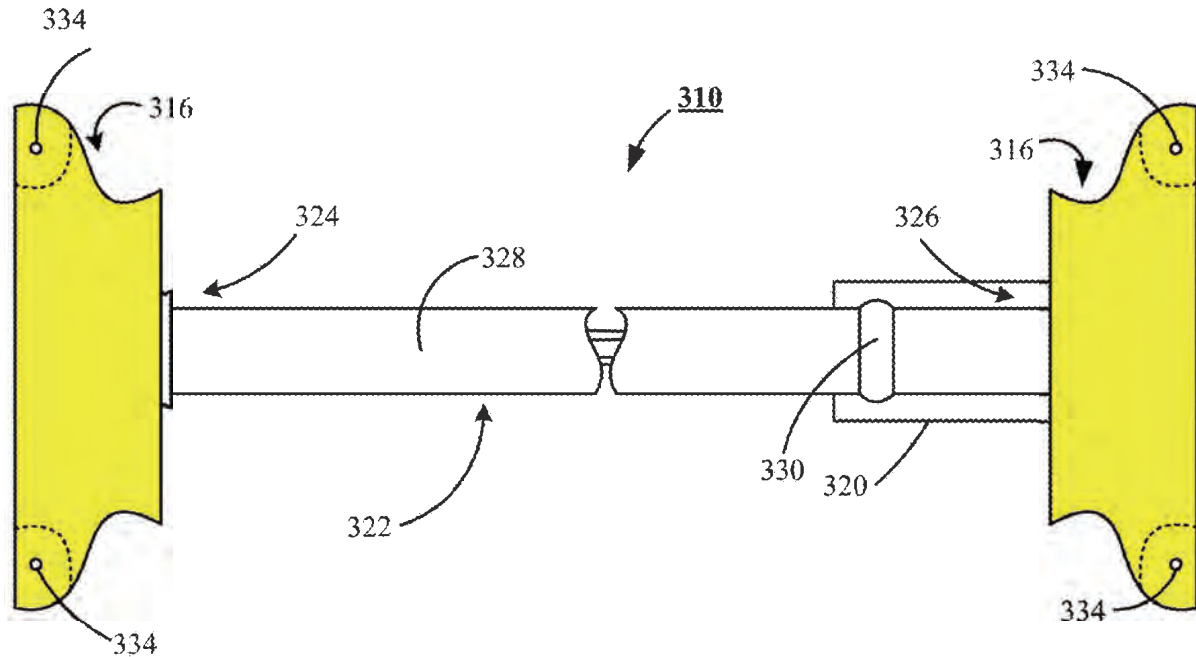
* * * * *

[*Claim limitation 1(d)(4)*] wherein each electronic game control module is a separate and distinct structure from each of their corresponding confinement structures, forming no structural portion of their corresponding confinement structures, . . .

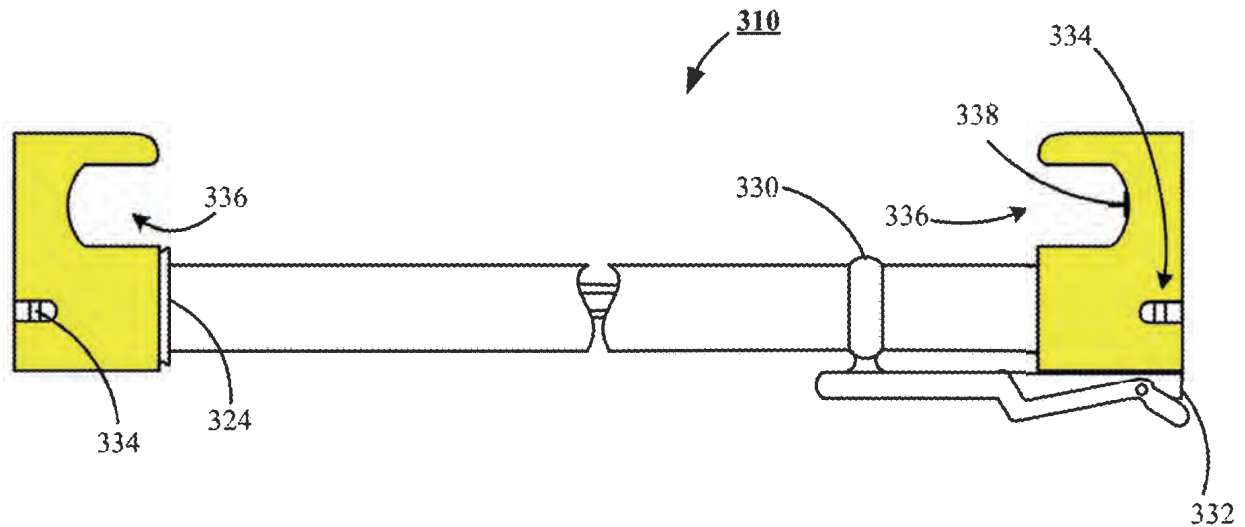
107. During prosecution, the Examiner identified aspects of this claimed arrangement is his statement of reasons for allowance. *See* Ex. 1009, 25-26.

108. It is my understanding that under the claim construction of the United States District Court for the Northern District of California, which Mr. Kitchen and Nintendo have applied, the claim term “pair of confinement structures” is construed as: “physical component(s) that **hold(s)** a computing device.” Ex. 1028, 10-12 (emphasis added); *see* Ex. 1002, ¶¶ 106, 108-110; Pet., 14-15.

109. As shown in an example embodiment depicted in Figs. 17 and 18 of the '393 Patent, each of the confinement structures 316 includes a cradle 336 (annotated in yellow). As shown in Fig. 18, each cradle 336 (annotated in yellow) includes a lip that prevents a computing device 302 that is held between the confinement structures 316 from coming out in the direction of the user.



'93 Patent, Fig. 17 (annotated)



'93 Patent, Fig. 18 (annotated)

110. In my opinion, under this construction of “pair of confinement structures,” the combination of Schoenith and Park, taken as a whole, fails to disclose or suggest this claimed arrangement to a POSITA.

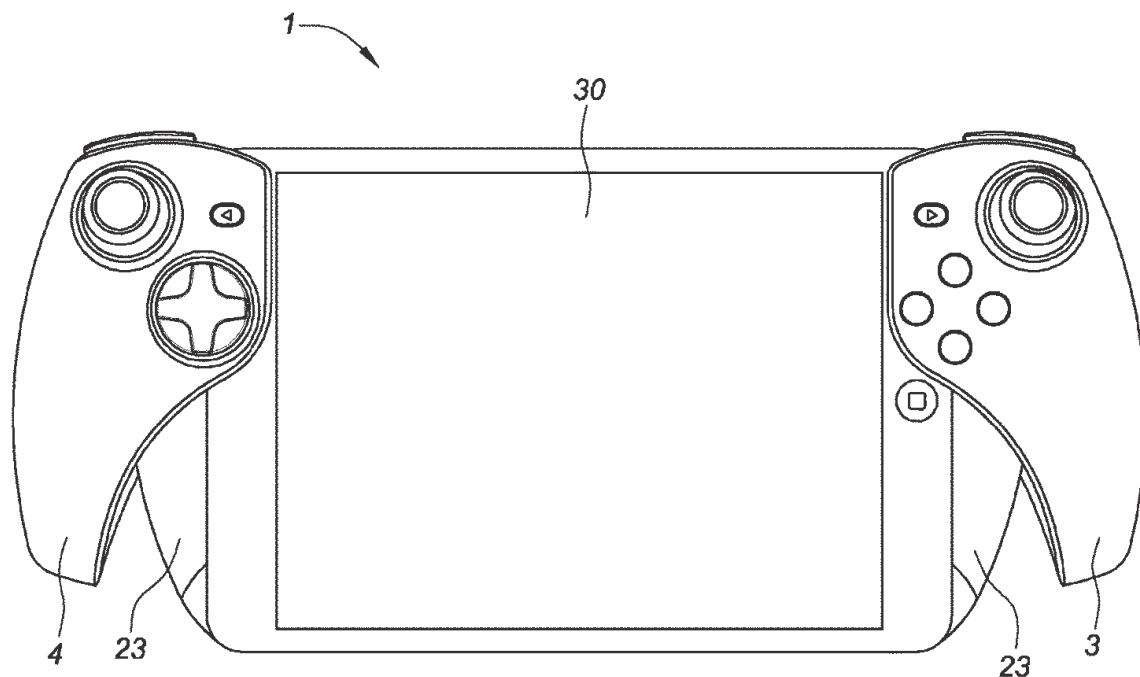
111. As an initial matter, for at least the reasons that I have discussed above in Section VII and Section IX.B, a POSITA would not have been motivated to combine Schoenith and Park as Mr. Kitchen proposes.

112. Moreover, even if they could be combined, the teachings of Schoenith and Park, taken as a whole, fail to disclose or suggest this claimed arrangement to a POSITA. Specifically, in the proposed combination, Schoenith's smart device 30 is only retained, *e.g.*, from coming out in the direction of the user (out of the page), by a combination of the right and left raised walls from Schoenith's cradle 20, which Mr. Kitchen points to as the purported "pair of confinement structures," **and the side panels 3, 4,** which Mr. Kitchen purports are the claimed "electronic game control modules." The right and left raised walls from Schoenith's cradle 20 themselves cannot **hold** Schoenith's smart device 30, and therefore do not satisfy the requirements of the claimed "pair of confinement structures" under the construction that Mr. Kitchen and Nintendo have applied.

113. Another way of describing this deficiency is: only the **combination** of the side panels 3, 4, which Mr. Kitchen purports are the claimed "electronic game control modules," together with the right and left raised walls from Schoenith's cradle 20, could constitute the "pair of confinement structures" that retains (if at all) Schoenith's smart device 30. Accordingly, the side panels 3, 4, which Mr. Kitchen purports are the claimed "electronic game control modules," are not "separate and

distinct structure[s] from each of their corresponding confinement structures, forming no structural portion of their corresponding confinement structures” (*i.e.*, the combination of side panels 3, 4 and raised side walls of cradle 20).

114. In his analysis of the relevant claim limitations 1[b][1] and 1[d][4], *see* Ex. 1002, ¶¶ 239-247, 284, Mr. Kitchen fails to consider how the combination of Schoenith’s raised side walls 24 and Park’s adjustable bridge (30, 40) could hold Schoenith’s smart device from popping out in the direction of the user (out of the page) absent Schoenith’s side panels 3 and 4 that overlap Schoenith’s smart device 30. As can be seen, for example, from Schoenith, Fig. 9 (reproduced below), the side panels 3, 4 overlap the smart device 30 to prevent it from coming out in the direction of the user (out of the page).



Schoenith, Fig. 9

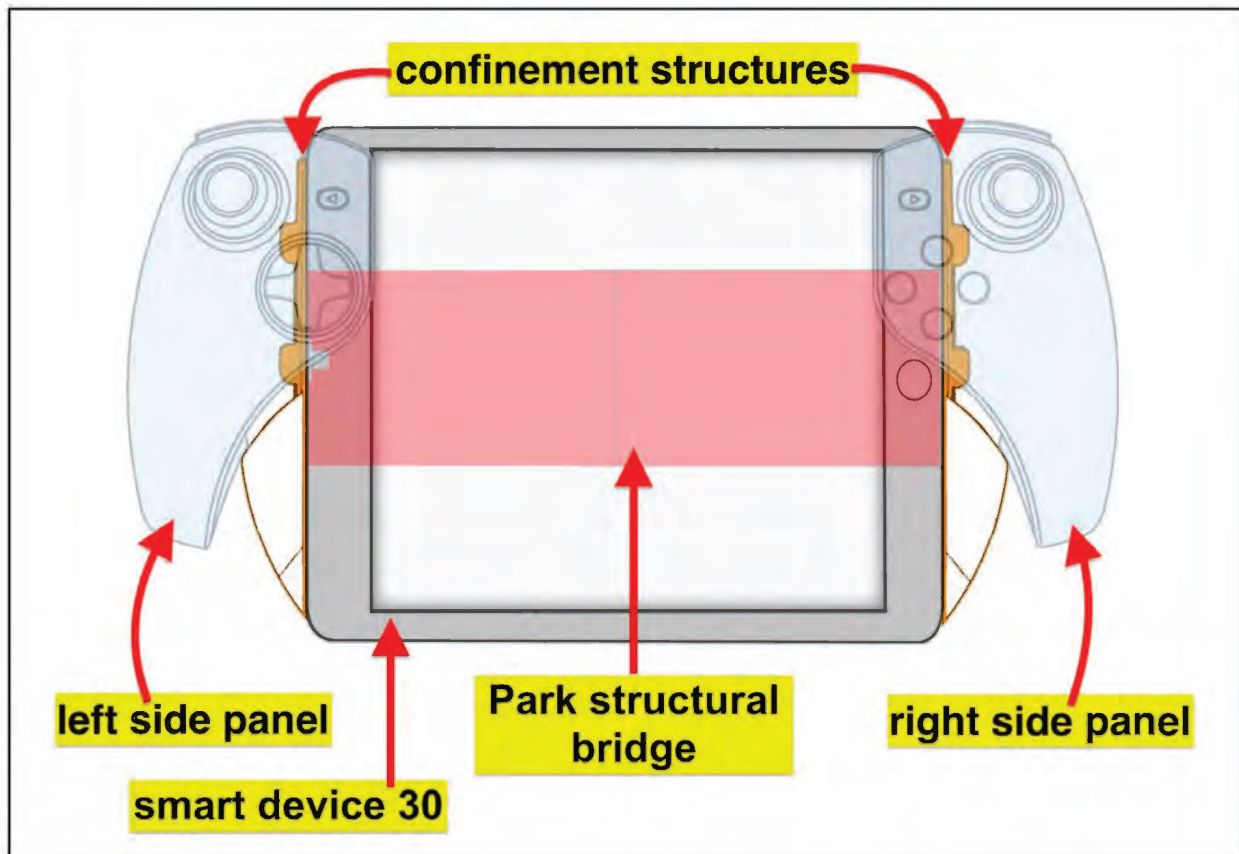
This diagram shows an exploded perspective view of a portable electronic device assembly. The main components are:

- 30**: A rectangular display panel with a circular home button at the bottom center.
- 20**: A frame or bezel assembly. It includes a top rail (**21**), a bottom rail (**22**), and side rails (**23**). A yellow layer (**24**) is shown between the rails.
- 3**: A game controller with a joystick and several buttons.
- 4**: Another game controller, similar to the one labeled **3**.

Arrows indicate the assembly direction: the display panel **30** is positioned above the frame **20**, and the controllers **3** and **4** are positioned to be attached to the side rails **23**.

-65-

Mr. Kitchen depicts his proposed combination of Schoenith and Park. That depiction (reproduced below) confirms that the side panels 3, 4 continue to overlap the smart device 30 to prevent it from coming out in the direction of the user (out of the page).



**Potential combination of Schoenith and Park
with game control modules secured to confinement structures**

Figure 14: Mr. Kitchen’s proposed combination of Schoenith and Park

117. As can be seen from Figure 14 above, Schoenith’s left and right side panels 3, 4 (*i.e.*, Mr. Kitchen’s purported “electronic game control modules”) provide an overhanging structure on top of smart device 30. Mr. Kitchen implies that Park’s adjustable bridge (30, 40) could compress the raised side walls of Schoenith’s

cradle 20 to hold Schoenith's smart device 30. But without Schoenith's overlapping side panels 3, 4 on top of smart device 30, compressing Park's bridge (30, 40) while placing the smart device 30 above Park's bridge (30, 40) will cause Park's bridge (30, 40) to bow and tend to make the smart device 30 pop out in the direction of the user (out of the page). This is because the reaction force from the smart device 30 on Schoenith's raised side walls is above the mid-plane of Park's adjustable bridge (30, 40). Thus, compressing Park's bridge (30, 40) would create a bending moment that curves the bridge and spreads Schoenith's raised side walls out, leading to the instability of Schoenith's smart device 30 in Mr. Kitchen's proposed combination absent Schoenith's overhanging side panels 3, 4.

X. GROUND 3: OBVIOUSNESS OF CLAIMS 1-7 IN VIEW OF SCHOENITH AND KESSLER

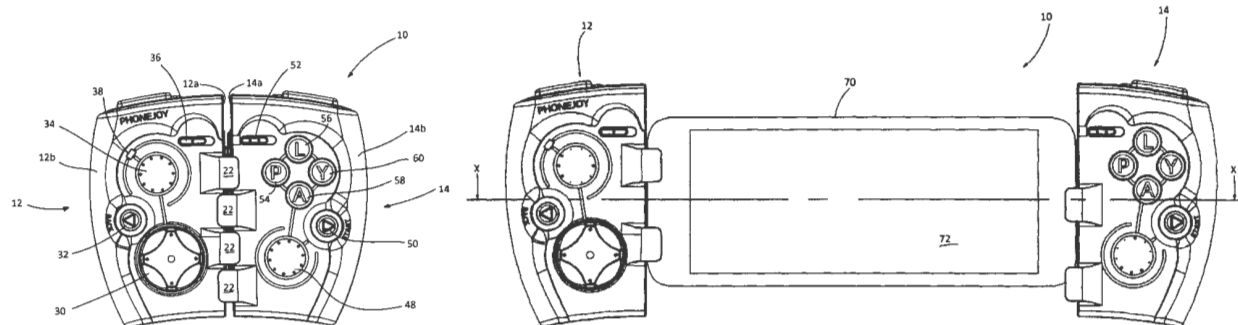
Overview of the Cited Art

A. 1. Schoenith (Ex. 1005)

118. I previously described Schoenith with respect to Ground 2 and incorporate that discussion here.

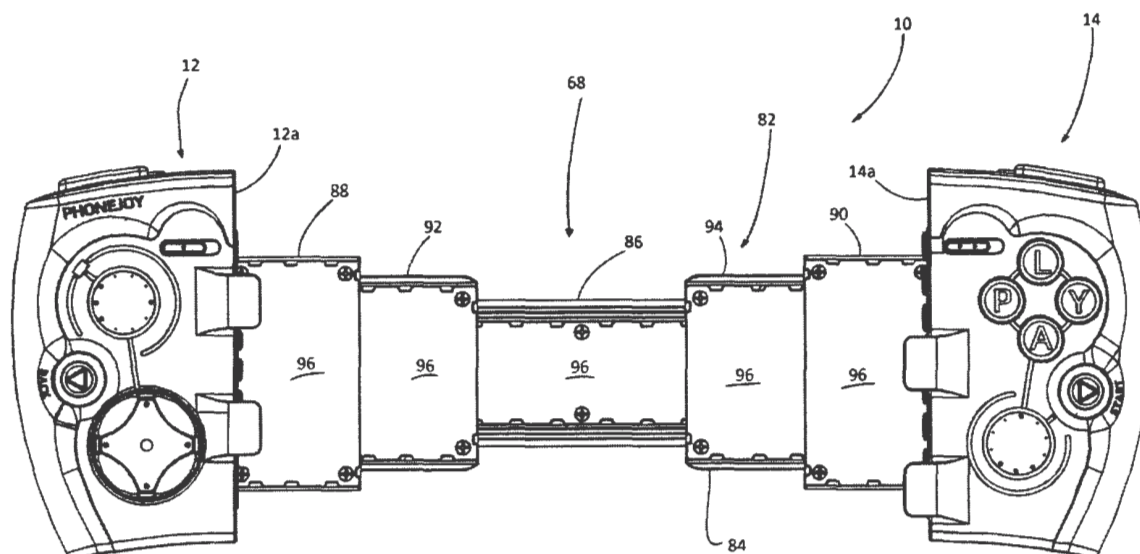
2. Kessler (Ex. 1006)

119. Kessler describes a portable, collapsible controller that is configured to work with a mobile phone oriented in landscape mode, as depicted in Kessler, Figs. 2, 11 (reproduced below).



