UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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TCL CORPORATION, TCL COMMUNICATION TECHNOLOGY HOLDINGS, LTD.; TCT MOBILE LIMITED; TCT MOBILE INC.; AND TCT MOBILE (US) INC.
Petitioners

v.

TELEFONAKTIEBOLAGET LM ERICSSON,
Patent Owner

_____

IPR Case No. IPR2015-01674
Patent RE43,931

_____

DECLARATION OF ANDREW WOLFE, PH.D.

IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. RE43,931
(CLAIMS 1-12 and 15 OF U.S. PATENT NO. RE43,931)

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I, Andrew Wolfe, declare:

I. INTRODUCTION

1. My name is Andrew Wolfe, Ph.D. I am currently an independent consultant, corporate board member, and Adjunct Professor.

2. I have been retained by TCL Corporation, TCL Communication Technology Holdings LTD., TCT Mobile Limited, TCT Mobile Inc., and TCT Mobile (US), Inc. ("Petitioners") to provide my expert opinions regarding U.S. Patent No. RE43,931 (the "'931 Patent"). More specifically, I have been asked to give my opinion about the meanings of certain terms of the '931 Patent claims, and to compare the '931 Patent claims to prior patents and publications. I submit this declaration in support of Petitioners' petition for *inter partes* review of the '931 Patent.

3. I am being compensated for my work in this matter. My compensation in no way depends upon the outcome of this proceeding.

4. Each statement and/or finding recited herein are based in whole or in part on one or more of the exhibits listed in Section III of this declaration, and a true and correct copy of each exhibit is submitted concurrently with this declaration.

II. EXPERT QUALIFICATIONS AND CREDENTIALS

5. My qualifications for presenting the opinions in this declaration are set forth in my curriculum vitae, a copy of which is attached as Appendix A to this declaration.

6. I have more than 30 years of experience as a computer architect, computer system designer, personal computer graphics designer, educator, and executive in the electronics industry.

7. In 1985, I earned a B.S.E.E. degree in Electrical Engineering and Computer Science from The Johns Hopkins University. In 1987, I received an M.S. degree in Electrical and Computer Engineering from Carnegie Mellon University. In 1992, I received a Ph.D. in Computer Engineering from Carnegie Mellon University. My doctoral dissertation proposed a new approach for the architecture of a computer processor.

8. In 1983, I began designing touch sensors, microprocessor-based computer systems, and I/O (input/output) cards for personal computers as a senior design engineer for Touch Technology, Inc. During the course of my design projects with Touch Technology, I designed I/O cards for PC-compatible computer systems, including the IBM PC-AT, to interface with interactive touch-based computer terminals that I designed for use in public information systems. I continued designing and developing related technology as a consultant to the

Carroll Touch division of AMP, Inc., where in 1986 I designed one of the first custom touch-screen integrated circuits. I designed the touch/pen input system for the Linus WriteTop, which I consider to be the first commercial tablet computer.

9. From 1986 through 1987, I designed and built a high-performance computer system as a student at Carnegie Mellon University. From 1986 through early 1988, I also developed the curriculum, and supervised the teaching laboratory, for processor design courses.

10. In the latter part of 1989, I worked as a senior design engineer for ESL-TRW Advanced Technology Division. While at ESL-TRW, I designed and built a bus interface and memory controller for a workstation-based computer system, and also worked on the design of a multiprocessor system.

11. At the end of 1989, I (along with some partners) reacquired the rights The Graphics Technology Company. Over the next seven years, as an officer and a consultant for The Graphics Technology Company, I managed the company's engineering development activities and personally developed dozens of touch screen sensors, controllers, and interactive touch-based computer systems.

12. I have consulted, formally and informally, for a number of fabless semiconductor companies. In particular, I have served on the technical advisory boards for two processor design companies: BOPS, Inc., where I chaired the board, and Siroyan Ltd., where I served in a similar role for three networking chip

companies—Intellon, Inc., Comsilica, Inc, and Entridia, Inc.—and one 3D game accelerator company, Ageia, Inc.

13. I have also served as a technology advisor to Motorola and to several venture capital funds in the U.S. and Europe. Currently, I am a director of Turtle Beach Corporation, providing guidance in its development of premium audio peripheral devices for a variety of commercial electronic products.

14. From 1991 through 1997, I served on the Faculty of Princeton University as an Assistant Professor of Electrical Engineering. At Princeton, I taught undergraduate and graduate-level courses in Computer Architecture, Advanced Computer Architecture, Display Technology, and Microprocessor Systems, and conducted sponsored research in the area of computer systems and related topics. I was also a principal investigator for DOD research in video technology and a principal investigator for the New Jersey Center for Multimedia Research. From 1999 through 2002, I taught the Computer Architecture course to both undergraduate and graduate students at Stanford University multiple times as a Consulting Professor. At Princeton, I received several teaching awards, both from students and from the School of Engineering. I have also taught advanced microprocessor architecture to industry professionals in IEEE and ACM sponsored seminars. I am currently a lecturer at Santa Clara University teaching graduate courses on Computer Organization and Architecture and undergraduate courses on

electronics and embedded computing.

15. From 1997 through 2002, I held a variety of executive positions at a publicly-held fabless semiconductor company originally called S3, Inc. and later called Sonicblue Inc. I held the positions of Chief Technology Officer, Vice President of Systems Integration Products, Senior Vice President of Business Development, and Director of Technology, among others. At the time I joined S3, the company supplied graphics accelerators for more than 50% of the PCs sold in the United States. At S3 I supervised the design of several PC graphics chips.