Kessler, Figs. 2, 11

120. As shown in Fig. 10 (reproduced below), the controller has left and right handle housings 12, 14 that can be gripped by a user, interconnected by an extension mechanism 82. Extension mechanism 82 has a telescoping slide mechanism 84 to allow the housings 12, 14 to collapse together (Fig. 2), or extend apart from each other sufficiently to allow a mobile phone 70 in between (Fig. 11).



Kessler, Fig. 10

B. A POSITA would not have been motivated to combine Schoenith and Kessler as Mr. Kitchen contends

121. I have reviewed Mr. Kitchen's declaration, in which he proposes to selectively combine portions of Schoenith's cradle 20 with Kessler's extension mechanism 82. Using SolidWorks™, I prepared a series of 3-D illustrations to show the modifications that Mr. Kitchen proposes to Schoenith's cradle 20.

122. First, as shown in Figure 15 below, Mr. Kitchen proposes to break apart Schoenith's single-piece cradle 20, keeping only the left- and right-facing raised sidewalls 24 (orange) of cradle 20. Mr. Kitchen proposes to discard the remaining structure of cradle 20.

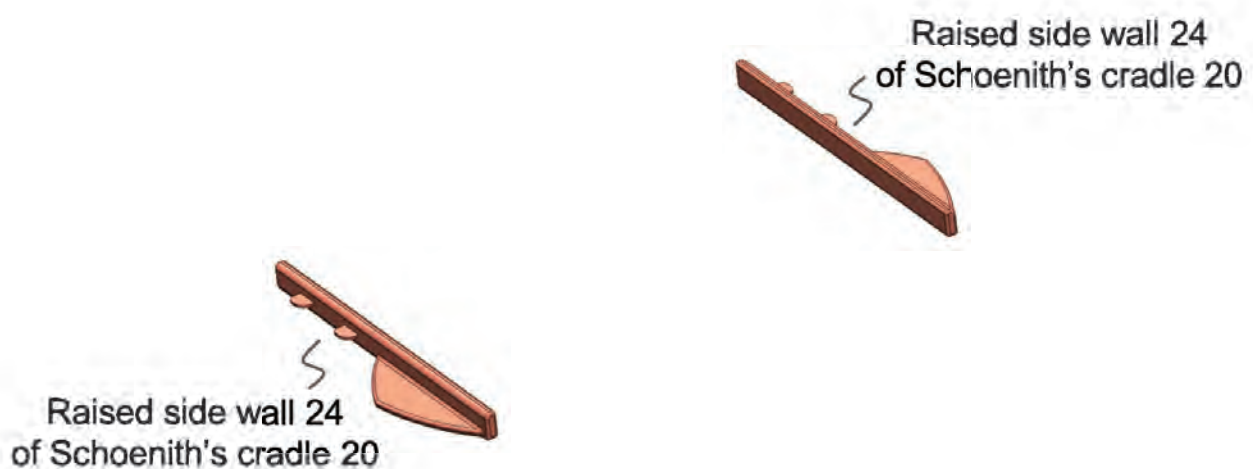


Figure 15: Structure of Schoenith's cradle 20 that Mr. Kitchen proposes to keep

123. Mr. Kitchen then proposes to replace the back of Schoenith's wider cradle 20 with Kessler's narrower extension mechanism 82. *See, e.g., Ex. 1002, ¶¶ 326, 348.* Figure 16 below provides a 3-D CAD model that I created to illustrate Mr. Kitchen's proposed combination.

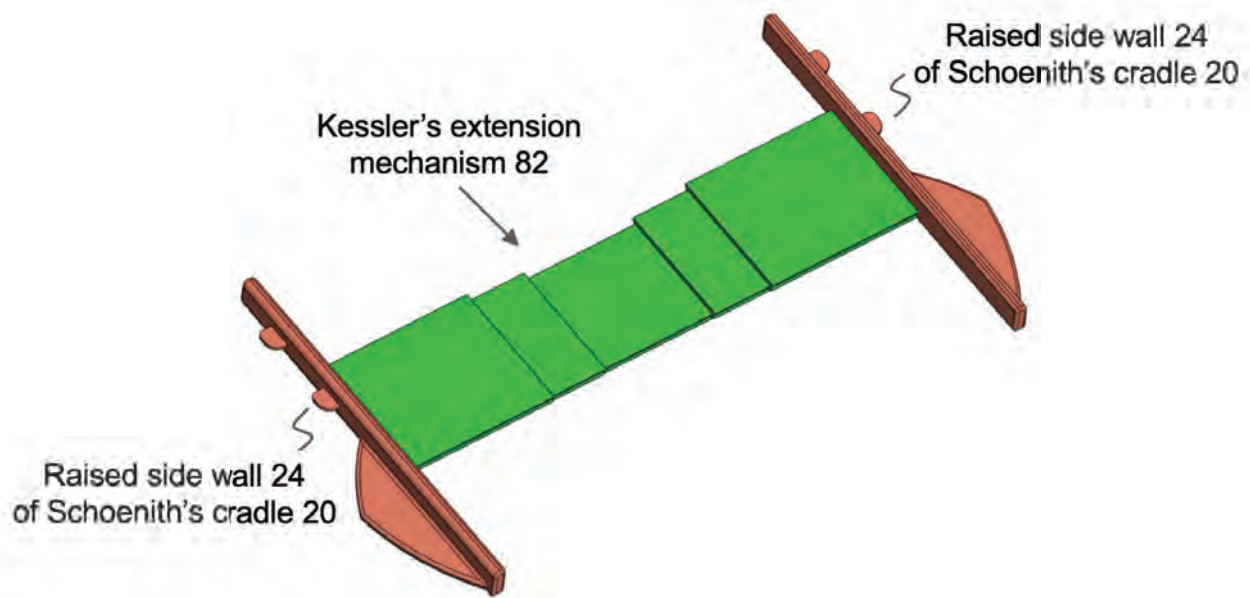


Figure 16: Mr. Kitchen's proposed combination of selective elements of Schoenith's cradle 20 with Kessler's extension mechanism 82

124. Mr. Kitchen's proposed combination of portions of Schoenith's cradle 20 with Kessler's extension mechanism 82 would then serve as an assembly to which Schoenith's left and right side panels 3, 4 are attached, as shown in Figure 17 below.

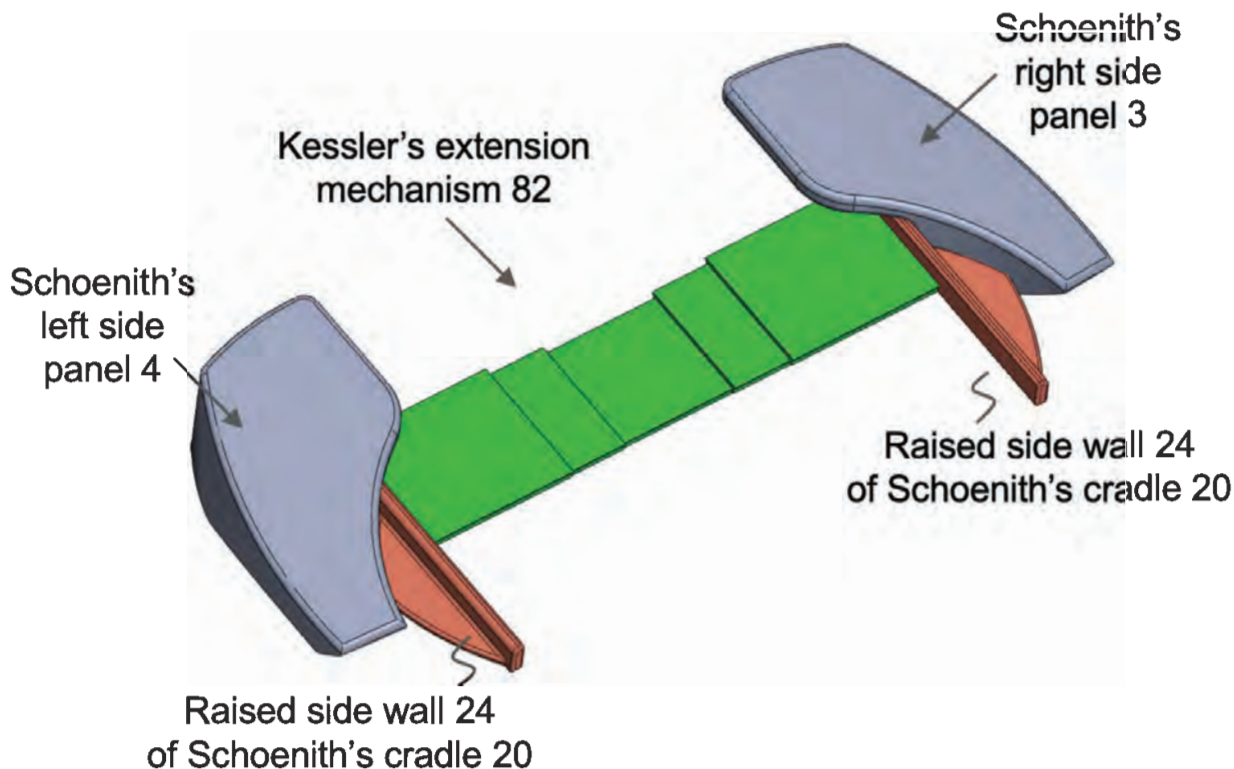


Figure 17: Mr. Kitchen's proposed combination of selective elements of Schoenith with Kessler's extension mechanism 82

125. In addition to the reasons that I described above in Section VII, in my opinion a POSITA considering Schoenith's and Kessler's teachings, taken as a whole, would not have been motivated to make the combination that Mr. Kitchen proposes, for two additional reasons.

126. First, Mr. Kitchen's proposed modification of Schoenith's cradle 20 with the teachings of Kessler's extension mechanism 82 would frustrate Schoenith's basic purpose of retaining its smart device 30 (*e.g.*, an iPad) between its left and right side panels 3 and 4, because the smart device 30 would come out during normal use

and operation. Thus, in my opinion, a POSITA would not be motivated to make the proposed combination.

127. Mr. Kitchen's proposed combination shown above in Figure 17 suffers from the deficiency that it cannot retain Schoenith's smart device 30 in position during normal user operation due to its weak tilting moment capacity.

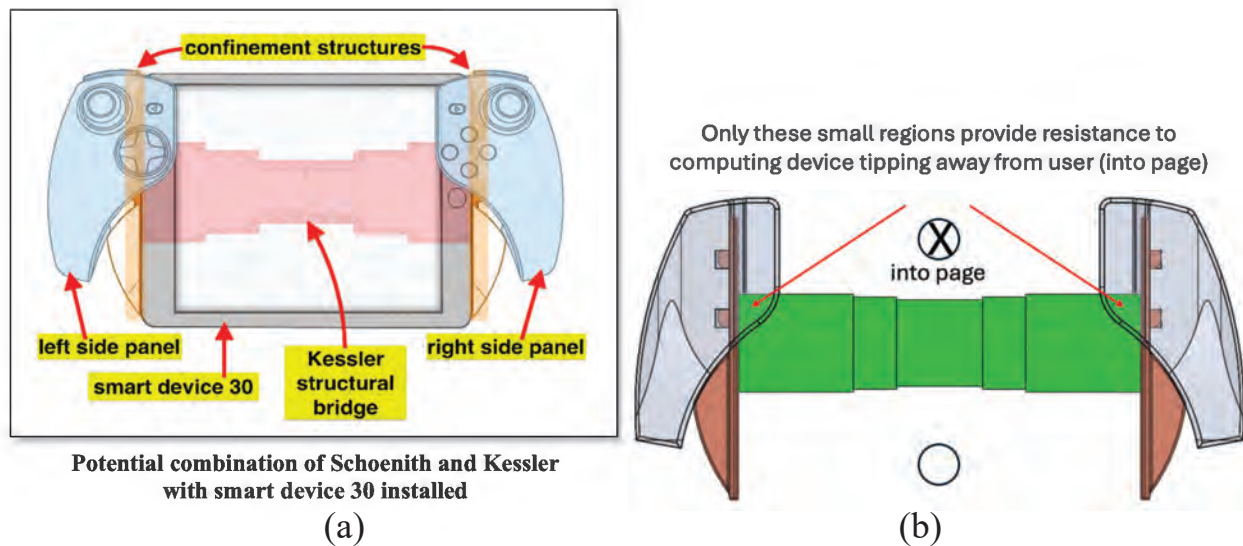


Figure 18: (a) Mr. Kitchen's proposed combination of Schoenith with Kessler;
(b) Deficiency of Mr. Kitchen's proposed combination

128. As illustrated above in Figure 18, Mr. Kitchen's replacement of Schoenith's wider cradle 20 with Kessler's narrower extension mechanism 82 would make smart device 30 (e.g., a large iPad) prone to tipping into the page as shown, because Schoenith's panels 3 and 4 would overlap only a small portion of Kessler's narrower extension mechanism 82. As can be seen from Figures 18(a)-(b), the top of Schoenith's smart device 30 can pivot into the page about a fulcrum (axis of pivot) located at the top edge of Kessler's narrower extension mechanism 82. Because of

the small regions providing resistance to tipping, any restraining force would be close to the fulcrum, thus offering low tipping resistance. Thus, when for example a user during normal operation pulls Schoenith's side panels 3 and 4 towards the user, the inertial loads can cause the smart device 30 to tip forward (due to Newton's third law), as indicated in my Figure 18(b).

129. This deficiency in Mr. Kitchen's proposed combination is related to the deficiency that Park expressly discusses in its disclosure (which, as prior art, would also be within the purview of a POSITA considering Schoenith and Kessler): "[A]s the mobile phone is not sufficiently in contact with the device according to the present invention when using the above configuration, the mobile phone (1) may come loose during gaming or become detached in severe cases, hindering comfortable and stable operation of a game." Ex. 1004, ¶ [0041]. In other words, Park discusses that routine game play subjects the device to forces that can prevent a mobile phone (1) from being seated in a stable manner in the device. *See id.*, ¶ [0042]. Park attempts to solve its identified problem by introducing a cushioning pad (60) on the face of the first controller body (10), as well as a connecting assembly with an air tube (110), contact sensor (112), fan (120), air offtake pipe (130), check valve (140), and controller (150). *See* Ex. 1004, Figs. 4-5, ¶¶ [0043]-[0062]. In his proposed combination of Schoenith and Kessler, Mr. Kitchen fails to include any such components that Park attempts to solve its problem with.

130. In contrast to Mr. Kitchen's proposed combination in which Schoenith's panels 3 and 4 overlap only a small portion of Kessler's narrower extension mechanism 82, in the example embodiment depicted in Figs. 16-18 of the '393 Patent, there is 100% overlap of the bottom and top lips of confinement structures 316. Based on estimating the proportions of the components from the drawings that Mr. Kitchen provided in his declaration, I estimate that the arrangement in the '393 Patent would offer ~7X greater resistance to tipping than Mr. Kitchen's proposed combination (the tipping resistance (stiffness) is proportional to square of the length of the region constrained).

131. In summary, Mr. Kitchen's proposed modification of Schoenith's cradle 20 with the teachings of Kessler's extension mechanism 82 would frustrate Schoenith's basic purpose of retaining its computing device 10 in position between its side panels 3 and 4. Thus, in my opinion, a POSITA would not be motivated to make Mr. Kitchen's proposed combination.

132. Second, in my opinion, a POSITA would require undue experimentation to connect the raised side walls 24 of Schoenith's cradle 20 with Kessler's extension mechanism 82 using screws or snap-fit connectors within the design constraints imposed by Schoenith's system. Schoenith's design does not provide the physical space necessary to connect Kessler's extension mechanism 82 to the raised side walls 24 of Schoenith's cradle 20 via screws or snap-fit connectors

that are properly sized to retain them together during normal user operation. Depending on how these screws or snap-fit connectors were oriented, they could interfere with Schoenith's side panels 3 and 4, and/or with Schoenith's smart device 30. In my opinion, a POSITA would require undue experimentation to re-design the connection of the raised side walls 24 of Schoenith's cradle 20 with Kessler's extension mechanism 82 using properly sized screws or snap-fit connectors without having them interfere with one or more of the above components.

133. In his declaration, Mr. Kitchen ignores these mechanical design issues entirely. He fails to articulate where or how to position the screws or snap-fit connectors to connect the raised side walls 24 of Schoenith's cradle 20 with Kessler's extension mechanism 82. *See* Ex. 1002, ¶¶ 370-380. He does not provide analysis to show the sizes of the screws or snap-fit connectors required to provide joints of requisite strength to sustain normal user operation. Nor does he discuss where such screws or snap-fit connectors would be positioned to securely retain the raised side walls 24 of Schoenith's cradle 20 with Kessler's extension mechanism 82 during normal user operation without having them interfere with one or more of the above components. To the extent that Mr. Kitchen provides additional information on these design aspects, I reserve the right to supplement and/or amend my opinions in view of such additional information.

C. The combination of Schoenith and Kessler fails to disclose or suggest the claimed arrangement of the “pair of confinement structures”

134. With respect to “pair of confinement structures,” independent claim 1 of the ’393 Patent recites, among other limitations, the following arrangement:

[Claim limitation 1(b)(1)] a pair of confinement structures, the pair of confinement structures interacting with the computing device and adjacent at least two opposing sides of the computing device, but not more than three sides of the sides of the computing device,

* * * * *

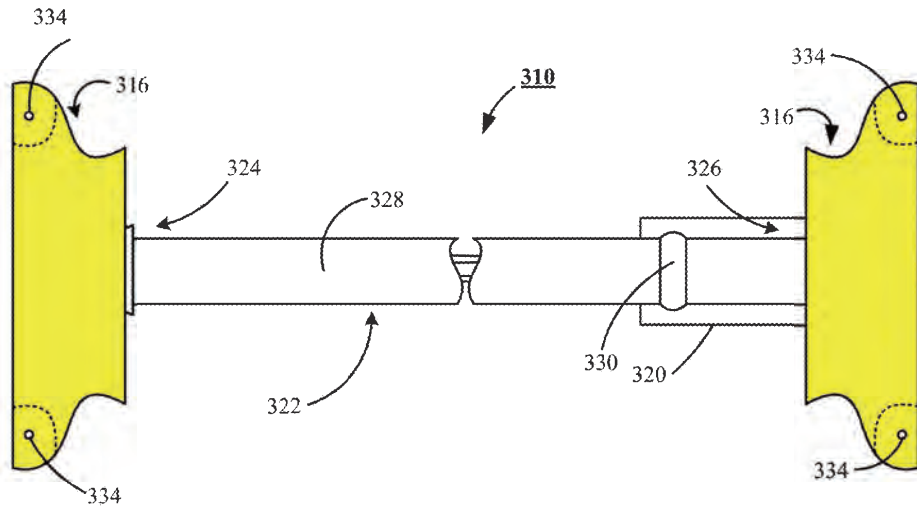
[Claim limitation 1(d)(4)] wherein each electronic game control module is a separate and distinct structure from each of their corresponding confinement structures, forming no structural portion of their corresponding confinement structures, . . .