16. I have published more than 50 peer-reviewed papers in computer architecture and computer systems and IC design.

17. I also have chaired IEEE and ACM conferences in microarchitecture and integrated circuit design and served as an associate editor for IEEE and ACM journals. I serve on the IEEE Computer Society Awards committee. I am a Senior Member of IEEE and a Member of ACM.

18. I am a named inventor on at least 43 U.S. patents and 26 foreign patents.

19. In 2002, I was the invited keynote speaker at the ACM/IEEE International Symposium on Microarchitecture and at the International Conference on Multimedia. From 1990 through 2005, I was also an invited speaker on various aspects of technology and the personal computer ("PC") industry at numerous

industry events including the Intel Developer's Forum, Microsoft Windows Hardware Engineering Conference, Microprocessor Forum, Embedded Systems Conference, Comdex, and Consumer Electronics Show, as well as at the Harvard Business School and the University of Illinois Law School. I have been interviewed on subjects related to computer graphics and video technology and the electronics industry by publications such as the Wall Street Journal, New York Times, Los Angeles Times, Time, Newsweek, Forbes, and Fortune as well as CNN, NPR, and the BBC. I have also spoken at dozens of universities including Massachusetts Institute of Technology, Stanford, University of Texas, Carnegie Mellon, University of California at Los Angeles, University of Michigan, Rice, and Duke.

III. BASIS FOR OPINIONS AND MATERIALS REVIEWED

20. The opinions set forth in my declaration are based on my personal knowledge gained from my education, personal experience, and on the review of the documents and information described in this declaration.

21. In preparation of this declaration, I have studied:

- U.S. Patent No. RE43,931 (the "'931 Patent")(Ex. 1001);
- U.S. Patent No. 6,278,888 (the "'888 Patent")(Ex. 1004);
- U.S. Patent No. 6,131,047 (the "'047 Patent") (Ex. 1005);
- The File History of U.S. Patent No. 6,278,888 (the "'888 File

History") (Ex. 1006);

- The File History of U.S. Patent No. RE43,931 (the "'931 File History") (Ex. 1007);
- U.S. Patent No. 6,424,830 ("O'Hagan") (Ex. 1008);
- E.U. Patent No. EP0499012 ("Yaniv") (Ex. 1009);
- U.S. Patent No. 5,615,384 ("Allard") (Ex. 1010);
- U.S. Patent No. 5,889,236 ("Gillespie") (Ex. 1011);
- U.S. Patent No. 4,566,001 ("Moore") (Ex. 1012);
- U.S. Patent No. 5,621,437 ("Jeong") (Ex. 1013);
- "Transducer", Dictionary.com Unabridged, Random House, Inc., 2015, Dictionary.com, http://dictionary. reference.com/browse/ transducer (Ex. 1014);
- "Elongate," American Heritage® Dictionary of the English Language, Fifth Edition, 2011, Houghton Mifflin Harcourt Publishing Company, http://www.thefreedictionary.com/ elongate (Ex. 1015);
- Horowitz, Paul and Winfield Hill, The Art of Electronics, Cambridge University Press, 2nd Edition, 1989 ("Horowitz") (Ex. 1016);
- U.S. Patent No. 3,382,588 ("Kling") (Ex. 1017);

- U.S. Patent No. 3,696,409 (“Braaten”) (Ex. 1018);
- U.S. Patent No. 4,972,496 (“Sklarew”) (Ex. 1019);
- Ha, Peter, “ALL-TIME 100 Gadgets: BellSouth Simon,” Time Magazine, Oct. 25, 2010 (“Ha - Simon”) (Ex. 1020);
- O’Malley, “Simonizing the PDA,” Byte Magazine, pp. 145-148, Dec. 1994 (“O’Malley”) (Ex. 1021);
- U.S. Patent No. 4,550,221 (“Mabusth”) (Ex. 1022);
- U.S. Patent No. 6,037,930 (“Wolfe”) (Ex. 1023);
- U.S. Patent No. 5,856,822 (“Du”) (Ex. 1024);
- U.S. Patent No. 5,543,588 (“Bisset - 588”) (Ex. 1025);
- Buxton, W. & Myers, B., A study in two-handed input, Proceedings of CHI '86, 1986 (“Buxton”) (Ex. 1026);
- U.S. Patent No. 5,825,352 (“Bisset - 352”) (Ex. 1027);
- U.S. Patent No. 5,943,052 (“Allen”) (Ex. 1028);
- U.S. Patent No. 6,009,338 (“Iwata”) (Ex. 1029);
- U.S. Patent No. 5,923,861 (“Bertram”) (Ex. 1030);
- U.S. Patent No. 5,663,748 (“Huffman”) (Ex. 1031);
- U.S. Patent No. 5,745,116 (“Pisutha”) (Ex. 1032);
- U.S. Patent No. 6,363,259 (“Larsen”) (Ex. 1033);
- Newton Apple MessagePad Handbook, Apple Computer, Inc.,

1995 (“Newton”) (Ex. 1034);

- Nokia Annual Report – 1996 (“Nokia Report”) (Ex. 1035);
- U.S. Patent No. 5,748,185 (“Stephan”) (Ex. 1036);
- U.S. Patent No. 5,710,844 (“Capps”) (Ex. 1037);
- U.S. Patent No. 5,936,615 (“Waters”) (Ex. 1043);
- Operating System Reference Manual for the Lisa, Apple Computer, Inc., 1983 (“Lisa Manual”) (Ex. 1044);
- Microsoft Word DOS Preview Demonstration Version, 5.25” Diskette, 1983 (“Microsoft Word”) (Ex. 1045);
- “Apple Introduces Macintosh Advanced Personal Computer, First Macintosh Press Release, January 24, 1984, http://web.stanford.edu/dept/SUL/library/mac/primary/pr1.html (“Macintosh Press Release”) (Ex. 1046);
- U.S. Patent No. 6,037,930 (“Wolfe”) (Ex. 1047);
- U.S. Patent No. 4,220,815 (“Gibson”) (Ex. 1048);
- U.S. Patent No. 4,198,539 (“Pepper”) (Ex. 1049);
- U.S. Patent No. 5,451,723 (“Huang”) (Ex. 1050);
- U.S. Patent No. 4,972,496 (“Sklarew”) (Ex. 1051);
- European Patent No. EP0239705 (“Carroll”) (Ex. 1052);
- Edwards, Cliff, “Evolution of Touch: How We Control

Technology", Bloomberg.com, March 6, 2012 ("Edwards") (Ex. 1053);

- HP-150 Touchscreen Personal Computer with HP 9121 Dual Drives, 1983, http://www.hp.com ("HP 150") (Ex. 1054);
- Linus Write-Top/TRW Write-Top, http://oldcomputers.net/linus.html ("Linus") (Ex. 1055);
- "IBM remains committed to pen-enhanced notebooks", PenLab Review: IBM ThinkPad 360PE, http://pencomputing.com/old_pcm_website/PCM_6/review_thinkpad_360pe.html, 1995 ("ThinkPad 360PE – Review") (Ex. 1056);
- Ha, Peter, "All-Time 100 Gadgets: Palm Pilot 1000", Time, October 25, 2010, http://content.time.com ("Ha – Palm Pilot") (Ex. 1057);
- Lemmons, Phil, "Product Description: The Gavilan Mobile Computer", BYTE, McGraw-Hill, June 1983 ("Lemmons") (Ex. 1058);
- PowerBook User's Guide, Apple Computer, Inc., 1994 ("Power Book User's Guide") (Ex. 1059);
- Macintosh PowerBook 540: Technical Specifications,

http://support.apple.com/kb/SP162 (“PowerBook 540 Specifications”) (Ex. 1060);

- IBM Thinkpad 360PE-2620 Touch Flip Screen: 20 years old, http://www.ebay.com/itm/IBM-THINKPAD-360PE-2620-TOUCH-Flip-Screen-20-years-old-/181604157715 (“Thinkpad 360PE – Ebay”) (Ex. 1061);
- Programmed Data Processor-1 Manual, Digital Equipment Corporation, 1961, (“PDP-1) (Ex. 1062);
- PDP-1 XD116.79, Computer History Museum, http://www.computerhistory.org/collections/catalog/XD116.79A (“PDP-1 Artifact”) (Ex. 1063);
- “Meet the Family”, Digital’s Video Terminals-VT100.net, http://www.vt100.net/vt_history (“VT100”) (Ex. 1064);
- Digital Equipment Corporation: Nineteen Fifty-Seven to the Present, 1972-1978 (“DEC – 1957 to Present”) (Ex. 1065);
- Apple II Personal Computer, Smithsonian National Museum of American History: Kenneth E. Behring Center, http://americanhistory.si.edu/collections/search/object/nmah_334638 (“Apple II”) (Ex. 1066);
- IBM PCjr Personal Computer, Smithsonian National Museum of

American History: Kenneth E. Behring Center, http://americanhistory.si.edu/collections/search/object/nmah_905913 ("IBM PC") (Ex. 1067);

- Timeline of Computer History, Computer History Museum, http://www.computerhistory.org/timeline/?category=cmptr ("Computer History Timeline") (Ex. 1068);
- U.S. Patent No. 5,920,310 ("Faggin") (Ex. 1069);
- The Mouse, Computer History Museum, http://www.computerhistory.org/revolution/input-output/14/350 ("The Mouse") (Ex. 1070);
- Microsoft Word for Windows Version 1.1a Source Code, Computer History Museum, http://www.computerhistory.org/atchm/microsoft-word-for-windows-1-1a-source-code/ ("Microsoft Word History") (Ex. 1071);
- A history of Windows: 1982-1985: Introducing Windows 1.0, Microsoft, https://windows.microsoft.com/en-us/windows/history ("Microsoft Windows History") (Ex. 1072);
- U.S. Patent No. 3,482,241 ("Johnson") (Ex. 1073);
- Lee, S.K., W. Buxton, K.C. Smith, "A Multi-Touch Three Dimensional Touch-Sensitive Tablet", CHI '85 Proceedings, April

1985. (“Lee”) (Ex. 1074);