135. During prosecution, the Examiner identified aspects of this claimed arrangement is his statement of reasons for allowance. *See* Ex. 1009, 25-26.

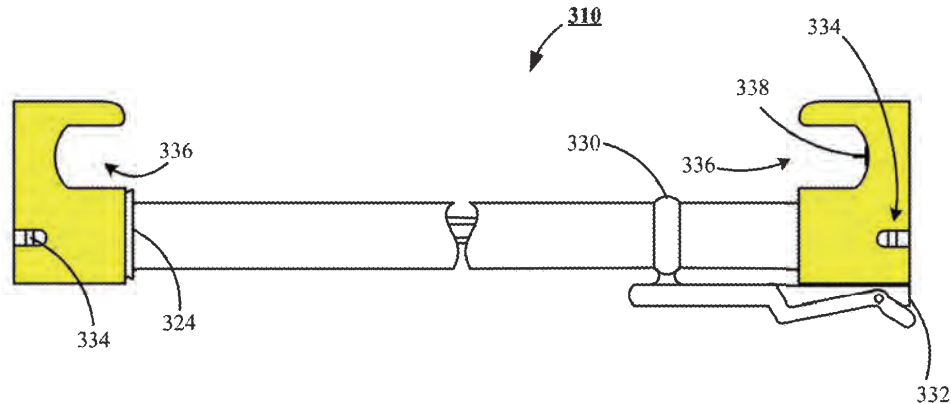
136. It is my understanding that under the claim construction of the United States District Court for the Northern District of California, which Mr. Kitchen and Nintendo have applied, the claim term “pair of confinement structures” is construed as: “physical component(s) that **hold(s)** a computing device.” Ex. 1028, 10-12 (emphasis added); *see* Ex. 1002, ¶¶ 106, 108-110; Pet., 14-15.

137. As shown in an example embodiment depicted in Figs. 17 and 18 of the ’393 Patent, each of the confinement structures 316 includes a cradle 336

(annotated in yellow). As shown in Fig. 18, each cradle 336 (annotated in yellow) includes a lip that prevents a computing device 302 that is held between the confinement structures 316 from coming out in the direction of the user.



'393 Patent, Fig. 17 (annotated)



'393 Patent, Fig. 18 (annotated)

138. In my opinion, under this construction of “pair of confinement structures,” the combination of Schoenith and Kessler, taken as a whole, fails to disclose or suggest this claimed arrangement to a POSITA.

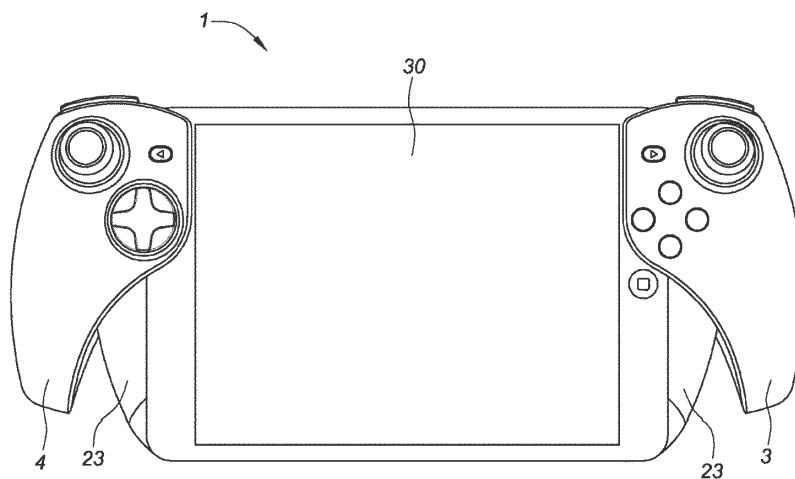
139. As an initial matter, for at least the reasons that I have discussed above in Section VII and Section X.B, a POSITA would not have been motivated to combine Schoenith and Kessler as Mr. Kitchen proposes.

140. Moreover, even if they could be combined, the teachings of Schoenith and Kessler, taken as a whole, fail to disclose or suggest this claimed arrangement to a POSITA. Specifically, in the proposed combination, Schoenith's smart device 30 is only retained, *e.g.*, from coming out in the direction of the user (out of the page), by a combination of the right and left raised walls from Schoenith's cradle 20, which Mr. Kitchen points to as the purported "pair of confinement structures," **and the side panels 3, 4,** which Mr. Kitchen purports are the claimed "electronic game control modules." The right and left raised walls from Schoenith's cradle 20 themselves cannot **hold** Schoenith's smart device 30, and therefore do not satisfy the requirements of the claimed "pair of confinement structures" under the construction that Mr. Kitchen and Nintendo have applied.

141. Another way of describing this deficiency is: only the **combination** of the side panels 3, 4, which Mr. Kitchen purports are the claimed "electronic game control modules," together with the right and left raised walls from Schoenith's cradle 20, could constitute the "pair of confinement structures" that retains (if at all) Schoenith's smart device 30. Accordingly, the side panels 3, 4, which Mr. Kitchen purports are the claimed "electronic game control modules," are not "separate and

distinct structure[s] from each of their corresponding confinement structures, forming no structural portion of their corresponding confinement structures” (*i.e.*, the combination of side panels 3, 4 and raised side walls of cradle 20).

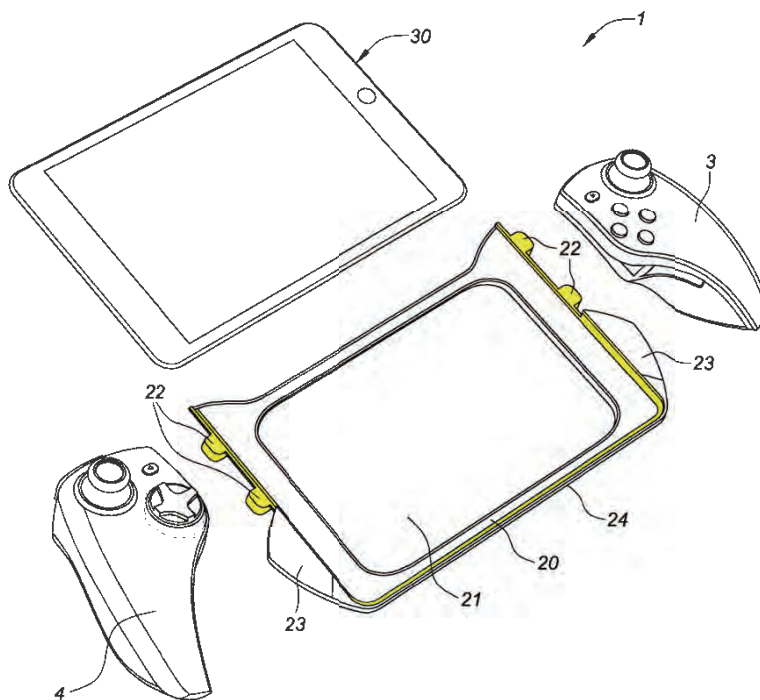
142. In his analysis of the relevant claim limitations 1[b][1] and 1[d][4], *see* Ex. 1002, ¶¶ 325-334, 368, Mr. Kitchen fails to consider how the combination of Schoenith’s raised side walls 24 and Kessler’s extension mechanism 82 could hold Schoenith’s smart device from popping out in the direction of the user (out of the page) absent Schoenith’s side panels 3 and 4 that overlap Schoenith’s smart device 30. As can be seen, for example, from Schoenith, Fig. 9 (reproduced below), the side panels 3, 4 overlap the smart device 30 to prevent it from coming out in the direction of the user (out of the page).



Schoenith, Fig. 9

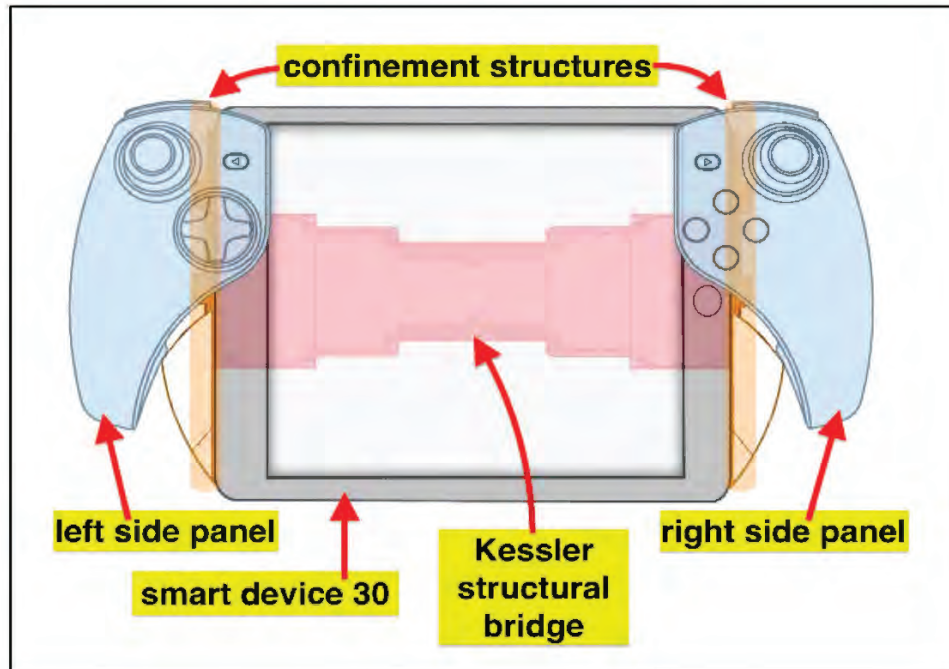
143. By contrast, as can be seen for example from Schoenith, Fig. 3 (annotated below), the raised side walls of Schoenith’s cradle 20 (annotated in

yellow) cannot prevent the smart device 30 from coming out in the direction of the user (out of the page).



Schoenith, Fig. 3 (annotated)

144. Modifying Schoenith's teachings with those of Kessler as Mr. Kitchen proposes does not materially alter this analysis. At Paragraph 348 of his declaration, Mr. Kitchen depicts his proposed combination of Schoenith and Kessler. That depiction (reproduced below) confirms that the side panels 3, 4 continue to overlap the smart device 30 to prevent it from coming out in the direction of the user (out of the page).



**Potential combination of Schoenith and Kessler
with smart device 30 installed**

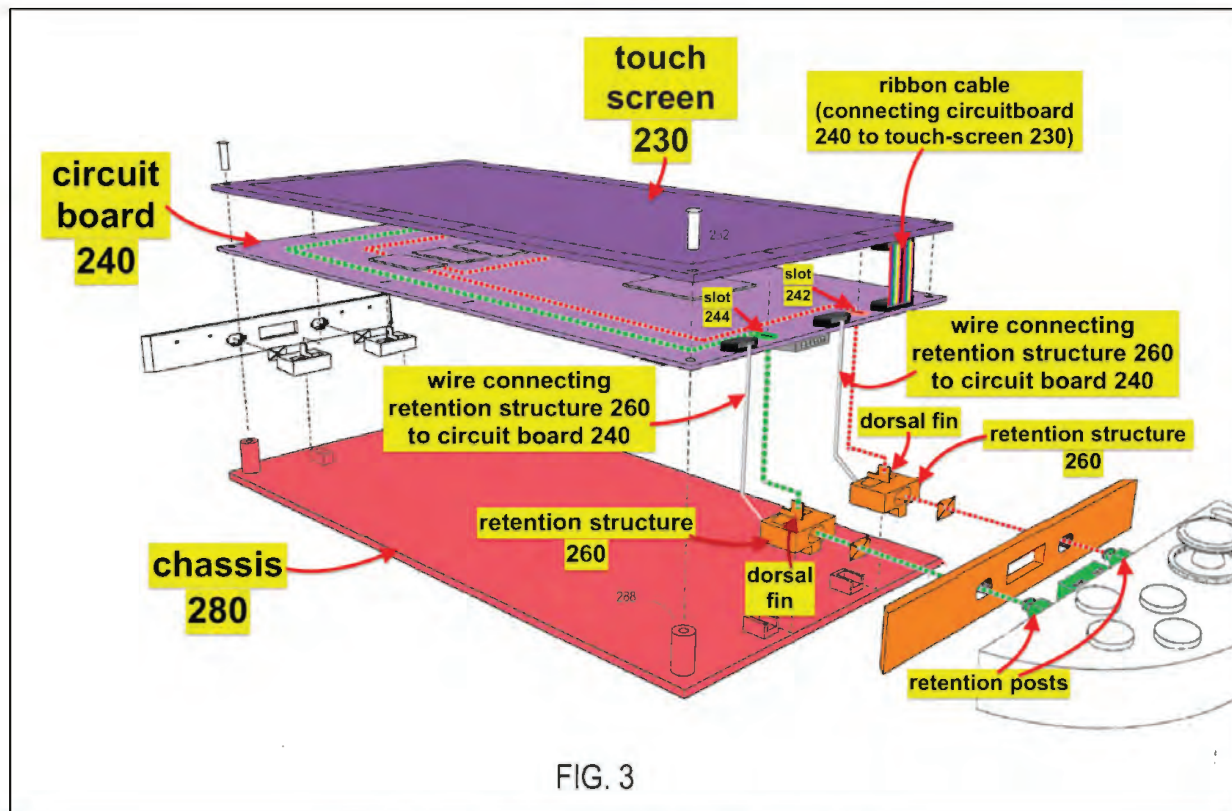
Figure 19: Mr. Kitchen’s proposed combination of Schoenith and Kessler

145. As can be seen from Figure 19 above, Schoenith’s left and right side panels 3, 4 (*i.e.*, Mr. Kitchen’s purported “electronic game control modules”) provide an overhanging structure on top of smart device 30. Mr. Kitchen implies that Kessler’s extension mechanism 82 could compress the raised side walls 24 of Schoenith’s cradle 20 to hold Schoenith’s smart device 30. But without Schoenith’s overlapping side panels 3, 4 on top of smart device 30, compressing Kessler’s extension mechanism 82 while placing the smart device 30 above Kessler’s extension mechanism 82 will cause Kessler’s extension mechanism 82 to bow and tend to make the smart device 30 pop out in the direction of the user (out of the page). This is because the reaction force from the smart device 30 on Schoenith’s raised

side walls 24 is above the mid-plane of Kessler's extension mechanism 82. Thus, compressing Kessler's extension mechanism 82 would create a bending moment that curves the bridge and spreads Schoenith's raised side walls 24 out, leading to the instability of Schoenith's smart device 30 in Mr. Kitchen's proposed combination absent Schoenith's overhanging side panels 3, 4.

XI. GROUND 4: ANTICIPATION AND OBVIOUSNESS OF CLAIMS 1-4 AND 6-7 BY HIRSCHMAN

146. Unlike Willner and Schoenith, which are fixed-size controller accessories designed for a larger palm or tablet sized (e.g., iPad) computing device, or Park or Kessler, which are adjustable-size controller accessories designed for a smaller mobile phone oriented in landscape mode, the portion of Hirschman that Mr. Kitchen relies on is not directed to a controller accessory but the internal configuration of a portable computer system 100.



Hirschman Fig. 3 (modified and annotated)

Figure 20: Mr. Kitchen's proposed mapping of elements of Hirschman's system to the claimed limitations

147. At Paragraph 436, Mr. Kitchen provides an illustration (reproduced above as Figure 20) of his proposed mapping of the claimed limitations to a modified version of Hirschman's system. As shown in the illustration, Mr. Kitchen maps, among other things:

- (1) touchscreen 230 and circuit board 240, after removing USB communication port 242 from circuit board 240, to the claimed "computing device" (annotated in purple);

- (2) two out of the four sidewalls 282 and their associated retention structures 260, with some added wiring, to the claimed “pair of confinement structures” (annotated in orange/green); and
- (3) chassis 280 to the claimed “structural bridge” (annotated in red).

148. I have reviewed Mr. Kitchen’s mapping provided in his declaration. For the reasons discussed below, it is my opinion that the teachings of Hirschman, taken as a whole, fail to disclose or suggest several claimed limitations to a POSITA.

A. Hirschman fails to disclose or suggest the claimed arrangement of the “pair of confinement structures”

149. With respect to “pair of confinement structures,” independent claim 1 of the ’393 Patent recites, among other limitations, the following arrangement:

[*Claim limitation 1(b)(1)*] a pair of confinement structures, the pair of confinement structures interacting with the computing device and adjacent at least two opposing sides of the computing device, but not more than three sides of the sides of the computing device

* * * * *

[*Claim limitation 1(d)(5)*] in which each of the pair of confinement structures are separate and distinct structures from the structural bridge, forming no structural portion of the structural bridge

150. During prosecution, the Examiner identified aspects of this claimed arrangement in his statement of reasons for allowance. *See* Ex. 1009, 25-26.

151. It is my understanding that under the claim construction of the United States District Court for the Northern District of California, which Mr. Kitchen and Nintendo have applied, the claim term “pair of confinement structures” is construed as: “physical component(s) that **hold(s)** a computing device.” Ex. 1028, 10-12 (emphasis added); *see* Ex. 1002, ¶¶ 106, 108-110; Pet., 14-15.

152. In his declaration, Mr. Kitchen points to two out of the four sidewalls 282, retention structures 260, and added wiring, as the claimed “pair of confinement structures” (annotated above in orange). In my opinion, under the applied construction of “pair of confinement structures,” the teachings of Hirschman, taken as a whole and modified as Mr. Kitchen proposes, fails to disclose or suggest this claimed arrangement to a POSITA.

153. Contrary to Mr. Kitchen’s argument, Hirschman’s sidewalls 282 and retention structures 260 are not even connected to one another. *See* Ex. 1002, ¶ 420. Thus, a POSITA would not regard them as together forming a “confinement structure.” Instead, these components are kept in place by being separately and independently connected to chassis 280, *e.g.*, via brackets 286 that are part of chassis 280. *See* Ex. 1007, ¶ [0057] (“The chassis 280 **may include sidewalls 282 . . .** The battery 250 may be partially secured by **brackets 284 and 286, which may be extruded from or attached to the surface of the chassis 280. . .** The battery 250

may also be secured by **retention structures 260, which may be inserted into and secured by the brackets 286.**”) (emphasis added).

154. Nor would a POSITA have been motivated to connect Hirschman’s sidewalls 282 to retention structures 260. A POSITA looking at Hirschman’s system design as a whole would have understood that Hirschman intended for chassis 280 to be the main support structure for the other components in Hirschman’s system. Hirschman discloses that the other components in its system, including bezel 210, touchscreen 230, circuit board 240, communication ports 242, battery 250, are all kept in place by mounting directly or indirectly to chassis 280. *See* Ex. 1007, Fig. 3, ¶¶ [0056]-[0057]. For example, Hirschman discloses that “[t]he touch-screen 230 and circuitboard 240 may be secured by inserts 220, which may be received by receptacles 288. The receptacles 288 may be extruded from or attached to the surface of the chassis 280.” *Id.*, ¶ [0057].

155. A POSITA would have understood that mounting to a common chassis 280 simplifies the system design, provides a robust mechanical platform with structural integrity to withstand forces of torsion, flex, or other physical stresses (*see* Ex. 1002, ¶ 420), and allows for common electrical grounding through the chassis 280. Indeed, given Mr. Kitchen’s admission that “a POSITA would have understood that the sidewalls 282 and retention structures 260 are secured to the chassis 280 by way of brackets 286,” Ex. 1002, ¶ 421, a POSITA would have no reason, and would

not have been motivated, to also connect the sidewalls 282 to retention structures 260.

156. Contrary to Mr. Kitchen's argument, connecting sidewalls 282 to retention structures 260 is not necessary to prevent intrusion of dust or other substances, particularly because, as Mr. Kitchen admits, Hirschman provides dust covers 270 to prevent intrusion of dust through retention structures 260. Nor would connecting sidewalls 282 to retention structures 260 meaningfully alter the overall exposure risk of intrusion of dust or other substances. *See* Ex. 1002, ¶ 420. Rather, Mr. Kitchen's removal of USB communication port 242 entirely from his modified version of Hirschman leaves the cutout in sidewall 282 for receiving communication connector 164 (*see* Hirschman, Fig. 2A) not properly utilized, and open to intrusion of dust or other substances to a far greater degree than through retention structures 260.

157. In sum, the retention structures 260 are not taught or suggested as connected to the sidewalls 282, but instead to the chassis 280 via brackets 286. Thus, the retention structures 260 are properly considered with chassis 280 as part of Mr. Kitchen's purported "structural bridge," not with sidewalls 282 as "confinement structures."

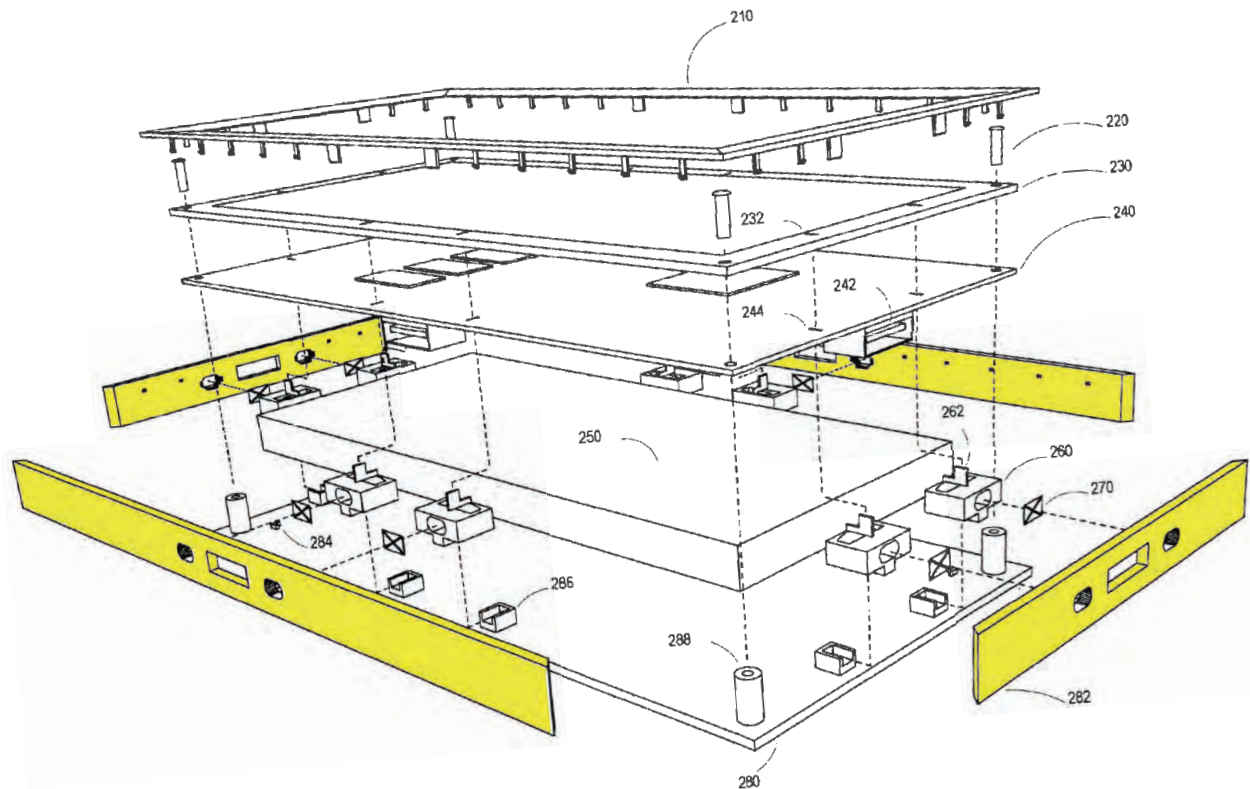
158. Without the retention structures 260, Mr. Kitchen does not argue that sidewalls 282 by themselves hold touchscreen 230 or circuit board 240, which

Mr. Kitchen purports are the claimed “computing device.” Mr. Kitchen only argues that dorsal fin structures 262 of retention structures 260 “secure” the circuit board 240 and touchscreen 230 by fitting into slots 232 and 244 in touchscreen 230 and circuit board 240 respectively. *See* Ex. 1002, ¶¶ 419 (citing Ex. 1007, ¶¶ [0057]-[0058]). But, as discussed above, the retention structures 260 are not taught or suggested as connected to sidewalls 282, and therefore are not part of the purported “confinement structure.” Rather, it is the sidewalls 282, if anything, that could possibly correspond to the claimed “confinement structures.” But because the sidewalls 282 do not hold touchscreen 230 or circuit board 240, the sidewalls 282 themselves do not constitute the claimed “confinement structures” under the applied construction.

159. An alternative way of characterizing this deficiency is that the so-called “confinement structures” that Mr. Kitchen identifies—the combination of sidewalls 282 and retention structures 260—are not “separate and distinct structures from the structural bridge [*i.e.*, chassis 280 including retention structures 260], forming no structural portion of the structural bridge.”

160. Moreover, as the Administrative Law Judge in International Trade Commission Investigation No. 337-TA-1197 found, and as shown in Fig. 3 below, Hirschman’s sidewalls 282 (annotated in yellow) surround all four sides of

Hirschman's device, and therefore fails to be "adjacent . . . not more than three sides of the sides of the computing device," as claimed. Ex. 1018, 398.



Hirschman, Fig. 3 (annotated)

B. Hirschman fails to disclose or suggest that “each of the pair of confinement structures compris[es] a communication link, each of the communication links configured for electronic communication with the computing device”

161. With respect to “communication links,” independent claim 1 of the ’393

Patent recites, among other limitations, the following arrangement:

[Claim limitation 1(b)(2)(a)-(b)] each of the pair of confinement structures comprising a communication link, each of the communication links configured for electronic communication with the computing device

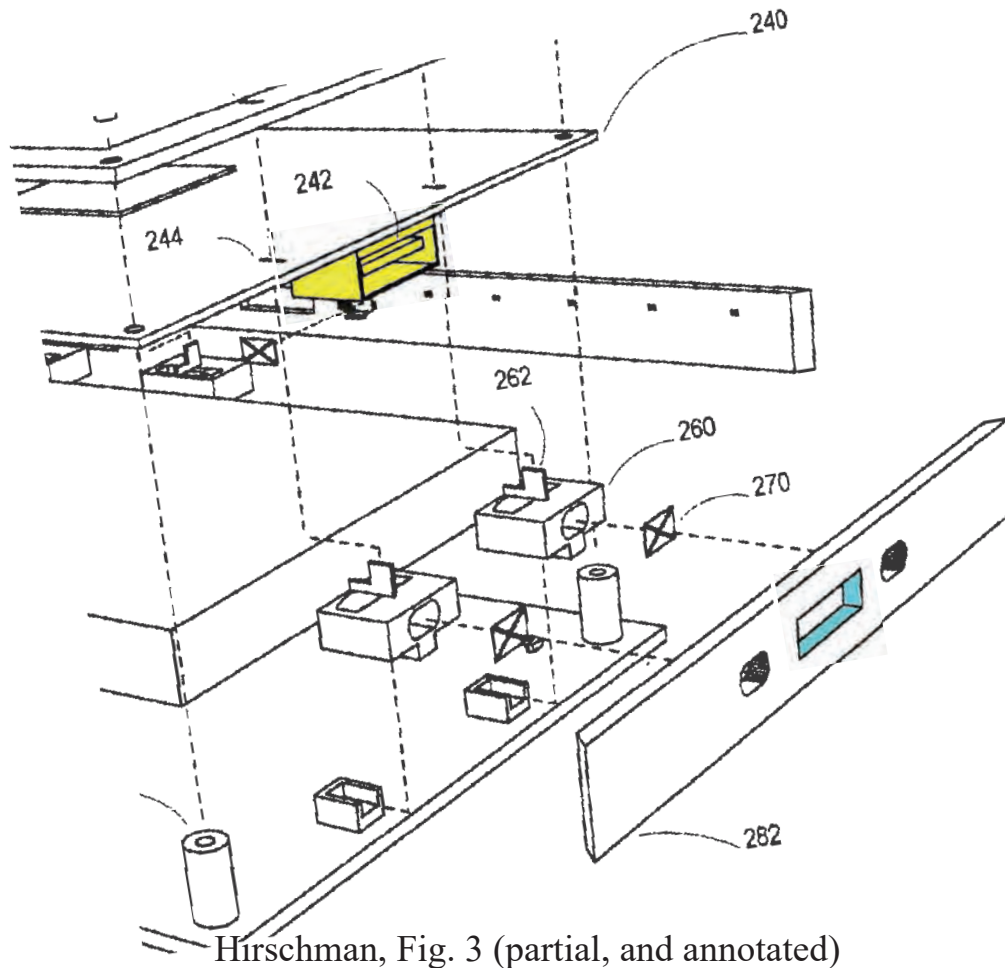
162. In my opinion, the teachings of Hirschman, taken as a whole and modified as Mr. Kitchen proposes, fails to disclose or suggest this claimed arrangement to a POSITA.

163. In his declaration, Mr. Kitchen does not argue that the sidewalls 282 can communicate any signals from gaming accessories 140 and 520 to circuit board 240. Instead, Mr. Kitchen argues that in Hirschman, communication signals may travel through retention structures 260 from gaming accessories 140 and 520 to circuit board 240. As I discussed above, however, the retention structures 260 are not taught or suggested as connected with sidewalls 282 as “confinement structures.” Thus, that the retention structures 260 may communicate signals from gaming accessories 140 and 520 to circuit board 240 is irrelevant to these claimed limitations requiring that “each of the pair of confinement structures compris[es] a communication link.”

164. Further, Mr. Kitchen attempts to modify Hirschman by removing USB communication port 242 (*see* Ex. 1007, ¶¶ [0056], [0060]) attached to circuit board 240 and adding one or more wires going from retention structures 260 to circuit board 240. *See* Ex. 1002, ¶¶ 437. In my opinion, a POSITA would not have been motivated to make these modifications. First, a POSITA would understand that the USB communication protocol built into USB communication port 242 would be a far more effective way of communicating gaming signals from gaming accessories

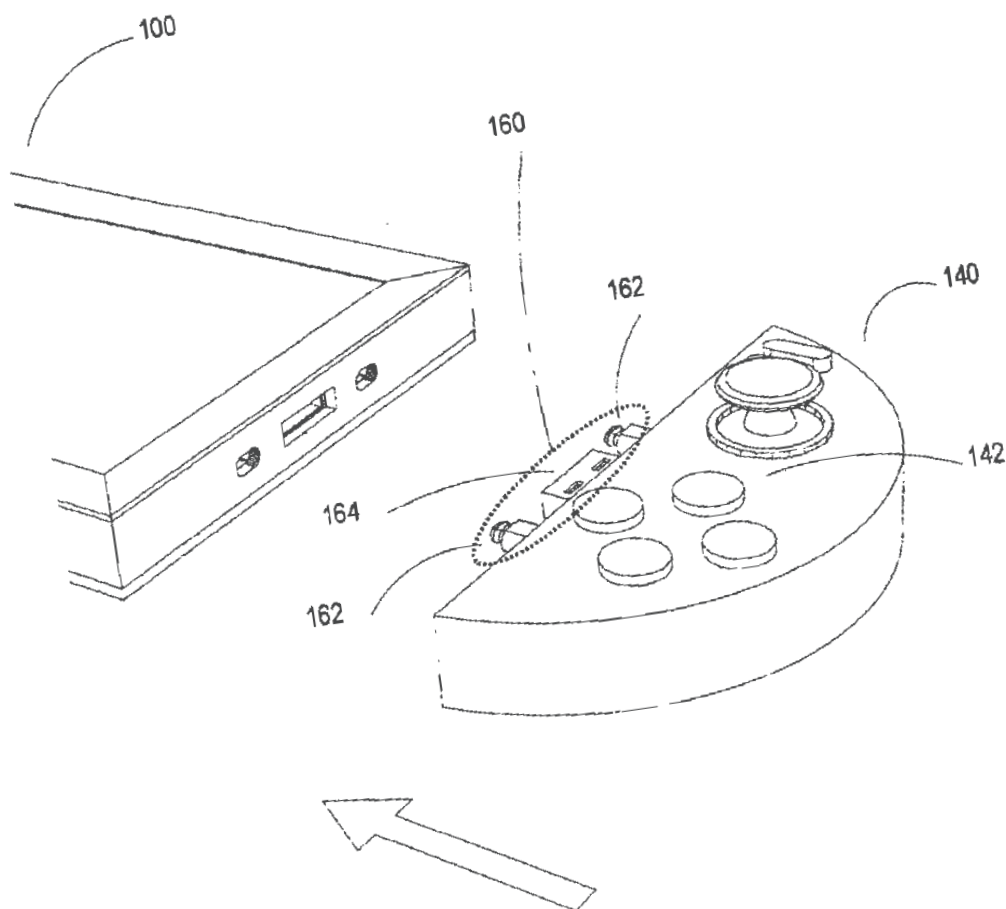
140 and 520 to circuit board 240 than the replacement wiring that Mr. Kitchen proposes.

165. Second, as shown in the partial illustration below of Hirschman Fig. 3, sidewalls 282 each have a cutout (annotated in blue) adapted for USB communication port 242 (annotated in yellow). The cutout would serve no purpose if USB communication port 242 were removed, and, as I mentioned above, would allow intrusion of dust or other substances.



166. Third, under Mr. Kitchen's proposal, Hirschman's gaming accessories 140 would all have to be modified to remove the corresponding USB communication

port 164 (see Ex. 1007, ¶¶ [0056], [0060]), and replace it with wires going between the gaming accessories 140 and Hirschman's computing system 100, as shown by Hirschman, Fig. 2A.



Hirschman, Fig. 2A (partial)

167. In my opinion, a POSITA would not be motivated to replace a much more convenient USB communication system between Hirschman's gaming accessories 140 and computing system 100 with wires as Mr. Kitchen proposes. Contrary to a POSITA's motivation, such a modification would make it much more

difficult to connect and disconnect Hirschman's gaming accessories 140 from its computing system 100.

C. Hirschman fails to disclose or suggest a “rigid structural bridge comprising a passageway between the pair of confinement structures”

168. With respect to “passageway,” independent claim 1 of the '393 Patent recites, among other limitations, the following arrangement:

[Claim limitation 1(c)(2)(a)] the rigid structural bridge comprising a passageway between the pair of confinement structures

169. During prosecution, the Examiner identified aspects of this claimed arrangement in his statement of reasons for allowance. *See* Ex. 1009, 25.

170. It is my understanding that under the claim construction of the United States District Court for the Northern District of California, which Mr. Kitchen and Nintendo have applied, the claim term “passageway” is construed as: “a space that accommodates a communication wire.” Ex. 1028, 12-13 (emphasis added); *see* Ex. 1002, ¶¶ 106, 111; Pet., 15.

171. In my opinion, the teachings of Hirschman, taken as a whole and modified as Mr. Kitchen proposes, fails to disclose or suggest this claimed arrangement to a POSITA. As I discussed above, Mr. Kitchen improperly attempts to modify Hirschman by removing USB communication port 242 (*see* Ex. 1007, ¶¶ [0056], [0060]) attached to circuit board 240 and adding one or more wires going

from retention structures 260 to circuit Board 240. Then, Mr. Kitchen argues that “[a] POSITA would also have understood that the space next to or around the battery on chassis 280 would have accommodated, in part, this wired connection.” Ex. 1002, ¶ 446. But because, as I discussed above, a POSITA would not have been motivated to incorporate wires as Mr. Kitchen proposes, there is no further teaching or suggestion of a space next to or around the battery on chassis 280 that would accommodate, in part, a wired connection.

XII. CONCLUSION

172. In my opinion, Mr. Kitchen has failed to show that any of the prior art combination anticipates or renders obvious independent claim 1. Further, I understand that dependent claims 2-7 incorporate each and every limitation of independent claim 1. Thus, Mr. Kitchen has also failed to show that any of the prior art combination anticipates or renders obvious claims 2-7.

I hereby declare that all statements made are of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this proceeding.



Dated: 28 January 2024

By: _____
Alexander H. Slocum
Cambridge, MA

APPENDIX A

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

School of Engineering Faculty Personnel Record

Full Name: Alexander H. Slocum
Department: Mechanical Engineering

1. Date of Birth: on file

2. Citizenship: U.S.

<u>School</u>	<u>Degree</u>	<u>Date</u>
M.I.T.	S.B., M.E	June 1982
M.I.T.	S.M., M.E	Jan. 1983
M.I.T.	Ph.D., M.E.	June 1985

4. Title of Thesis for Most Advanced Degree:
Sensor System Design to Determine Position and Orientation of Articulated Structures

5. Principle Field of Interest:
Precision Engineering

6. Name and Rank of Other Department Faculty in the Same Field:
David Trumper, Professor
Martin Culpepper, Professor
Sangbae Kim, Associate Professor
Amos Winter, Associate Professor

7. Name and Rank of Faculty in Other Departments in Same Field:
Jeff Lang, Professor, Electrical Engineering

Non-MIT Experience:		<u>Beginning</u>	<u>End</u>
<u>Employer</u>	<u>Position</u>		
NIST	Mechanical Engineer	June 1982	Sept. 1986
Cranfield Inst. Tech.	Visiting Professor	Oct. 1989	Oct. 1990

9. History of M.I.T. Appointments:

<u>Rank:</u>	<u>Beginning</u>	<u>End</u>
Assistant Professor (CE)	Sept. 1985	July 1989
Assistant Professor (ME)	July 1991	July 1992
Associate Professor (ME)	July 1992	July 1995
Associate Professor (ME, tenured)	July 1995	July 1998
Professor	July 1998	?