- Sears, Andrew, Catherine Plaisant, Ben Shneiderman, “A new era for touchscreen applications: High precision, dragging icons, and refined feedback”, Human-Computer Interaction Laboratory, University of Maryland, June 1990 (“Sears”) (Ex. 1075);
- Plaisant, Catherine, Andrew Sears, “Touchscreen interfaces for flexible alphanumeric data entry”, Human-Computer Interaction Laboratory, University of Maryland, September 1991 (“Plaisant”) (Ex. 1076);
- GUIFX: Touch Screens that Changed the World, http://blog.guifx.com/2010/01/27/touchscreens-that-changed-the -world (“GUIFX”) (Ex. 1077);
- Bitzer, D.L., D. Skaperdas, Plato IV – An Economically Viable Large Scale Computer-Based Education System, University of Illinois (“Bitzer”) (Ex. 1078);
- Cullen, Ann, “Getting Started With Your EO Personal Communicator”, EO Publications, AT&T, 1992 (“Cullen”) (Ex. 1079);
- MacWorld Magazine Cover, International Data Group, September 1993 (“1993 Macworld”) (Ex. 1080);

- U.S. Patent No. 5,526,422 ("Keen") (Ex. 1081);
- European Patent No. EP0473465 ("Harte") (Ex. 1082);
- U.S. Patent No. 5,179,724 ("Lindoff") (Ex. 1083);
- U.S. Patent No. 5,293,639 ("Wilson") (Ex. 1084);
- U.S. Patent No. 5,276,917 ("Lindoff") (Ex. 1085);
- Razavi, Behzad, "RF Transmitter Architectures and Circuits," IEEE, 1999 ("Razavi") (Ex. 1086);
- U.S. Patent No. 5,892,475 ("Palatsi") (Ex. 1087);
- European Patent No. EP0721272A2 ("Tiilikainen") (Ex. 1088);
- U.S. Patent No. 8,812,059 ("'059 patent") (Ex. 1089); and
- U.S. Application 14/459,536 ("'536 application") (Ex. 1090).

IV. SUMMARY OF MY OPINIONS

22. My opinions expressed herein are in support of the *inter partes* review of the ''931 Patent claims 1-12, and 15.

23. It is my opinion that:

a. Claims 1-11, and 15 are invalid under 35 U.S.C. § 103(a) as being obvious over Palatsi in view of Moore; and

b. Claim 12 is invalid under 35 U.S.C. § 103(a) as being obvious over Palatsi in view of Moore and Tiilikainen.

V. LEGAL STANDARDS APPLIED

24. In preparing and expressing my opinions and considering the subject matter of the ’931 patent, I am relying on certain basic legal principles that counsel have explained to me. I understand that a claim is invalid if it is anticipated under 35 U.S.C. § 102 or obvious under 35 U.S.C. § 103. These principles are discussed below.

A. Anticipation

25. I have been informed by counsel that a patent claim is invalid as anticipated if each element of that claim is present either explicitly or inherently in a single prior art reference. I have also been informed that for a claim element to be inherently present in a prior art reference, the claim element must be “necessarily present” in the disclosed apparatus, system, product, or method, and not probably or possibly present. In other words, the mere fact that the apparatus, system, product, or method described in the prior art reference might possibly (or sometimes) practice or contain a claimed limitation is insufficient to establish that the reference inherently discloses the limitation. I understand it is acceptable to examine evidence outside the prior art reference (extrinsic evidence) in determining whether a feature, while not expressly discussed in the reference, is necessarily present in it. In determining whether or not every one of the elements of the claimed invention is found in the item of prior art, I understand one should

take into account what a person of ordinary skill in the art (POSITA) would have understood from his examination of the particular item of prior art.

26. I have been informed that there are several ways in which a patent claim can be invalid under 35 U.S.C. § 102. First, I have been informed that a patent claim is invalid under 35 U.S.C. § 102(a)[1] if the invention defined by the patent claim was known or used by others in the United States, or patented or described in a printed publication authored by others, such as a journal, magazine article, or newspaper, anywhere in the world before applicant's invention date.

27. Second, I have been informed that a patent claim is invalid under 35 U.S.C. § 102(b) if an invention reflected in a patent claim was patented or described in a printed publication anywhere in the world or was in public use or on sale in the United States more than one year before the effective filing date of the patent claim in the United States.

28. Third, I have been informed that the patent claim at issue is invalid under 35 U.S.C. § 102(e) if the invention defined by the claim was disclosed in a patent by another inventor that was filed in the United States before the applicant's invention date.

[1] I understand that all citations to the Patent Act are to the version of the Patent Act applicable to the '931 Patent.

29. I have been informed that each of the above-described types of 35 U.S.C. § 102 prior art can individually be a basis for invalidating a patent, or these references can be combined to show a patent is invalid under 35 U.S.C. § 103(a).

30. I have been informed that unless the patent owner comes forward with evidence proving that it is entitled to an earlier priority date for a patent claim, the date of the invention for that patent claim for purposes of Sections 102(a) and (e) is the filing date of the patent. I have been informed that to establish a priority date earlier than the filing date, the patentee must show (i) an earlier reduction to practice of the invention, or (ii) an earlier date of conception followed by a diligent attempt to reduce the invention to practice.

31. I have been informed that for a document to constitute a "printed publication" under 35 U.S.C. § 102 and thus potentially qualify as prior art, that document must be reasonably accessible to that portion of the public most likely to use it. The date that a printed publication becomes available to the public is the date that it becomes prior art. I have been informed that any printed publication that was published more than one year before the application for the patent was filed will constitute prior art regardless of the alleged date of invention.