10. Department and Institute Committees, Other Assigned Duties:

<u>Activity</u>	<u>Beginning</u>	<u>End</u>
Inst. Comm. on Design in UG Education	Feb. 1987	June 1988
Inst. UG Admissions Folder Reader	Jan. 1987	Present
Inst. Committee on the Hobby Shop	July 1989	June 1997
Chairman, Inst. Committee -- Hobby Shop	June 1997	Present
Dept. Committee on Graduate Curricula	Oct. 1992	June 2004
Dept. Support Staff Cost Committee	Mar. 1994	May 1994
Pi Tau Sigma Faculty Advisor	May 1994	Jan. 2002
Dept. Faculty Search Committee	Jan. 1995	June 1995
Leader, OME 2nd Summer Design Program	Jan. 1996	Jan. 2008
MIT Educational Council	June 1996	Present
ME Strategic Planning Committee	Sept. 1996	June 1998
ME Design Faculty Search Committee	Jan. 1997	June 1998
Designated Course Professors Committee	Sept. 1997	June 2004
ME Design Faculty Search Committee	Jan. 1998	Nov. 1998
Space Committee	Jan. 2000	Sept. 2003
CalTech/MIT Voting Commission	Jan. 2001	June 2001
ME Council	Jan 2004	June 2005
Director: Experimental Study Group	Sept. 2004	June 2012
Research Administration Improvement Initiative	July. 2005	
co-chair of the Class of 1982 Reunion Gift Fund	Spring 2007	
Energy Education Task Force	Dec. 2008	June 2012
Institute Committee on Student Life	Aug. 2009	June 2012
Energy Minor Oversight Committee	Feb. 2009	June 2012
Daper Advisory Board	Aug. 2009	June 2016
Institute Committee on Student Life, Chair	June 2010	June 2012
Department Awards Committee	Spring 2011	June 2018
ME Design Faculty Search Committee	Fall 2017	June 2018
Institute Committee on Intellectual Property	Fall 2019	Fall 2022

11. Professional Service:

<u>Activity</u>	<u>Dates</u>
Office of Secretary of Defense, Foreign Strategic Trade	June 1990-June 2005
Department of Justice, Bearing Tariffs	Jan.1992-Dec.1992
NIST, Technology Assessment	June 1986-Aug. 1997
International Scientific Committee of the European Union Society for Precision Engineering and Nanotechnology	Feb. 2004-present
Session Chair "Education" 4th. Intl. Conf. Advanced Engineering Design, Glasgow, Scotland,	Sept. 5-8, 2004
Vice Chair, ASME Design Education Committee	2005
Associate Editor ASME Jou. Mechanical Design	2007-2012
Department of Energy: BP Gulf Oil Spill response team	May 2010-Sept. 2010
Assistant Director for Advanced Manufacturing, Executive Office of the White House	June 2013- May 2014

12. Awards or Honors Received:

1. U.S. DoC Development of an Advanced Robot Gripper Feb. 1984
2. U.S. DoC Outstanding Performance Rating Mar. 1985
3. SME Outstanding Contribution to FMS Feb. 1986
4. U.S. DoC Outstanding Performance Rating Mar. 1986
5. U.S. DoC Outstanding Performance Rating Mar. 1986
6. U.S. DoC Development of Robotic Micromanipulator June 1986
7. U.S. DoC Robot End Effector Patent July 1986
8. U.S. DoC Robotic Micromanipulator Patent July 1986
9. SME Outstanding Contribution to Robotics Aug. 1986
10. U.S. DoC Bronze Medal Award for Federal Service Dec. 1986
11. NSF Presidential Young Investigator June 1987
12. Royal Society Visiting Scholar Fellowship Aug. 1988
13. Oak Ridge Offsite Research Fellowship Aug. 1988
14. SME Earl E. Walker Outstanding Young Manufacturing Engineer Award, June 1993
15. ASCE 1994 Thomas Fitch Rowland Prize
16. 1994 R&D 100 Award, one of 100 best new technical products of the year (ShearDamper™)
17. 1994 International Machine Tool Show “Best of Show” award for development of Weldon Machine Tool’s 1632 Gold Cylindrical Grinder (it used Slocum’s hydrostatic bearings and ShearDamper technology).
18. 1994 R&D 100 Award, one of 100 best new technical products of the year (HydroGuide™)
19. 1995 R&D 100 Award, one of 100 best new technical products of the year (HydroSpindle™)
20. 1996 R&D 100 Award, one of 100 best new technical products of the year (TurboTool™ Ultra-High Speed Spindle)
21. SME 1997 SME Frederick W. Taylor Research Medal
22. 1997 R&D 100 Award -one of 100 best new technical products of the yr. (Machining Variation Analysis)
23. 1997 R&D 100 Award-- one of 100 best new technical products of the yr. (ShieldBeam™ Contactor)
24. 1997 R&D 100 Award, one of 100 best new technical products of the yr. (Kinematic Docking System)
25. 1998 R&D 100 Award, one of 100 best new technical products of the yr. (Q-Tool™)
26. Who’s Who in America Science and Engineering
27. Martin Luther King Jr. Leadership Award, January 1999.
28. MacVicar Faculty Fellow, January 1999.
29. 1999 R&D 100 Award, one of 100 best new technical products of the yr. (Quasi Kinematic Coupling for Engine Assembly)
30. Massachusetts Professor of the Year Award, November 2000
31. ASME Leonardo da Vinci Award, 2004
32. 100K Competición Winner (2007, Team Robopsy)
33. ASME Machine Design Award, 2008
34. 2008 R&D 100 Award, one of 100 best new technical products of the yr. (Saber Furnace)
35. 2009 R&D 100 Award, one of 100 best new technical products of the yr. (Micro-ESR with Active Spectrum, Inc).
36. 2010 Arthur Smith Faculty Achievement Award
37. Best Paper Award: O. Yaglioglu, R Martens, A. Cao, A. H. Slocum, “Compliant Carbon Nanotube-Metal Contact Structures”, Proc. of 57th IEEE Holm Conference on Electrical Contacts, 2011
38. 2014 ASME Thar Energy Award
39. 2014 Association of Manufacturing Technology Charlie Carter Award
40. 2015 Best Paper Award: J.M. Kluger, T.P. Sapsis, and A.H. Slocum, Combined offshore wind-wave-storage system power and cost predictions, NAWEA Symposium, Blacksburg, VA, June 8, 2015.

41. 2016 Best Paper Award: M.N. Haji, C. Delmy, J. Gonzalez, A.H. Slocum , “Uranium Extraction from Seawater Using Adsorbent Shell Enclosures Via a Symbiotic Offshore Wind Turbine Device”, ISOPE-2016 Best Student Paper Award, Twenty-sixth (2016) International Offshore and Polar Engineering Conference, Rhodes, Greece, June 26 – July 1, 2016.
 42. 2017 Member National Academy of Engineering
 43. 2017 Capers and Marion MacDonald Award for Excellence in Mentoring and Advising
 44. 2018 ASME Ruth and Joel Spira Outstanding Design Educator Award
 45. 2020 Elected Fellow of the American Society for Precision Engineering (inaugural year of the Fellows program).
13. Current Organization Membership:
- American Society of Mechanical Engineers, Fellow
 American Society for Precision Engineering, Fellow
 Society of Manufacturing Engineers, Member
 National Academy of Engineering, Member
14. Patents
1. US4606696, Slocum, Alexander, H. Mechanism To Determine Position And Orientation In Space, 8/19/1986
 2. US4676002, Slocum, Alexander, H. “Mechanisms To Determine Position And Orientation In Space”, 6/30/1987
 3. US4685661 Slocum, Alexander, H. | Peris, James, P. Method And Mechanism For Fixturing Objects, 8/11/1987
 4. US4694230 Slocum, Alexander, H. | Peris, James, P. Micromanipulator System, 9/15/1987
 5. US4765754 Slocum, Alexander, H. Inclined Contact Recirculating Roller Bearing, 8/23/1988
 6. US4765668 Slocum, Alexander, H. | Jurgens, Peter, A., Robot End Effector, 8/23/1988
 7. US4821436 Slocum, Alexander, H., Plow System, 4/18/1989
 8. US4836042 Slocum, Alexander, H., System To Convert Rotary Motion To Linear Motion, 6/6/1989
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 10. US4878002 Heatzig, Eric | Slocum, Alexander | Thurston-Slocum, Debra, Multi-Axis Dsp-Based Parallel Processing Servo Controller For Machine Tools And Robots, 10/31/1989
 11. US4987526 Slocum, Alexander, H. | Thurston, Debra, System To Provide High Speed, High Accuracy Motion, 1/22/1991
 12. US5023528 Saidin, Zain | Slocum, Alexander, H., Method Of Three-Phase Winding Motor Control Of Rotary Motor-Driven Linear Actuators, Linear Motor-Actuated Carriages, And Similar Systems, And Apparatus For Practicing The Same, 6/11/1991
 13. US5090265 Slocum, Alexander, H., System To Convert Rotary Motion To Linear Motion, 2/25/1992
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 15. US5281032 Slocum, Alexander H. Self-Compensating Hydrostatic Bearings For Supporting Shafts And Spindles And The Like For Rotary And Translational Motion And Methods Therefor, 1/25/1994
 16. US5472367 Slocum, Alexander, H. | Olsen, John, H., Machine Tool Apparatus And Linear Motion Track Therefor, 12/5/1995
 17. US5466071 Slocum, Alexander H. High Speed Hydrostatic Spindle Design, 11/14/1995
 18. US5484208 Kane, Nathan, R. | Slocum, Alexander, H., Elastically Supported Self-Compensating Flow Restrictors For Optimizing Hydrostatic Bearing Performance, 1/16/1996
 19. US5533814 Slocum, Alexander, H., Low Profile Self-Compensated Hydrostatic Thrust Bearing, 7/9/1996
 20. US5667204 Slocum, Alexander, Henry, Slit-Tube Replicated In-Place Constrained Layer Damper And Method, 9/16/1997

21. US5674032 Slocum, Alexander, H. | Wasson, Kevin, Tooling System And Method With Integral Hydrostatic Bearings And Turbine Power Source, 10/7/1997
22. US5678944 Slocum, Alexander, H. | Muller, Luis | Braunstein, Daniel, Flexural Mount Kinematic Couplings And Method, 10/21/1997
23. US 5683118 Slocum, Alexander, H., Kinematic Coupling Fluid Couplings And Method, 11/4/1997.
24. US5682795 Solomon, Todd, R. | Slocum, Alexander, H., Robotic Joint Using Metal Bands, 11/4/1997
25. US5700046 Van, Doren, Matthew, J. | Sauer, Don | Slocum, Alexander, H. | Rocki, David, Pap | Tam, Johann | Gerszewski, Larry, Wafer Gripper, 12/23/1997
26. US5700092 Wasson, Kevin, Lee | Slocum, Alexander, Henry, Integrated Shaft Self-Compensating Hydrostatic Bearing, 12/23/1997
27. US5711647 Slocum, Alexander, H., Method Of And Apparatus For Locating And Orientating A Part On A Gripper And Transferring It To A Tool While Maintaining Location And Orientation On The Tool, 1/27/1998
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31. US5758776 Slocum, Alexander, H. | Ziegenhagen, Ii, R., Scott | Slocum, Iii, Richard, W. | Muller, Luis, A., Integrated Circuit Tray With Flexural Bearings, 6/2/1998
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- 126.US 9401501 Bazzarella; Ricardo, Slocum; Alexander H., Doherty; Tristan, Cross, III; James C., "Electrochemical cells and methods of manufacturing the same", 07/26/2016
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- 135.US9844394 Pedro Del Nido, Christopher Di Biasio, Keith Vaughn Durand, Jonathan B Hopkins, Samir A Nayfeh, Alexander H Slocum, Zachary Traina and Nikolay Vasilyev | Instrument Port for Minimally Invasive Cardiac Surgery, 12/19/2017
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- 137.US 10060149 Smith; Eric D., Slocum; Alexander H., "Tapered spiral welded structure" 08/28/2018
- 138.US10131023 Werner, Jr.; Charles H., Gjovik; Erik J., Slocum; Alexander H., "Adjustable fixture", 11/20/2018
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- 141.US10195653 Smith; Eric D., Takata; Rosalind K., Slocum; Alexander H., Nayfeh; Samir A., "Tapered structure construction", 02/05/2019
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- 146.US10265683 Anastasios John Hart, Brian L. Wardle, Enrique J. Garcia, Alexander H. Slocum | Continuous Process for The Production Of Nanostructures Including Nanotubes, 4/23/2019
- 147.US 10266402 Yaglioglu; Onnik, Eldridge; Benjamin N., Slocum; Alexander, "Contactor devices with carbon nanotube probes embedded in a flexible film and processes of making such", 04/23/2019
- 148.US 10,399,316 Wardle; Brian L., Hart; Anastasios John, Garcia; Enrique J., Slocum; Alexander H., "Nanostructure-reinforced composite articles and methods", 09/23/2019
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- 153.US10637038 Zagars; Raymond, Curhan; Jeffrey, Doherty; Tristan, Slocum; Alexander H., "Electrochemical cells having semi-solid electrodes and methods of manufacturing the same", 04/28/2020
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- 156.US10886521 Zagars; Raymond, Curhan; Jeffrey, Doherty; Tristan, Slocum; Alexander H., "Electrochemical cells having semi-solid electrodes and methods of manufacturing the same", 01/05/2021
- 157.US10895088 Smith, Eric | Slocum, Alexander | Tapered spiral welded structure, 01/19/2021
- 158.US10906285, Wardle; Brian L., Hart; Anastasios John, Garcia; Enrique J., Slocum; Alexander H., "Nanostructure-reinforced composite articles and methods", 02/02/2021
- 159.US10925655 Alexander Slocum, James Connor Jr., Jacob Mooney, Nicholas Wing-Ping Kwok | "Bone Reduction Forceps", 02/23/2021
- 160.US10926418 Lu Lu; Xiaodong, Tang; Peter, Slocum; Alexander H., Chen; Rui, "Robotic devices and methods for fabrication, use and control of same", 02/23/2021
- 161.US 10974298 Smith; Eric D., Takata; Rosalind K., Slocum; Alexander H., Nayfeh; Samir A., "Tapered structure construction", April 13, 2021
- 162.US10,988,279, Alexander Slocum, Debra Thurston-Slocum, "Package Maker", April 27, 2021
- 163.US11,065,036, DiBiasio; Christopher, Durand; Keith, Hopkins; Jonathan, Traina; Zach, Slocum; Alexander, Nayfeh; Samir, del Nido; Pedro J., Vasilyev; Nikolay V., "Instrument port for minimally invasive cardiac surgery", 07/20/2021
- 164.US11,111,141 Jonathan Slocum, Alexander Slocum, "Storing Activated Aluminum", Sept. 7, 2021.
- 165.US11121437, Bazzarella; Ricardo, Slocum; Alexander H., Doherty; Tristan, Cross, III; James C., "Electrochemical cells and methods of manufacturing the same", 09/14/2021
- 166.US 11161579, Slocum; Alexander H., Slocum; Jonathan T., "Systems, modules, and submersible vehicles for collecting material from a seafloor", 09/23/2021

- 167.US11130557, Slocum; Alexander H., Slocum; Jonathan T., "Controlling lifting gas in inflatable structures", 9/28/2021
168. US11148947, Slocum; Jonathan T., Slocum; Alexander H., "Controlling hydrogen production from water-reactive aluminum", 10/19/2021
169. US11148840, Slocum; Jonathan T., Slocum; Alexander H., "Method of packaging water-reactive aluminum", 10/19/2021
- 170.US11,268,180 Slocum; Jonathan T., Slocum; Alexander H., "Structure inflation using activated aluminum", 3/8/2022
- 171.US11312466 Slocum; Jonathan T., Slocum; Alexander H., "Inflatable structure deployment", 4/26/2022
- 172.US11318437 Slocum; Jonathan T., Slocum; Alexander H., "Controlling contamination in hydrogen production from water-reactive aluminum" 5/3/2022
- 173.US11332366 Slocum; Jonathan T., Slocum; Alexander H., "Controlling reactivity of water-reactive aluminum" 05/17/2022
- 174.US11373549 Johnson, Hilary; Slocum Alexander, "Braille writing device", June 28, 2022

15. Professional Registration: None.

16. Major New Products, Processes, Designs, or Systems:

- SEMI E57 - Specification for Kinematic Couplings Used to Align and Support 300 mm Wafer Carriers. I proposed to SEMI/Sematech a new standard for locating 300 mm wafer cassettes, and then led the formulation and implementation of the standard, which is now in use by all companies for 300 mm semiconductor wafer cassettes and interfaces.
- OMAX Jet Machining Center (many different models). See: www.omax.com.
- Weldon 1632 Gold Grinder, International Machine Tool Show (IMTS:"Best of Show" award for development Weldon Machine Tool's 1632 Gold Cylindrical Grinder (it used Slocum's hydrostatic bearings and ShearDamper technology), Sept. 1994.
- ShieldBeam Contactor, manufactured by Teradyne, which won an R&D 100 Award for one of 100 best new technical products of the year, June 1997.
- K-Dock Kinematic Docking System, manufactured by Teradyne, which won an R&D 100 Award for one of 100 best new technical products of the year, June 1997.
- Executive Producer for inner-city kids' rap group Mental Block, their first CD entitled, "IF".
- Kinetrix, Inc. (a new startup I helped create) Apollo Semiconductor Device Sorter and Galileo Semiconductor Device Handler.
- Created web sites and programs for the Urban Design Corp (www.urbandesigncorp.org), and Paths-to-Peace (www.pathstopeace.org) to help teach kids to design and create and to promote better understanding between cultures.
- Advised 2nd Summer students as UROPs to pursue patenting their device "Ergonomic Cleaning Apparatus with Multiple Scrubbing Surfaces," US Patent # 5,915,869, June 1999.
- Worked with Overbeck Corp. of Long Island, NY to create the LT Grinding machine, which was featured as a cover article: "Get a Preload of This," *American Machinist*, December 2002.
- Executive Producer for "Journey of The Lost Souls" by Marc Graham (book of poems and rap CD).
- Dial Soap "Quest for the Best" consumer product search finalist for "Massagasoap".
- Massachusetts State Archives: Encasements for Documents of Freedom (cases to provide 20 years O₂ free enclosures to enable public viewing of original documents: Commonwealth of MA Charter of 1629, Charter of 1692, original copies provided to the 13 colonies of: US Declaration of Independence, Constitution, and Bill of Rights, all with combined value >\$80 million).
- OOSEH massaging balls (see www.roll2run.com)
- OOSEH finger splint

17. Teaching Experience:

<u>Term</u>	<u>Subject Number</u>	<u>Title</u>	<u>Role</u>
ST 1986	1.965	Special Studies in Civil Engineering	Lect. in Charge
FT 1986	1.964	Design for Construction Automation*	Lect. in Charge
ST 1987	1.13	Design for Construction Automation*	Lect. in Charge
FT 1987	1.08	Introduction to Robotics*	Lect. in Charge
FT 1987	1.502A	Freshman Seminar "Design of Machine Systems"	Lect. in Charge
ST 1988	1.13	Design for Construction Automation*	Lect. in Charge
FT 1988	2.70	Introduction to Design	Recitation
FT 1988	1.S04	Fr Freshman Seminar "Precision Machine Design"	Lect. in Charge
ST 1989	2.996	Precision Machine Design*	Lect. in Charge
FT 1991	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1991	2.731	Advanced Engineering Design	Co-lecturer
ST 1992	2.732	Advanced Engineering Design	Co-lecturer
ST 1992	2.840	Precision Machine Design*	Lect. in Charge
FT 1992	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1992	2.731	Advanced Engineering Design	Co-lecturer
ST 1993	2.732	Advanced Engineering Design	Co-lecturer
ST 1993	2.75	Precision Machine Design*	Lect. in Charge
FT 1993	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1993	2.72	Machine Elements	Co-lecturer
ST 1994	2.75	Precision Machine Design*	Lect. in Charge
FT 1994	2A08	Freshman Seminar: Precision Machine Design*	Lect. in Charge
FT 1994	2.73	Design	Co-Lect. in Charge
ST 1995	2.70	Introduction to Design	Lect. in Charge
FT 1995	2A08	Freshman Seminar: Design of Toys & Games*	Lect. in Charge
FT 1995	2.75	Precision Machine Design*	Lect. in Charge
IAP 1996	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1996	2.70	Introduction to Design	Lect. in Charge
FT 1996	2A08	Freshman Seminar: Design of Toys & Games*	Lect. in Charge
FT 1996	2.75	Precision Machine Design*	Lect. in Charge
IAP 1997	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1997	2.007	Design & Mfg I*	Lect. in Charge
IAP 1998	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1998	2.75	Precision Machine Design*	Lect. in Charge
ST 1998	2.007	Design & Mfg I*	Lect. in Charge
FT 1998	2.009	Product Design Section Instructor	
IAP 1999	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 1999	2.007	Design & Mfg I*	Lect. in Charge
IAP 2000	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2000	2.007	Design & Mfg I*	Lect. in Charge
ST 2000	2.75	Precision Machine Design*	Lect. in Charge
IAP 2001	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2001	2.007	Design & Mfg I*	Lect. in Charge
FT 2001	2.75	Precision Machine Design*	Lect. in Charge
FT 2001	2.997	(J with 6.963 Medical Innovation)	Co-Lect. in Charge
IAP 2002	2.971	2nd Summer Intro. to Design*	Lect. in Charge
IAP 2002	2.996	Paths to peace*	Lect. in Charge
ST 2002	2.007	Design & Mfg I*	Lect. in Charge
FT 2002	2.996	Paths to peace*	Lect. in Charge
IAP 2003	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2003	2.007	Design & Mfg I*	Lect. in Charge
FT 2003	SP247	8.01 Physics with Sports*	Lect. in Charge
FT 2003	2.75	Precision Machine Design*	Lect. in Charge
IAP 2004	2.971	2nd Summer Intro. to Design*	Lect. in Charge

ST 2004	2.007	Design & Mfg I*	Lect. in Charge
FT 2004	SP247	8.01 Physics with Sports*	Lect. in Charge
FT 2004	2.75	Precision Machine Design*	Lect. in Charge
IAP 2005	2.971	2nd Summer Intro. to Design*	Lect. in Charge
ST 2005	2.007	Design & Mfg I*	Lect. in Charge
FT 2005	2.75	Precision Machine Design*	Lect. in Charge
ST 2006	2.007	Design & Mfg I*	Lect. in Charge
FT 2006	2.75	Precision Machine Design*	Lect. in Charge
ST 2007	2.007	Design & Mfg I*	Lect. in Charge
ST 2008	2.007	Design & Mfg I*	Lect. in Charge
FT 2008	2.75/2.750	Precision Machine Design*	Lect. in Charge
ST 2009	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2009	2.75/2.750	Precision Machine Design*	Lect. in Charge
FT2009	2.A38	Freshman Advisor Seminar*	Lect. in Charge
ST 2010	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2010	2.75/2.750	Precision Machine Design*	Lect. in Charge
FT2010	2.A38	Freshman Advisor Seminar*	Lect. in Charge
ST 2011	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2011	2.75/2.750	Precision Machine Design*	Lect. in Charge
ST 2012	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2012	2.75/2.750	Precision Machine Design*	Lect. in Charge
ST 2013	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2014	2.75/6.525, 2.750/6.025J	Design of Medical Devices	Co-Lect. In Charge
ST 2014	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
FT 2015	2.75/6.525, 2.750/6.025J	Design of Medical Devices	Co-Lect. In Charge
ST 2016	2.752/2.753	Developing Mechanical Products*	Lect. in Charge
ST 2016	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge
FT 2016	2.75/6.525, 2.750/6.025J	Design of Medical Devices*	Co-Lect. In Charge
ST 2017	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge
FT 2017	2.75/6.525, 2.750/6.025J	Design of Medical Devices*	Co-Lect. In Charge
ST 2018	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge
FT 2018	2.75/6.525, 2.750/6.025J	Design of Medical Devices*	Co-Lect. In Charge
ST 2019	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge
FT 2019	2.75/6.525, 2.750/6.025J	Design of Medical Devices*	Co-Lect. In Charge
ST 2020	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge
FT 2020	2.75/6.525, 2.750/6.025J	Design of Medical Devices*	Co-Lect. In Charge
ST 2021	2.70/2.77	FUNdaMENTALS of Precision Product Design *	Lect. in Charge

* Indicates subject developed by Slocum

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- 184) Johnson, H. A., Simon, K. P., and Slocum, A. H., 2020, "Improving the Design Life Cycle Efficiency of Wastewater Treatment Plant Inflow Pumps," Proceedings of Applied Energy Symposium: MIT A+B, ICAE, p. 5. <http://www.energy-proceedings.org/improving-the-design-life-cycle-efficiency-of-wastewater-treatment-plant-inflow-pumps/>
- 185) J. Oeding, S. Bockman, H. Chiu, C. Hua, J. Connor, A. Slocum, "Design of a Multi-Degree-of-Freedom Traction and Stabilization Device for Open Reduction and Internal Fixation of Distal Radius Fractures", BIOMED 2021; V001T13A007doi:<https://doi.org/10.1115/DMD2021-1047>
- 186) Doron, P., Karni, J., & Slocum, A. (2019), "A Generalized Approach for Selecting Solar Energy System Configurations for a Wide Range of Applications", MRS Energy & Sustainability, 6, E#. doi:10.1557/mre.2019.10
- 187) Gessel, D., Slocum, A., "Lifespan Analysis of Utility Scale Energy Storage Options", euspen special interest group mtg, 13-14 Oct. 2021.
- 188)

*Outgrowth of supervised student research.

21. Other Major Publications:

- 1) Slocum, A. H., (Executive Producer) for inner-city kids' rap group Mental Block, their first CD entitled "IF".
- 2) Slocum, A. H., (Executive Editor) for Marc Graham's book of poems and images entitled "JoTLS" (Journey of The Lost Souls) www.jotls.com .

22. Invited Lectures:

1. April 1986, "Flexible Automated Fixturing Systems," SME Conf. on Jigs and Fixtures, Cincinnati, OH.
2. Dec. 1986, "A Five Axis Robotic Micromanipulator," ASME Winter Annual Meeting, Anaheim, California.
3. Dec. 1986 "A Servo-Controlled Pneumatic Double Gripper with Changeable Fingers," ASME Winter Annual Meeting, Anaheim, CA.
4. Sept. 1989, *Precision Machine Design*, Short course for the American Society for Precision Engineering Annual Meeting in Monterey, CA.
5. Sept. 1990, *Precision Machine Design*, Short course for the American Society for Precision Engineering Annual Meeting in Rochester, NY.
6. Oct. 1991, *Precision Linear Motion Bearing Design*, Short course for the American Society for Precision Engineering Meeting in Santa Fe, NM.

7. Oct. 1991, *Error Budgeting and Machine Modeling*, Short course for the American Society for Precision Engineering Meeting in Santa Fe, NM.
8. Oct. 1992, *Actuators for Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Orlando, FL.
9. Oct. 1992, *Applications of Ceramic Materials in Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Orlando, FL.
10. Nov. 1993, *Actuators for Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
11. Nov. 1993, *Applications of Ceramic Materials in Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
12. Nov. 1993, *Design of Damping Systems for High Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Seattle, WA.
13. Nov. 1994, *Actuators for Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Cincinnati, OH.
14. Nov. 1995, *Actuators for Precision Machines*, Short course for the American Society for Precision Engineering Meeting in Phoenix, AZ.
15. Oct. 2000, *Getting Students Psyched about Engineering and Science*, Robofesta Conf., Osaka, Japan
16. Nov. 2000, *Advances in Machine Tool Design*, ASME Winter Annual Meeting, Orlando, FL
17. July 2001, *Advances in Machine Elements*, keynote address, 10 International Conference on Precision Engineering, Yokohama, Japan.
18. Nov. 2002, *Mechanics of Designing Precision Machines*, Harvard University, Division of Engineering and Applied Science Dept. seminar
19. April. 2003, *The Nanogate*, Harvard University, Division of Engineering and Applied Science Dept. seminar
20. June 2003, *Characterization and Fabrication of the NanoGate for Nanoscale Fluidics, Wireless Communications, and ?*, NSF Workshop on Nanoscale Mechanical Engineering, Arlington, VA Nov. 2002
21. Nov. 2003, *Advances in Precision Machine Design*, keynote speaker, Mechatronics, Automation and Control Symposium of the COBEM 2003 Sao Paulo Brazil
22. Nov. 20, 2003, "Fundamentals of MEMS machines", Invited lecture, University of Florida
23. March 22, 2004, "Fundamentals of Precision Machine Design", invited lecture, Brigham Young University
24. March 22, 2004, "Applying Macro Machine Design Experience to Dinky Designs", invited lecture, Brigham Young University
25. May 17, 2004, "Fundamentals of Precision Machine Design", invited lecture, Ohio State University
26. June 2, 2004, "Magnetically Preloaded Friction Drive System", Invited keynote speaker, European Union Society for Precision Engineering & Nanotechnology annual meeting.
27. Sept. 6, 2004, "A design Environment to Teach Students about Optimal Transmission Ratios", 4th. Intl. Conf. Advanced Engineering Design, Glasgow, Scotland, Sept. 5-8, 2004.
28. Sept 14, 2006, "Design of Small Precision Machines", ICOMM Univ. of Illinois UC, keynote address
29. Oct. 16, 2007, "Water Hydrostatic Bearings for Precision Machine Tools and Industrial Machinery", invited talk, ASPE Annual Mtg
30. April 14, 2008 "A Fantasy Vision of how as a Giant Bio Nano Team We All Zoom Forward to Infinity and Beyond," 2008 Bio-Nano Manufacturing Grand Challenges for 2020 Workshop, Arlington, VA
31. Oct 21, 2010 "Precision Machines for Renewable Energy Harvesting and Storage", First IFToMM Asian Conference on Mechanism and Machine Science, Taipei, Taiwan
32. March 13-14, 2013 "Kinematic and Elastically Averaged Joints: Connecting the Past, Present and Future", IUSPEN, Tokyo Japan
33. July 10-11, 2014 "Symbiotic Offshore Energy Harvesting and Storage Systems," Offshore Energy & Storage Symposium, invited talk, UWCAES Society, Windsor, Ontario, Canada

34. July 25, 2014 “Big hydrostatic bearings for ships and offshore wind machines”, invited keynote speech, Japan Society for Precision Engineering annual meeting, Komatsu Japan.
35. Nov 2014, “Symbiotic Systems for The Future of Energy, Water, and Food”, Atlantic Council Energy and Economic Summit, Istanbul
36. March 24, 2015, “The Future of Energy, Generation, Demand & Supply”, PEWA, Johannesburg, South Africa
37. Oct. 29, 2015, “Symbiotic Systems for The Future of Energy, Water, and Food”, Dartmouth College, Visionaries in Technology Distinguished Lecture
38. Feb 16, 2016, “Symbiotic Systems for The Future of Energy, Water, and Food”, Weizmann Institute of Science
39. June 2, 2016, “A Bright Future for Energy & the World”, Frankfurter Allgemeine Forum, Berlin Germany.
40. Volo Foundation/ ClimateCorrec4on, “Symbiotic Systems for The Future of Energy, Water, and Food”, Oct 11, Orlando, FL.
41. Dec. 11.2018, “Vision Speech: A Bright Future for Energy & the World”, Future Energies Science Match 4 December 2018, Kiel Germany

Theses Supervised by Alexander H. Slocum

	<u>Total</u>	<u>Completed</u>	<u>In Progress</u>
S.B.	127	127	0
S.M.	85	84	1
Engineers	1	1	0
Doctoral Supervisor:	59	57	2
Doctoral Reader (committee member):	44	44	0

S.B. Theses:

1. Robinson, Darryl K., "Design of a Prototype Fastening System for the Trackbot Automated Construction Robot," May 1986.
2. Kang, Jiin, "Design of a Track Positioning Mechanism for an Interior Wall Construction Robot," June 1986.
3. Paulson, Bruce A., "Design of a Materials Handling System to Automate Interior Wall Construction," June 1986.
4. Thackston, III, George W., "Design of an Automatically Guided Vehicle for Use in Automated Drywall Construction," June 1986.
5. Gladwin, S. C., "Design and Assembly of a Construction Robot Subsystem to Fasten Drywall to Studs," June 1986.
6. Shiller, Andrew, "Kinematic Analysis of A Precision Slide," June 1987.
7. Gregory, Arthur, "Vacuum Gripper Design for Automated Assembly," June 1987.
8. Wurman, Peter, "Anechoic Chamber Design and Acoustical Analysis of Room 1-051," June 1987.
9. Heatzig, Eric, "Scafbot-A Servo Controlled Scaffolding Device," June 1987.
10. Huang, Stanley, "Design and Implementation of a Software Controller for a Wall Building Robot," June 1987, (Electrical Engineering and Computer Science).
11. Barrientos, Miguel, "Tools for Developing Countries," June 1993.
12. Mateo, Evan, "Semiconductor Wafer Gripper," June 1994.
13. Phillips, Alton, "Electrostatic Air Cleaner," June 1994.
14. Breinlinger, Keith J., "A Handbook to show 2.007 Students How to Better Utilize the Materials in the 2.007 Kit," February 1996
15. Percer, Adrian C., "2.007 Briggs and Stratton Lawnmower Engine Exercise," June 1996
16. Estan, Basak, "Modeling Methods Using Computer Aided Design," June 1996.
17. Goldstein, Evan D., "The Design Process as Employed in the Introduction to Design Class at MIT," June 2006.
18. Hicks, Robert J., "A Proposal for the 2.007 Book: Instrument to Design," February 1997
19. Youngbear, Kathy, "Optimization of Cross-Sectional Configuration of an Extruded Plastic Truss," June 1997.
20. Richkus, Rebecca, "Performance Limiters in the Clamping Mechanism of Injection Molding Machine," June 1997.
21. Schmidt-Lang, Michael P., "The Design of a Simple Wind Tunnel Test Stand for Measuring Lift to Drag Ratio," June 1997.
22. Pellegrini, Brian J., "Guide to the Design Process through the MIT 2.70 Contest," June 1997.
23. Melvin, Jason W., "Design of a Kinematic Coupling for Machine Tool Fixturing," June 1997.
24. Lehman, David M., "The Design Process: MIT 2.70 Contest," June 1997.
25. Burn III, Robert D., "Simulator Chair Design: Ergonomics and Vibration," June 1997.
26. Shah, Raj, "Creation of a Website for the Purposes of Archiving Course-Related Material," June 1997.
27. Allen, Holly, "Multimedia as a Teaching Tool in 2.007," June 1998.
28. Miller, John, "Design of an Anti-Backlash Transmission for Position Control Applications," June 1998.
29. Butville, Michael, "Driveshaft Design for a Dynamometer Utilizing Rotary Motion Flexural Bearings," June, 1998.
30. Durant, Lawrence C., "Administration of the Urban Design Corp. and the Implementation of Design in Hip Hop Production," February 1999.
31. Prieto, Rodrigo, "2.007 Contest Design and Machine Design," June 1999.

32. Cooperman, Seth J., "The History, Mechanics, and Psychology of Magic," June 1999.
33. Cortesi, Roger S., "Designing a Mechanical Engineering Contest," June 1999.
34. Sprunt, Alexander D., "A Three Axis CNC Router Design," February 2000.
35. Davis, Wallace B., "Design and Cost Optimization of a Cast Concrete Constrained Layer Vibration Damper," September 2000.
36. Loiselle, Phillip J., "Thermal Stability of Kinematically Coupled Microscope Stack Structure," June 2001.
37. Moon, Daniel K., "Flexure Based Mounts for Sensitive Payloads: A Management and Engineering Stack Study (Course 2B)," June 2001.
38. Harper, Christopher, "Redesign of Industrial Pin Joint Test Apparatus," June 2001.
39. Chouinard, Natalie, "Design Process of a 2.007 Design and Manufacturing Contest Table," June 2001.
40. Arguelles, David, "Design and Manufacture of a BattleBot," June 2001.
41. Sanchez, Manuel A., "Planteez Business Plan and Preliminary Research," June 2001.
42. Kisai, Darul "Mechanical Design of Chassis and Drivetrain for an Autonomous Mobile Robot," June 2001.
43. Montgomery, Sean J., "An Analysis of the Dynamics of the 2001 2.007 Contest Table with an Overview of its Application to Table Design Choice," June 2001.
44. Harper, Kelly, "Redesign of Industrial Pin Joint Test Apparatus," June 2001.
45. Shur, Maiya, "Design and Manufacturing of a Device Prototype for Performing Combined Ultrasound and X-Ray Mammography," June 2002.
46. Bernstein, Oren, "Wireless Touch Pads for Competitive Swimming," June 2002.
47. Bravard, Marjory A., "Design and Implementation of an Electrical System for a Combined Ultrasound and X-ray Mammography Breast Imaging Device," June 2002.
48. Ferguson, Kevin M., "Design and Fabrication of the Testing Apparatus for the Characterization of the Z-axis Flexure in the MIT-PERG/UIUC-LFD High-Precision Microscope Project," June 2002.
49. Praster, Stephanie M., "Prototype Development of Linear Actuator System to Enable Breast Ultrasound," September 2002.
50. Roberts, Michael H., "Approximation of Air Bearings as Linear Point Springs: Verification of an Analytical Model for a New Five-Axis Machine Tool," June 2002.
51. Bloomsburgh, John G., "Sealing and Heat Transfer Analysis of Gas Flow through Alumina Tubes in a Tube Furnace," June 2003.
52. Jacobs, Alex T., "Development of a Right-Angle Gearbox Design Module for Use in Undergraduate Mechanical Design Curriculum," June 2003.
53. Varady, Eric J., "Design and Manufacture of the 2003 2.007 Wireless Control Boxes," February 2004.
54. Browne, Courtney, "Design of a 2.007 machine with All-Terrain Suspension," June 2004.
55. Read, Melissa, "Designing a Better Hair Straightener," June 2004.
56. Kahn, Christopher, "Solution for Modular Die-Level Anodic Bonder," June 2004.
57. James, Richard, "Design of an Aluminum Differential Housing and Driveline Component for High Performance Application Abstract," June 2004.
58. Figueroa, Victor A., "Designing a Mechanism to Cleave Silicon Wafers," September 2004.
59. Mukaddam, Kabir, "Design of a Silicon Wafer Fracturing Instrument," February 2005.
60. Gomez III, Nicasio, "PCV Valve Flutter: Vibration Characterization through Pressure and Flow," June 2005.
61. Held, David, "Modeling and Control of a Silicon Substrate Heater for Carbon Nanotube Growth Experiments," June 2005.
62. Fonder, Gregory Paul, "The Back Stroke Buddy," June 2005.
63. Bonas, Calvin, "Re-Usability of Plastics," June 2005.
64. Jonnalagadda, Aparna S., "Passive Microfluidic Interconnects," June 2005.
65. Shu, Yuan, "Tabletop Robot to Aid in Arm Rehabilitation of Stroke Patients," June 2005.
66. Su, Benjamin W., "Wheelchair Exercise Roller Product Design," June 2005.
67. Johnson, Philip Tyler, "Development and Design of an Adjustable Elastic Support System for Ensuring Safety While Learning Physical Skills," June 2005.