32. I have also been informed that a prior art reference must only be shown to perform or disclose the steps of a method claim to anticipate that claim.

33. I understand that the test for anticipation is essentially identical to the

test for literal infringement, leading to the use of the phrase "that which infringes if later anticipates if earlier." In other words, if granting patent protection on the disputed claim would allow the patentee to exclude the public from practicing the prior art, then that claim is anticipated. I have been further informed that it is improper to read limitations into the claims that are not there in order to prevent an anticipation – if the claims are broad enough to read onto the prior art, courts will find them anticipated.

B. Obviousness

34. I further understand that a claim is invalid for obviousness if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention was made (or, in some cases, at the statutory "critical date" of the patent claim) to a POSITA to which the subject matter pertains.[2] In deciding this question I understand it is relevant whether a POSITA would have been motivated to

[2] I understand that the statutory "critical date" is one year before the effective filing date of a patent claim, and thus I understand that the "critical date" may be used for the obviousness determination where a reference or references relied on were published more than one year before the earliest effective filing date of the subject patent claim.

combine or modify the prior art to achieve the claimed invention and whether there would have been a reasonable expectation of success.

35. I understand that an obviousness evaluation can be based on more than one item of prior art. I have also been informed that the analysis of obviousness generally requires consideration of the following four factual inquiries (although not necessarily in the listed order): (i) the scope and content of the prior art, (ii) the differences between the prior art and the claim, (iii) the level of ordinary skill in the pertinent art at the time of the invention, and (iv) the existence of any objective factors (also referred to as secondary considerations) indicating obviousness or non-obviousness that may be present in any particular case, such as commercial success, long-felt but unresolved needs, failure of others, and so on.

36. I understand that to be part of the "scope and content of the prior art" for purposes of an obviousness determination, in addition to qualifying as prior art under Section 102 discussed above, the referenced prior art must be "analogous" prior art. I understand a reference constitutes analogous prior art if it is within the same field as the inventor's endeavor. I also understand that even though a prior art reference may be in a different field from that of the inventor's endeavor, the reference may still be used as an obvious reference if it is "reasonably pertinent" to the particular problem with which the inventor was involved. I understand a reference is reasonably pertinent if it is one which, because of the matter with

which it deals, logically would have commended itself to an inventor's attention in considering his problem.

37. I have been informed that, in seeking to determine whether an invention that is a combination of known elements would have been obvious to a POSITA at the time of the invention, one must consider the references in their entirety to ascertain whether the disclosures in those references render the combination obvious to such a person.

38. I also understand that the historical framework applicable for assessing obviousness was whether there was a teaching, suggestion, or motivation either explicitly or implicitly in the prior art to combine the teachings of the reference. I have been informed, however, that although the claimed subject matter can still be found obvious when that test is satisfied, the obviousness inquiry is actually broader and more flexible than that. One need not identify such teachings, suggestion, or motivation explicitly in the prior art. Instead, one can take into account the inferences, creative steps, common knowledge, and common sense that a POSITA would employ.

39. I further understand that an obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references also may be supplied by the direction of the marketplace.

40. I have been informed that, if a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. Stated differently, I understand that the proper question is whether one of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to combining the teachings of the prior art.

41. I understand that a particular combination may be proven obvious merely by showing that it was "obvious to try" the combination. For example, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp because the result is likely the product not of innovation but of ordinary skill and common sense.

42. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. Thus, where all of the elements of a claim are used in substantially the same manner, in devices in the same field of endeavor, the claim is likely obvious. Additionally, I understand that a patent is likely to be invalid for obviousness if a person of ordinary skill can implement a predictable variation or if

there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. Therefore, when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one.

43. I further understand that a claim can be obvious in light of a single reference without the need to combine references if the elements of the claim that are not found explicitly or inherently in the reference can be supplied by the teachings of multiple embodiments disclosed in the reference, or by the common sense of one of skill in the art. I further understand that combining embodiments related to each other in a single prior art reference would not ordinarily require a leap of inventiveness.

44. I have also been informed that certain objective factors, sometimes referred to as "secondary considerations," must also be taken into account in determining whether a claimed invention would have been obvious. I understand that secondary considerations such as commercial success, a long felt but unmet need in the prior art that was satisfied by the invention of the patent, and failures of others may be evidence of non-obviousness. I also understand that there must be a connection or "nexus" between any such secondary considerations and the claimed invention if the evidence is to be given any weight in the obviousness analysis.

45. I further understand that contemporaneous and independent invention

by others is a secondary consideration supporting an obviousness determination. I also understand that a strong case of obviousness can overcome evidence of secondary considerations of non-obviousness.

46. I have been informed that a POSITA (or "POSA") is one who is presumed to have had full knowledge of the relevant prior art at the time of invention and is presumed to think along the lines of conventional wisdom in the art. I understand that the person of ordinary skill is not an automaton, and may be able to fit together the teachings of multiple prior art references employing ordinary creativity and the common sense that familiar items may have obvious uses beyond their primary purposes. In many cases, a person of ordinary skill will be able to fit the teachings of multiple prior art references together like the pieces of a puzzle.