68. Nelson, Alexandra T., "Press Fit Design: Force and Torque Testing of Steel Dowel Pins in Brass and Nylon Samples," June 2005.
69. Trangle, Etan S., "SmartBat: A Baseball Swing Analysis and Training Product," June 2005.
70. Smith, Benjamin D., "HandSkates: An Apparatus for physically Intelligent Exercise," June 2005.
71. McKenney, Kyle S., "The Design and Development of Aquatic Exercise Shoe Flags," June 2005.
72. Hatton, Ross L., "Plant Design for Deterministic Control of STEMs and Tape-Springs," June 2005.
73. Breinlinger, Joshua E., "Design and Construction of a Linear Induction Powered LEGO Roller Coaster," June 2006.
74. Fuertes, Amilcar, "Read and Do with the Animaroots," June 2006.
75. Shull, Craig M., "Fundamentals of the 2.007 Design Process," June 2006.
76. Lin, Wey-Jiun, "Product Realization of the 2.007 Control Box," June 2006.
77. Yang, Tiffany, "The Wall-Mill: The Design of a Flexible Machine for the In-Situe Architectural Machining of Surfaces," June 2006.
78. Tsai, Helan, "Swimming Fins for Strengthening the Inner Quadriceps Muscle," June 2007.
79. Juan Herrera, "Wall Miller," June 2007.
80. Colton, Shane, "Energy harvesting power electronics," June 2008.
81. Bosworth, Will, "Adjustable Kinematic Coupling," June 2008.
82. Schroll, Gregory, "Gyroscope Actuated Spherical Robot," June 2008.
83. Treadway, Shane, "Climbing knot fixture," June 2008.
84. Harrington, Jeremy, "Steerable Catheter," June 2009.
85. Paxton, Adam, "Air Window over Salt Receiver," June 2009.
86. Gil Amrita, "Multi Loop Heat Exchanger for Molten Salts," June 2009.
87. Koniski, Cyril, "Precision 4-Bar linkages," June 2009.
88. Nikandrou, Paul, "Dynamic Valuation Model For Wind Development In Regard to Land Value, Proximity to Transmission Lines, and Capacity Factor," June 2009.
89. Houston, Emily, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures," June 2010.
90. Lampe, Evan M, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures," June 2010.
91. Schantz, Jarred L, "Design of an Endoscope Lens Shielding Device for Use in Laparoscopic Procedures," June 2010.
92. Adames, Adrian, "Design Considerations of a 15KW Heat Exchanger for the CSPonD Project"
93. Chen, Xuefeng, "Instrument Guide for MRI-guided Percutaneous Interventions," June 2010.
94. Ding, Hao, "Characterization of a Pre-curved Stylet Distal Tip Manipulation Mechanism for use in Volume Targeting," June 2010.
95. Esmail, Adnan M, "Cannabis Sativa: An Optimization Study for ROI," June 2010.
96. Powelson, Stephen K, "Developing a Low-Cost Ventilator," June 2010.
97. Rodriguez Alvarado, Juan F, "Validation of a Numerical Model for the Analysis of Thermal-Fluid Behavior in a Solar Concentrator Vessel," June 2010.
98. Racz, Rastislav, "Design of Bicycle Testing Rig," June 2010.
99. Adames, Adrian A., Design considerations of a 15kW heat exchanger for the CSPonD Project," June 2010.
100. Cervantes, Thomas Michael, "Analysis and Design of an Adjustable Bone Plate for Mandibular Fixation," June 2011.
101. Correll, Eric Owen, "Design of a rapid, continuous, small-scale device for creating dry powders from concentrated suspensions containing active pharmaceutical ingredients," June 2011.
102. O'Rourke, Conor Rakis, "Mechanical Development of the Mounting and Actuation System of a Parabolic Solar Trough," June 2011.
103. Westwood, Mitchell, "Creation and Validation of a Numerical Model for the Analysis of Bending Patterns of a Flexural Laparoscopic Grasper," June 2011.
104. Hawthorne, Stephan, "Device for the Mechanization of Corneal Transplants," June 2011.
105. Marten-Ellis Graves, Carmen, "Drive Train Improvements and Performance Evaluation of a Robotically Steered Needle," June 2011
106. Reyda, Caitlin J., "Design of a Pressure Sensing Laparoscopic Grasper," June 2011.
107. Rees, Jennifer A., "Modeling the Solar Thermal Receiver for the CSPonD Project," June 2011.

108. Dündar, Gökhan, "Design and manufacture study of Ocean Renewable Energy Storage (ORES) prototype," June 2012.
109. Erickson, Andrew T., "Design and optimization of actuation mechanisms for rapid skin closure device," June 2012.
110. Khalifa, Sammy Mohsen, "Mechanics of jammed media used as a structural element," June 2012.
111. Mason IV, Alexander M., "Design, measurement, and analysis of oxygenated fluid pump system," June 2012.
112. Peña, Kristen Helen, "Characterization of an oxygen suspension used for intravenous infusion," June 2012.
113. Piazzarolo, Bruno Aiala, "Design optimization of oxygenated fluid pump," June 2012.
114. Jarboe, Jason Neal, "A Method for Infrared Temperature Measurements of Thin Im Materials with a Low, Unknown and/or Variable emissivity at Low Temperatures," June 2013.
115. Popovic, Katarina, "Design and Analysis of Hydraulically Driven Actuation System for a Parabolic Solar Trough," June 2013.
116. Carrillo, Juan Felipe, "Mechanical Development of an Actuation System for a Parabolic Solar Trough Collector," June 2013.
117. Flowers, Susan Caroline, "Design of a Laparoscopic Simulation Device for Testing and Training," June 2014.
118. Abiose, Kabir, "Improving The Concentrated Solar Power Plant Through Connecting The Modular Parabolic Solar Trough", June 2016.
119. Cao, Cyndia, "Exploration of Configurations of Wave Energy Converters to Mechanically Drive a Seawater Uranium Harvester", June 2017
120. Delmy, Cédric, "Making Haiti "The Pearl of the Antilles" again: What Can Be Done?" June 2018
121. Brown, Austin, "Axially Compliant Grinding Spindle for Robotic Grinding", June 2018
122. Gray, Luke, "Cable Train: A Platform for In-Situ Manufacturing of Underground Cable", June 2018
123. Bratten, Richard, "Cost Analysis and Profitability of the Cable Train: A Mobile Platform for Manufacturing Underground Cable Systems", June 2018
124. Leathrum, Travis, "Modular Auger Design to Prevent Clogging in Suction", June 2019
125. Wettermark, Susan Daly, "Modeling Flow Characteristics of a Low Specific-Speed Centrifugal Pump with Different Volute Shapes", June 2019
126. Le, Serena, "Design of a Load-Lock System for the Lyophilization of Unit-Dose Pharmaceuticals in a Continuous Manufacturing Machine", June 2019
127. Flores, Ryan, "Design of Load-lock Door for Unit Dose Continuous Lyophilization Process for Complex Biologics", June 2019

S.M. Theses:

- 1) Hou, William M., "Conceptual Design of an Automated System for Emplacement and Retrieval of Nuclear Waste," January 1987.
- 2) Schena, Bruce, "Design Methodology for Large Work Volume Robotic Manipulators: Theory and Application," Sept. 1987.
- 3) Gedney, Richard, "Sensor and Control System Design for Automated Testing of Structural Materials," January 1988.
- 4) Damazo, Bradford, "Mechanical, Sensor, and Control System Design of an Accelerometer Calibrator with One Part Per Million Accuracy," January 1988.
- 5) Ousterhout, Karl, "Design of a Force and Position Servo Controlled Robotic Gripper with a 50:1 Grip Force to Weight Ratio," January 1988.
- 6) Levy, David, "Studbot: A Construction Robot for the Automated Assembly of Steel-Stud Partition Walls," Sept. 1987.
- 7) Ziegler, Andrew, "Studwelder: A Construction Robot for In-Situ Automated Welding of Shear Studs," June 1988.
- 8) Heatzig, Eric, "Modular digital servo controller," June 1989 (Civil Engineering).
- 9) Hochmuth, Catrsten, "Design and Construction of a machine tool axis prototype for evaluation of adaptive and learning control systems," January 18, 1990.

- 10) Carey, John, "Methodologies of Controller Design for Precision Linear Motion Systems," June 1992.
- 11) Gaub, Heinz, "Hydrostatic Linear Motion Bearings for Precision Machine Tools," June 1992.
- 12) Schmeichen, Philip, "Design of Precision Kinematic Systems," Jan. 1993.
- 13) Bhatena, Firdaus, "Mapped Control Systems for Precision Machines," (Co-supervisor with Prof. Lang), June 1993.
- 14) Mintz, David, "Models for the development of precision machine tools", June 1993.
- 15) Smith, Michael, "Adaptive Control Systems for Precision Machines," (Co-supervisor with Prof. Annaswamy), June 1993.
- 16) Br  nner, Christoph, "Self Compensating Hydrostatic Bearings for Grinding Machine Tables," January 1994.
- 17) Chiu, Michael, "Design of a Precision High Speed Tool Servo," January 1994.
- 18) Wasson, Kevin, "High Speed Hydrostatic Spindle Design," 1994.
- 19) Doubleday, Roland, "A control system for a testhead manipulator," June 1995.
- 20) Vallance, Ryan, "Design and prototype fabrication of a manipulator for semiconductor test equipment," June 1996.
- 21) Culpepper, Martin, "Design of Debris Cleaner Using a Compound Auger and Vacuum Pick Up," January 1997.
- 22) Scrivens, Jevin, "A Wireless Robot for Semiconductor Manufacturing Equipment," June, 1997.
- 23) Houdek, Phillip, "Design and Implementation Issues for Stewart Platform Configuration Machine Tools," June 1997.
- 24) Alden, John, "Active Kinematic Coupling," June 1997.
- 25) Ellahi, Farooq, "An Integrated Decanter Centrifuge-Pitot Pump," June 1997.
- 26) Brienlinger, Keith, "Hexapod Home Flight Simulator," August 1998.
- 27) Balakrishnan, Asha, "Planarized Ball Grid Arrays," June 1999.
- 28) Schmidt-Lange, Michael, "A graduate level treatment of the design of a machine for the 1999 2.007 Contest," June 1999.
- 29) Rohatgi, Gaurav, "Damped Tool Holder - Approaches for Chatter Reduction in Deep Cavity and Intricate Surface Milling," June 1998.
- 30) Cortesi, Roger, "An Easy to Manufacture Non-Contact Precision Linear Motion System and Its Applications," August 2000.
- 31) Sprunt, Alex, "Electrical Contact tester," June 2002.
- 32) Robertson, Alec, "Precision Aerostatic Spherical Joint," June 2003.
- 33) Montgomery, Sean, "Electronics Curriculum for 2.007," June 2003.
- 34) Werkmeister, Jaime, "Mesomill," June 2004.
- 35) Thompson, Kate, "MEMS Fluid Coupling," June 2004.
- 36) Abu-Ibrahim, Fadi, "Low-cost precision waterjet," June 2004.
- 37) Vanderpoel, Timothy, "Design of a Snowboard Simulating Exercise Device," June 2005.
- 38) Figueredo, Stacy, "Monolithic Plastic Biopsy Device," June 2006.
- 39) Durand, Keith, "Design of an Energy Efficient and Economical Actuator for Automobile Windows," June 2007.
- 40) Jonnalagadda, Aparna, "Automotive Energy Harvesting," Jan. 2007.
- 41) Trimble, Zachary, "Rotating Energy Harvesting Device," June 2007.
- 42) Rothenhofer, Gerald, "Hydrocline linear motion axis," June 2007.
- 43) Zurovcik, Danielle, "Negative Pressure Wound Therapy Device," June 2007.
- 44) Kuhn, David, "Desktop systems for manufacturing carbon nanotube films by chemical vapor deposition," June 2007.
- 45) Edinger, Sarah, "Multi Motion Door," Jan. 2008.
- 46) Bassett, Erik, "Linear clutch for needle insertion," June 2008.
- 47) Rojas, Folkers, "CSPonD Heat Exchanger," January 2011.
- 48) Zimmerman, Julia, "Single-use Lancet and Capillary Loading Mechanism for Complete Blood Count Point of Care Device," January 2011.
- 49) Fennell, Gregory, "Offshore Renewable Energy Storage System," June 2011.
- 50) Bosworth, William, "Design and Parametric Simulation of Radially Oriented Electromagnetic Actuators," June 2011.
- 51) Begg, Nikolai, "Bistable Flexure-based Trocar," June 2011.

- 52) Wong, Anthony, "Water Hydrostatic Bearings for Ships," June 2012.
- 53) Bridgers, Daniel, "Ex-Vivo Brain Holding Fixture for MRI Studies," June 2012.
- 54) Rosario, Matthew, "Characterization of Cardiac Lead Perforation Risk via a Dynamic Simulated Environment," January 2012.
- 55) Meredith, James. "Design, Construction and Testing of an Ocean Renewable Energy Storage Scaled Prototype," January 2012.
- 56) Gorbaty, Emily, "Development of an efficient off-grid pumping system and evaporation reduction strategies to increase access to irrigation for smallholder farmers in India," June 2013.
- 57) Carrasquillo, Omar, "Design of inflatable solar concentrator," June 2013.
- 58) Hopkins, Brandon James, "Mechanical design of flow batteries" June 2013.
- 59) Kluger, Jocelyn Maxine, "Nonlinear beam-based vibration energy harvesters and load cells" June 2014.
- 60) Bayless, Jacob, "A High-Speed Hysteresis Motor Spindle for Machining Applications" February 2014.
- 61) Sondej, Nicholas, "Direct Tablet Formation by Electrospinning and Compaction" June 2014.
- 62) Taylor, David Donald James, "Reducing Booster-Pump-Induced Contaminant Intrusion in Indian Water Systems with a Self-Actuated, Back-Pressure Regulating Valve" June 2014.
- 63) Simon, Kevin, "Low Cost Water Pump", June 2015
- 64) Abbott, Jonathan E., "Bee Care Technology" Jan 2016.
- 65) Mills, Nathan, "Pan Tilt Mechanism", June 2016.
- 66) O' Brien, Megan, "Design of a Mobile Torrefaction Reactor for In-Situ Conversion of Agricultural Waste to Solid Biofuel", June 2016.
- 67) Labib, Shahd, "Pill Forming Apparatus", June 2017
- 68) Beautyman, Michael, "Load Bearing Interface Design for a Pan-Tilt Mechanism for Severe Marine Environments", June 2017
- 69) Finley, Thomas, "Slip Clutch Design for Position Sensitive Systems in Marine Environments" , June 2017
- 70) Hamlet, Amanda, "Uranium Extraction from Seawater: Investigating Hydrodynamic Behavior and Performance of Porous Shells ", June 2017
- 71) Krol, Przemyslaw Michal, "Productization and Instrumented Testing of a Corrosion Fatigue Test Device", June 2017
- 72) Cervantes, Thomas "Thumb Ligament Stiffness Measurement Instrument", January 2018
- 73) Johnson, Hilary, "Braille Writer", January 2018
- 74) Leibowitz , Dalia, "Design of a Large-Dose Minimally Invasive Drug Delivery Device for Tuberculosis", June 2018
- 75) Carrus, Justin, "Brick Press for Africa", June. 2018
- 76) Huynh, Daniel, "Next Generation Probabilistic Prediction Model for Submarine Propulsion Shaft Life", June 2018
- 77) Yue, Brian, "Design of a Construction Saw Kickback Evaluation Machine for the Comparison of Kickback Energies in Pipe Cutting Applications", June 2019
- 78) Duenner, Andrew, "A Framework for Error Budgeting in Engineering Design", June 2019
- 79) Peng, Val, "Design and System Integration of a Low-Cost Packing Method for Profitable Utilization of Water Hyacinth (*Eichhornia crassipes*)", June 2019
- 80) Canning, Julia, "Gesture Sensing with Flexural Ultrasonic Transducers", June 2019
- 81) Burcat, Steven, "Development of a Benchtop Chainsaw Kickback Measurement Device for Manufacturing", June 2019
- 82) Gray, Luke, "Open Ocean Sargassum Sequestration", June 2019
- 83) Southerland, Sarah, "Utilization of High Contaminant Recycled HDPE in Concrete Aggregate and Investigation into Additional Industrial Applications", January 2021
- 84) O'Connell, Ellen, Lyophilization system vial supports, 2021
- 85) Flores, Ryan, Lyophilization system load lock, work started June 2020

Engineer Degree

- 1) Werkmeister, Jaime, "Development of Silicon Insert Molded Plastic (SIMP)", June 2005.

Doctoral Theses, Supervisor:

- 1) Demsetz, Laura, "Methodology for Formulating Designs of Task Specific Automated Construction Machinery," Jan. 1989. (Civil Engineering).
- 2) Everett, John, "Construction Automation: Basic Task Selection and Development of the Cranium," June 1991. (Civil Engineering).
- 3) Marsh, Eric, "Design of Precision Coordinate Measuring Machines," June 1994.
- 4) Van Doren, Matthew, "Precision Machine Design Methodology for Design of Semiconductor Processing Equipment," June 1995.
- 5) Scagnetti, Paul, "Design of Precision Grinding Machines for Ceramics," January 1996.
- 6) Ho, Chris, "Concurrent Development of a Rotationally-Symmetric Barb Joint for Modular Storage Systems through Product Innovation Research," June 1997.
- 7) Levy, David, "Portable Product Miniaturization and the Ergonomic Threshold," August 1997.
- 8) Braunstein, Daniel, "Precision Printed Circuit Board Manufacturing," August 1997.
- 9) Chiu, Michael, "High Precision Semiconductor Equipment Test Design," January 1998.
- 10) Nayfeh, Samir, "Design and Application of Damped Machine Elements," June, 1998.
- 11) Pfahnl, Andreas, "Design of Precision Temperature Controlled Precision Machine Tools," June 1998.
- 12) Hale, Layton, "Principles and Techniques for Designing Precision Machines," January 1999
- 13) Hochmuth, Carsten, "Platform Concept for Precision Machining Centers," January 1999
- 14) Kiani, Sefhir, "Multi-connection vias for printed circuit boards," January 1999.
- 15) Vallance, Ryan, "Precision Miniature Mechanism Manufacture," June 1999.
- 16) Muller, Luis, "Modular Semiconductor Test, Assembly & Packaging Manufacturing Equipment Design," June 1999.
- 17) Kane, Nathan, "Surface Self-Compensated Modular Linear Hydrostatic Bearings," June 1999.
- 18) Kotilainen, Markku Sami Antero, "Design and Manufacture of Modular Self-compensating Hydrostatic Journal Bearings," June 2000.
- 19) Culpepper, Martin, "Design and Application of Compliant Quasi-Kinematic Couplings," January 2000.
- 20) Bamburg, Eberhard, "Principles of Rapid Machine Design," June, 2000.
- 21) O'Sullivan, Donald, "Structural Elements with Mathematically Defined Surfaces for Enhanced Structural and Acoustic Performance," August 2001.
- 22) White, James, "The Nanogate: Nanoscale Flow Control," June 2003.
- 23) Qiu, Jin, "An Electrothermally-Actuated Bistable MEMS Relay for Power Applications," June, 2003.
- 24) Brienlinger, Keith, "Three Dimensional Routed Manifolds with Externally Inserted Cables," June, 2003.
- 25) Sihler, Joachim, "A Low Leakage 3-Way Silicon Microvalve," January 2004.
- 26) Awtar, Shorya, "Synthesis and Analysis of Parallel Kinematic XY Flexure Mechanisms," January 2004.
- 27) Li, Jian, "Electrostatic Zipping Actuators and Their Application to MEMS," January 2004.
- 28) Willoughby, Pat, "Elastically Averaged Precision Alignment," June 2005.
- 29) Sprunt, Alexander, "A Variable Capacitor Made from Single Crystal Silicon Fracture Surface Pairs," August 2005.
- 30) Yang, Xueen, "MEMS LC Tunable Filter," June 2005.
- 31) Graham, Marc, "Product Development by Deterministic Design," June 2006.
- 32) Hart, Anastassios John, "Continuous Growth Nanotubes," August 2006.
- 33) Thompson, Mary Kate, "A Multi-Scale Iterative Approach for Finite Element Modeling of Thermal Contact Resistance," August 2007.
- 34) Yaglioglu, Onnik, "Carbon Nanotube Based Electromechanical Probes," June 2007.
- 35) Ma, Hongshen, "Electrochemical Impedance Spectroscopy using adjustable nanometer-gas electrodes," June 2007.
- 36) Freeman, David, "Resonator PCV Valve," January 2008.
- 37) Weber, Alexis, "MEMS relays for make-break power switching applications: {111} silicon etched planar electrical contacts," June 2008.
- 38) Read, Melissa, "Design of a Standard Method and Instrumentation for the Measurement and Characterization of MEMS Fabricated Electrical Contacts," January 2009.

- 39) Walsh, Conor, "Image-guided robots for dot-matrix tumor ablation," June 2010.
- 40) Rothenhofer, Gerald, "Elements for the Design of Precision Machine Tools with High Required Loop Stiffness and their Application to a Prototype 450 mm Si-Wafer Grinder," August 2010.
- 41) Durand, Keith, "Hermetically sealed encasements for historic document display and preservation," January 2011.
- 42) Trimble, A. Zachary, "Energy harvesting of random wide-band vibrations with applications to an electro-magnetic rotational energy harvester," June 2011.
- 43) Figueredo, Stacy, "Parabolic Trough Solar Collectors: Design for Increasing Efficiency," June 2011.
- 44) Codd, Daniel Shawn, "Concentrated Solar Power on Demand," June 2011.
- 45) Hanumara, Nevan Clancy, "Design of Efficient Precision Medical Robotics," August 2012.
- 46) Zurovcik, Danielle, "Negative Pressure Wound Therapy," August 2012.
- 47) Heberley, Brian, "Advances in hybrid water-lubricated journal bearings for use in ocean vessels," June 2013.
- 48) Rojas, Folkers, "Continuous Feed of an Occluding Medium into an Uncontrolled Well," February 2014.
- 49) Padhye, Nikhil, "Film based pharmaceutical tablet manufacturing," August, 2015.
- 50) Begg, Nikolai D., "Increasing the Safety and Precision of Medical Tissue Puncture," June 2014.
- 51) Wortman, Tyler, "LesionAir: A low-cost tool for automated skin cancer diagnosis and mapping" June 2016
- 52) Jonart, Douglas, "Methods and Devices for Corrosion Fatigue Testing without Acceleration," June 2016
- 53) Haji, Maha, "Extraction of Uranium from Seawater: Design and Testing of a Symbiotic System". June 2017
- 54) Kluger, Jocelyn Maxine, "Synergistic Design of a Combined FloatingWind Turbine -Wave Energy Converter", June 2017
- 55) Taylor, David Donald James, "Tools for Managing Intermittent Water Supplies", June 2018
- 56) Melanie Tretault-Friend, "Thermal-Fluid Characterization And Performance Enhancement Of Direct Absorption Molten Salt Solar Receivers" June 2018 (co-advisor with Prof. E Baglietto in NSE)
- 57) Simon, Kevin, "Low cost water pumps", January 2019
- 58) Johnson, Hilary, "Design and analysis of adaptive hydraulic geometry for centrifugal pumps", work initiated January. 2018
- 59) Burcat, Steven, "Lyophilization machine", work initiated June 2020.

Doctoral Theses, Reader:

- 1) Bausch, John J. III, "Kinematic Methods for Automated Fixture Design," Jan. 1990.
- 2) Trumper, Dave, "Magnetic Suspension Techniques for Precision Motion Control," Sept. 1990 (Electrical Engineering and Computer Science).
- 3) Chai, Jangbom, "Non-Invasive Diagnostics of Motor-Operated Valves," June 1993.
- 4) Mosleh, Mohsen, "The Role of Wear Particles in Geometrically Constrained Frictional Systems in Dry Sliding," June 1994.
- 5) Walczyk, Daniel, "A Complete Sheet Metal Forming System Incorporating a New Quick Prototyping Method for Dies," January 1996.
- 6) Frey, Daniel, "Using Product Tolerances to Drive Manufacturing System Design," June 1997.
- 7) Williams, Mark, "Precision Six Degree of Freedom Magnetically-Levitated Photolithography Stage," October 1997.
- 8) Pfahnl, Andy, "Design of a Thermal Control System for an IC Test-In-Tray Handler," June 1998.
- 9) Ludwick, Stephen, "High-Speed Lens Cutting Machine," MIT, Mechanical Engineering, June, 1999.
- 10) Hidrovo, Carlos, "Development of a Fluorescence Based Optical Diagnostics Technique and Investigation of Particle Ingestion and Accumulation in the Contact Region of Rotating Shaft Seals," Mechanical Engineering, June 2001.
- 11) Liebman, Michael, "Five-Axis Grinding Machine for Centimeter-scale Parts," MIT, Mechanical Engineering, June 2002.
- 12) Sweetland, Mathew, "Precision Thermal Control System for Semiconductor Devices Under test," MIT, Mechanical Engineering, June 2002.

- 13) Meggiolaro, Marco, "Achieving Fine Absolute Positioning Accuracy in Large Powerful Manipulators," Mechanical Engineering, June 2002.
- 14) Sujan, Vivek, "Compensating for Model Uncertainty in the Control of Cooperative Field Robots," June, Mechanical Engineering, 2002.
- 15) Konkola, Paul, "Phase Interference Gratings," Mechanical Engineering, June, 2003.
- 16) Savran, Cagri, "A Robust Micromechanical Sensor for Label-free Biomolecular Detection in Real-time," Mechanical Engineering, Jan. 2004.
- 17) Griffith, Saul, "Self Assembling 3D structures," Mechanical Engineering, June 2004.
- 18) Turner, Kevin, "Wafer Bonding: Mechanics-Based Models and Experiments," Mechanical Engineering, June 2004.
- 19) Wilhelm, Eric, "Printed Electronics and Micro-Electromechanical Systems," Mechanical Engineering, June 2004.
- 20) Hai Ning, "Building E-Education Platforms for Design-Oriented Learning," Civil Engineering, June 2004.
- 21) Sparks, Andrew, "Scanning Probe Microscopy with Inherent Disturbance Suppression Using Micromechanical Devices," Mechanical Engineering, Sept. 2004.
- 22) Wilson, Andrew, "Wafer Bonding," June 2004.
- 23) Varanasi, Kripa "Damping mechanisms," June 2004.
- 24) Hashemi, Fardod, "Nanotweezers," June 2005.
- 25) Montesanti, Rick, "High speed tool servo," June 2006.
- 26) Balakrishnan, Asha, "Development of Novel Dynamic Indentation Techniques for Soft Tissue Applications," August 2007.
- 27) Winter, Amos, "Burrowing Robots," August 2010.
- 28) Yamamoto, Namiko, "CNT reinforced composites," June 2010.
- 29) Kesner, Samuel (Harvard), "Robotic Catheters for Beating Heart Surgery," January 2012.
- 30) Phan, Long, "Thermal imaging of buildings," May 2012.
- 31) Amin-Shahidi, Darya, "High Force Density Piezoelectric Reticle Assist Device," May 2013.
- 32) Gilbertson, Mathew, "Electromechanical Systems to Enhance the Usability and Diagnostic Capabilities of Ultrasound Imaging," May 2014.
- 33) Greenblatt, Elliot, "The Impact of Pathological Ventilation on Aerosol Deposition Imaging, Insight and Interventions," January 2015.
- 34) Weinstein, Lee, "Improving solar thermal receiver performance via spectral and directional selectivity", August, 2017
- 35) Xu, Ruzie, "Low-Frequency, Low-Amplitude MEMS Vibration Energy Harvesting", Oct .2017
- 36) Bousquet, Gabriel, "Optimal wind energy extraction at interfaces: from Dynamic Soaring to the amphibious Sailplane", Dec. 2017
- 37) Hopkins, Brandon, "Stopping Self-Discharge in Metal-Air Batteries", June 2018
- 38) Mannai, Sebastien, "A Novel Framework for Acoustic Diagnostic of Artificial Lift System for Oil-Production", June 2018
- 39) K.S. Kung, Design and Validation of a Decentralized Biomass Torrefaction System", June 2017.
- 40) Fan, Dixia "Mapping the Hydrodynamic Properties of Flexible and Rigid Bodies Undergoing Vortex-Induced Vibrations", June 2019
- 41) Zhou, Lei, "Magnetically Levitated Hysteresis Motor Driven Linear Stage for In-Vacuum Transportation Tasks", June 2019
- 42) Justin Beroz "Precision pipetting and crack-free colloidal assembly" June 2019
- 43) Guillermo F. Diaz Lankenau, "Tractor design for resource limited small farms", Dec. 2019
- 44) Max Carlson, "Design of Fouling-Resistant Coatings for Energy Systems: Theory and Proof of Principle at Realistic Conditions", June 2021

Postdoctoral Associates and Fellows supervised by Alexander H. Slocum

- 1) Hart, A.J., Carbon Nanotubes (2007). Current employer and title: Associate Professor of Mechanical Engineering, MIT.

- 2) Ma, Hongshen, “Electrochemical Impedance Spectroscopy using adjustable nanometer-gap electrodes,” 2007. Current employer and title: Assistant Professor, University of British Columbia, Department of Mechanical Engineering, Multi-scale Design Laboratory, Vancouver, BC, Canada.
- 3) Hanumara, Nevan Clancy, “Efficient design of precision medical robots,” 2012 MIT Postdoctoral Associate Appointment: August 2012 – August 2014. Current employer and title: MIT Dept. mech. Engineering, Research Scientist.
- 4) Gil, Antoni, “Concentrated Solar Power on Demand”, MIT Postdoctoral Associate Appointment: September 2014-2017. Current employer and title: Unknown.

Disclosable list of companies with which Dr. Slocum has consulted in the past five years:

1. ASML, Inc., Wilton CT
2. Keystone Tower Systems, Inc., Broomfield, CO
3. LTAG Systems, Bow, NH
4. KLA, Inc., Milpitas, CA
5. Nabors, Inc., Houston, TX
6. OMAX Corp., Kent, WA
7. Raptors Design, Bow, NH
8. Schlumberger, Inc., Houston, TX
9. Zimmer Biomet, Warsaw, IN

Expert Witness History of Alex Slocum since 2016

Plaintiff	Defendant	Year began	Expert for	Firm	Deposition	Appear at Trial	Case No. Filing Date Court Location
Keurig	Touch	2016	Keurig	Wolf, Greenfield	yes	no	1:16-cv-10142-DJC 02/01/2016 USDC Massachusetts (Boston) <i>Case settled</i>
Husky	Plastics Engineering	2016	Husky	Wolf, Greenfield	yes	no	IPR2016-00432 1/4/2016
Gillette	Shavelogic	2016	Gillette	Goodwin Proctor	yes	no	IPR2016-00918 3/10/2016 <i>Ruling in favor of Shavelogic</i>
Arthrex	Smith & Nephew	2016	Smith & Nephew	Wolf, Greenfield	yes	yes	2:15-cv-1047-R ED Tx 6/17/2015 USDC Eastern District of Texas <i>Court ruled for Arthrex, parties later settled</i>
Fontem Ventures	Nu Mark	2016	Nu Mark	MTO	no	no	2:16-cv-02291-GW-MRW 4/4/2016 USDC California Central (Western) Related Cases: 2:14-cv-01645-GW-MRW

Plaintiff	Defendant	Year began	Expert for	Firm	Deposition	Appear at Trial	Case No. Filing Date Court Location
							1:16-cv-01259-CCE-JEP 10/26/2016 USDC N. Carolina Middle District Related Cases: 1:16-cv-01255-CCE-JEP 1:16-cv-01257-CCE-JEP 1:16-cv-01258-CCE-JEP 1:16-cv-01261-CCE-JEP <i>Case settled</i>
Barn Light Electric Company, LLC	Jeffrey Ohai	2016	Barn Light Electric Company, LLC	Brinks Gilson & Lione	no	no	IPR 2017-00145 11/18/2016 <i>Case settled</i>
J&M MFG. Co., Inc.	Unverferth Mfg. Co., Inc.	2017	Unverferth Mfg. Co., Inc.	Wood, Herron, & Evans	no	no	1:12-cv-00931-SJD 12/5/2012 USDC Southern District of Ohio (Cincinnati) <i>Case settled</i>
Nivel	Textron	2017	Nivel	Weiss & Arons LLP	no	no	3:17-cv-00146-TJC-JRK February 7, 2017 USDC, Middle District of Florida, Jacksonville <i>Case settled</i>
Gillette	Schick	2017	Gillette	Goodwin	yes	yes	ITC 337-TA-1079
Sanofi	Mylan, Biocon	2017	Sanofi	Weil, Gotshal & Manges LLP	yes	yes	C.A. No. 17-cv-09105-SRC-CLW USDC DISTRICT OF NEW JERSEY Related cases: IPR2018-01670 IPR2018-01675 IPR2018-01678 IPR2018-01679 IPR2018-01680 IPR2018-01682 IPR2018-01684 IPR2019-00122 <i>Court ruled for Mylan, under appeal</i>
Fujifilm	Sony	2017	Sony	Wolf, Greenfield	no	no	1:17-CV-01209-LPS-CJB 9/15/2017 USDC Delaware (Wilmington) ITC 337-TA-1076 <i>Court ruled for Sony</i>
Sanchez and Crow v. Airbus Helicopters, Inc.	KOMO	2018	KOMO	The Rosen Law Firm	yes	yes	16-2-06330-6 03/17/2016 King County Superior Court (Washington) Consol. With: 16-2-26710-6 <i>Case settled</i>

Plaintiff	Defendant	Year began	Expert for	Firm	Deposition	Appear at Trial	Case No. Filing Date Court Location
Canon, Inc	Ninestar	2018	Ninestar	Mayer Brown	yes	no	ITC 337-TA-1106 <i>Case settled</i>
Fox Factory, Inc	SRAM	2018	Fox Factory, Inc	Finnegan	yes	no	Civil Action No. 1:18-cv-00130-WJM-NYW <i>Case settled.</i>
Rexa	MEA	2018	Rexa	Wolf Greenfield	no	no	Civil Action No. 17-cv-8716 USDC NORTHERN DISTRICT OF ILLINOIS
Heineken	ABI	2018	ABI	Cadwalader	no	yes	ITC 337-TA-1130 <i>Case settled</i>
Daly	Sullivan Tire	2019	Daly	Sheff	no	no	Middlesex and Norfolk Middlesex County Superior Court 1581CV05961 10/09/2015 <i>Case settled</i>
Strothman, et al.	Airbus Helicopters, Inc., et al.	2019	Strothman, et al.	Landye Bennett Blumstein LLP	yes	no	Cause No. 153-280107-15, In the 153rd Judicial District Court, Tarrant County, Texas. <i>Case settled</i>
Philip Morris Products	RAI Strategic Holdings	2019	Philip Morris Products	Latham & Watkins	yes	yes	Civil Action No. 1:20-cv-393 (E.D. Va.)
BlueCatBio	AusBio	2019	BlueCatBio	Wolf Greenfield	yes	no	PTAB (Case PGR2020-00051)
Valeant & Kaken	Mylan	2020	Valeant & Kaken	Finnegan	yes	no	UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF WEST VIRGINIA (C.A. No. 18-cv-00184-IMK (Lead)) <i>Case settled</i>

Plaintiff	Defendant	Year began	Expert for	Firm	Deposition	Appear at Trial	Case No. Filing Date Court Location
Nespresso	Williams-Sonoma	2020	Williams-Sonoma	Orrick, Herrington & Sutcliffe LLP	no	no	UNITED STATES DISTRICT COURT FOR THE SOUTHERN DISTRICT OF NEW YORK (Civil Action No.: 19-cv-04223-LAP) <i>Case settled</i>
SGRE	GE	2021	GE	Wilmar Hale	yes	yes	Civil Action No. 1:21-cv-10216-WGY <u>Result: one patent invalidated, one patent valid</u>
Nidec Corp	Seagate Technology LLC et al	2021	Seagate	Faegre Drinker Biddle & Reath LLP	yes	yes	No. 1:21-cv-00052 <i>Arbitration: found for Seagate on all counts</i>
Garrity et. Al.	Deere	2021	Garrity	CONNER, MARR & PINSKI, PLLP	no	no	Cause No. BDV-19-0439 Case settled. Farmers VERY happy.
Becton Dickinson & Co.	Beckman Coulter, Inc.	2021	Beckman	Williams & Connolly	yes	no	No. 1:21-cv-00833-CFC (D. Del.) <u>Ongoing</u>
Pelican Biothermal, LLC	VA-Q-TEC AG	2022	VA-Q-TEC	Andrus Intellectual Property Law, LLP	no	no	PGR2021-00085 (PTAB) <u>Ongoing</u>
SGRE	GE	2022	GE	Hogan Lovells International LLP	no	no	UK court action HP-2021-000011