47. I understand that the hypothetical person of ordinary skill is a person of ordinary skill at the time of the alleged invention I have been informed that that several factors may help determine the level of skill in the art, such as types of problems encountered in the art, prior art solutions to those problems, the sophistication of the technology involved, and the education level of active workers in the field. I understand the hypothetical POSA to which the claimed subject matter pertains would, of necessity have the capability of understanding the scientific and engineering principles applicable to the pertinent art. This standard

prevents one from using his or her own insight or hindsight in deciding whether a claim is obvious.

48. I am informed that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. Similarly, if the claimed invention is a predictable variation from the prior art that a POSA can implement, then I understand the invention is unpatentable as obvious. For example, if a technique has been used to improve one device, and a POSITA would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

49. I am informed that it is often be necessary for one addressing the obviousness of a claim to look at interrelated teachings of multiple patents, references, and prior art products; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a POSA, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

50. In determining whether the subject matter of a patent claim is obvious, I understand neither the particular motivation nor the avowed purpose of the patentee controls; if the claim extends to what is obvious, it is invalid. One of the

ways in which a patent's subject matter can be shown to be obvious is by noting that there existed a known problem for which there was an obvious solution encompassed by the patent's claims.

C. Claim Interpretation in *Inter Partes* Review

51. I understand that the first step in determining the validity of an asserted claim is for the claim to be properly construed.

52. I understand that the Patent Trial and Appeal Board ("PTAB") has not yet construed the terms, and I reserve the right to supplement this Declaration based on alternative constructions proposed by the Patent Owner and the constructions adopted by PTAB to the extent that these constructions differ from those proposed by TCL. I understand that in proceedings before the PTAB, patent claims are to be given their broadest reasonable construction, consistent with the teachings of the specification and file history.

53. For purposes of this IPR, I understand that each challenged claim must be given "its broadest reasonable construction in light of the specification." I am informed that broadest reasonable construction standard dictates that claim terms be given their ordinary and customary meaning, as would be understood by a POSITA in the context of the entire disclosure. I understand a patentee can be his own lexicographer, however, I understand that any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness,

and precision.

54. I understand that TCL has proposed certain claim constructions based on the specification, the prosecution file history, and the meaning ascribed by a POSITA, and I agree with those constructions. For purposes of this Declaration, I have explained constructions for certain claim terms, consistent with how those terms would be understood by a POSITA under a broadest reasonable construction in view of the specification. For the remaining terms, I have applied their ordinary and customary meaning.

55. I provide my opinions in this report based on the guidelines set forth above.

VI. THE PERSON OF ORDINARY SKILL IN THE ART

56. I understand that the hypothetical person of ordinary skill is presumed to have knowledge of all references that are sufficiently related to one another and to the pertinent art, and to have knowledge of all arts reasonably pertinent to the particular problem that the claimed invention addresses.

57. I also understand that a person of ordinary skill is also a person of ordinary creativity, not an automaton. A person of ordinary skill, while not someone who undertakes to innovate, is capable of drawing inferences and taking creative steps. I understand that the hypothetical person of ordinary skill is a person of ordinary skill at the time of the alleged invention.

58. In my opinion, a POSITA with respect to the ’931 Patent would have had a bachelor’s degree in computer engineering, electrical engineering, or computer science, and two years of experience with touch-based user input systems or equivalent education and experience on December 30, 1997, the date that the parent application to the ’931 Patent was filed. Such a person would be capable of reading and understanding the ’931 Patent disclosure and practicing the claimed invention. I was a person of at least ordinary skill as of December 30, 1997 and had supervised other persons of ordinary skill at that time.

VII. TECHNOLOGY BACKGROUND

A. User Interface Technology

59. Users have always had a need to interact with computing systems in order to provide input data and to view output results. In the earliest electronic computers, input was provided by connecting wires on programming cards and output was provided on rows of light bulbs. (Ex. 1068, Computer History Timeline.) By the 1950s, perforated punched paper cards, commonly referred to as “punch cards,” were used for input and output and printers had been developed to provide easily readable results. (*Id.*) As computers became more interactive in the late 1950s and early 1960s, the teletype terminal which included a typewriter-style keyboard and printer became common. (*Id.*)

60. The teletype was noisy and had to be regularly supplied with paper. In

the 1960s, a new type of user interface console, the video display terminal (VDT), was demonstrated together with the Digital Equipment PDP-1. (Ex. 1062, PDP-1.) The VDT used a television-like display for output. (*See* Ex. 1062, PDP-1; *see* also Ex. 1063, PDP-1 Artifact.)

(Ex. 1063, PDP-1 Artifact.)

61. By 1970, video display terminals were common. (*See* Ex. 1064, VT100; *see* also Ex. 1065, DEC – 1957 to Present.)

(Ex. 1064, VT100.)

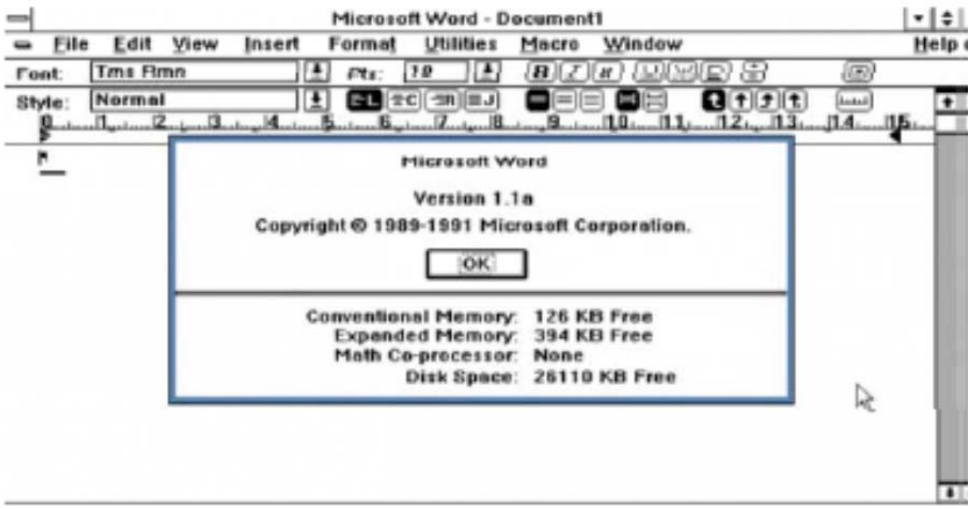
62. In 1977, the Apple II computer included an integrated keyboard and video display controller that could produce both text and graphics on a television or video monitor. (Ex. 1066, Apple II.) Individuals would use these more integrated computer systems to produce personal documents using word-processing software and to create and interact with spreadsheets and databases. (*Id.*) The IBM PC followed in 1983. (Ex. 1067, IBM PC.) While both computers could support both text-based and graphical applications, office tasks were most commonly text based at the time while graphics were used mostly for games and educational software.

63. In this early text-based environment, it was most common to use "cursor keys" such as up and down arrow keys and page-up or page-down keys to scroll through documents or to move a selector around on the display. Sometimes these were special key combinations or sequences that user would learn and

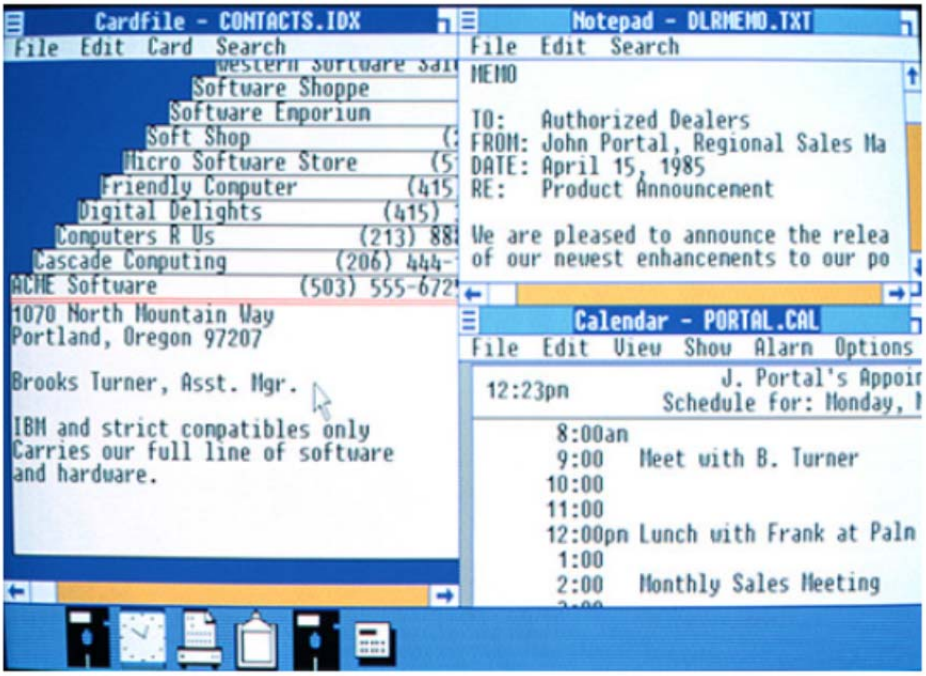
sometimes they were dedicated keys on the keyboard. (Ex. 1047, Wolfe, at 1:22-41.) Other types of cursor control or content selection devices were known including touchscreens, touchpads, trackballs, dial boxes, the computer mouse, digitizer tablets, and the joystick. (*Id.*, at 1:41-2:40; *see* also Ex. 1070, The Mouse.) Other than the joystick, these were mostly used for specialized systems prior to 1983, rather than for general office or home computing activities.

64. In 1983, Apple launched the Lisa computer, a general-purpose office computer with a graphics-based user interface (GUI) controlled by a computer mouse. (*See* Ex. 1044, Lisa Manual.) In late 1983, Microsoft launched a computer mouse for IBM-compatible PCs along with a graphical version of Microsoft Word. (Ex. 1067, IBM PC; Ex. 1071, Microsoft Word History.) In 1984, Apple launched a home version of its GUI/mouse-based computing platform, the Macintosh. (Ex. 1046, Macintosh Press Release.) All of these systems shared common characteristics. (*Id.*; Ex. 1044; Ex. 1066; Ex. 1067.) Both individual documents and user controls such as menus or lists of files were presented on the display in a graphics mode. (Ex. 1046; Ex. 1072, Microsoft Windows History.) Text was drawn using one of several selected fonts and presented in windows which had borders drawn with lines. (*Id.*) Various on-screen controls were provided to allow interactions. These included a menu bar that would allow various drop-down menus to be selected. (*Id.*) It also included horizontal and vertical "scroll bars" at

the edge of document windows when the entire document would not fit on the screen. (*Id.*) A user could use the mouse to select and interact with these controls. For example, the mouse could be used to drag a locator control within the vertical scroll bar up and down to scroll the document up and down in proportion to the user's movement. (*Id.*)



(Ex. 1071, Microsoft Word History.)



(Ex. 1072, Microsoft Windows History.)

65. This form of graphical user interface became a common form of interaction with computer over the next 30 years. In addition to the desktop form factor, computer systems using a GUI and a cursor controller were used in laptops, tablets, personal organizers, and screen-based phones. Cursor control devices such as touchscreens and touchpads were often used in the smaller devices. (Ex. 1076, at 2.)

B. Touch Sensing Technology

66. The technology behind touch sensing, used for touchscreens and touchpads, dates back at least to the 1960s. (See Ex. 1072, Johnson.) Numerous sensing technologies have been used and many variations and enhancements have been developed over the years. (Ex. 1047, Wolfe, at 1:22-41.) In addition,

innovations have been introduced in sensing circuitry, measurement and decision algorithms, and detection of motion and gestures. (*Id.*) The term "touchscreen" is often used when touch detection occurs on or near the surface of a display device, via an overlay sensor or a sensing device surrounding the display. The term "touchpad" is often used to describe touch detection devices, including touch detection devices that are positioned on a separate part of the display surface, away from the display surface, on another portion of the device housing, or in a separate housing. The technology for detecting and measuring touch is generally the same, allowing for the possibility that a touchpad may not be transparent. I will use the term "touchscreen" to refer to both technologies generally when there is no substantial distinction.

67. Many different types of technology have been used for touchscreens including technologies that measure light, sound, pressure, or various electrical phenomena. In general, touch sensing technologies fall into 3 general categories:

- A set of technologies that are generally referred to as "analog" technologies use light, sound, pressure, or an electrical property such as resistance or capacitance to measure the distance and/or direction from the touched location to a reference point, usually the edge of the touch surface. In general, this is done in both the X and Y axes so that a location within a rectangular area can be

determined, but in some applications only a single axis is measured.

- Another class of technologies, often called "beam," "matrix," or "row/column" sensors use a set of detection structures such as electrodes or light beams in each of the X and Y axes. These determine which of the detection structures is being activated along one or more axes to locate one or more touches. Separate signals can be generated corresponding to each row or column.
- The remaining common technologies use independent sensing zones. Sensing structures related to each zone determine if that zone is being touched. If the zones are arranged in a regular structure such as a 1-dimensional or 2-dimensional array, this is sometimes called an array-sensing technology or a pixel-sensing technology. Separate signals can be generated corresponding to each location.

68. Within each of these broad categories, there are many more variations depending on what physical phenomenon is being measured, how it is measured, how measurements are processed and converted to digital data, and what further processing is performed to filter, interpret, and/or report the resulting data. Each of these technologies has advantages and disadvantages when compared to others

including variations in cost, size, power, manufacturing complexity, reliability, sensitivity, transparency, speed, and accuracy. In the 1997 time period, common touch-sensing technologies included:

69. **Resistive sensor technologies:** These technologies use the electrical property called "resistance" to locate touch points on a touch sensor. (Ex. 1047, Wolfe, at 5:55-6:37; Ex. 1048, Gibson, at 1:15-30, 2:63-3:25, 4:42-65.) Resistance is an alternative way of expressing the property of conductance. (*Id.*) Resistive touch sensors were produced in analog, matrix, and pixel-array forms. One or more conductive/resistive layers were generally applied to two substrates each made of glass or plastic. (Ex. 1047, Wolfe, at 5:55-6:37; Ex. 1048, Gibson, at 1:15-30, 2:63-3:25, 4:42-65.) The substrates could be rigid sheets or flexible films and were separated by an insulator. (*Id.*) Both opaque conductors such as carbon films and transparent conductors such as Indium Tin Oxide (ITO), Tin Antimony Oxide (TAO), and gold were used in resistive sensors. (*Id.*) Since resistive touchscreens respond to physical pressure, they are generally operational when the screen is directly touched or when a flexible layer, such as a protective film or the fingertip of a glove, placed on top of the touchscreen is pressed. (*Id.*)

70. **Capacitive sensor technologies:** Capacitance is the ability of a body to store an electrical charge, and for the purpose of understanding touch sensor design, capacitance may be thought of as the ability to conduct alternating current

signals. Alternating current signals can travel through air, glass, plastic, or other normally insulating materials when capacitance is present. The human body provides a measurable amount of capacitance and thus can be detected in this manner. (Ex. 1027, Bisset 352, at 1:27-40.) Capacitive touch sensors were produced in analog, matrix, and pixel-array (zone capacitive) forms. (*Id.*; Ex. 1074, Lee, at 23-24; Ex. 1075, Sears, at 18-19.) Some designs used conductive electrodes placed on a single substrate while others used multiple substrates each containing conductive electrodes. (Ex. 1027, Bisset 352, at 1:27-40; Ex. 1074, Lee, at 23-24; Ex. 1075, Sears, at 18-19.) Capacitive touchscreens can be based on measurement of self-capacitance whereby a change in the capacitance between an electrode and ground is used to detect a touch. (*Id.*) A finger provides this type of capacitance. Other capacitive touchscreens are based on measurement of mutual capacitance whereby a change in the capacitance between one electrode and another is detected. (*Id.*) A finger provides this type of capacitance as well. Since capacitance can be detected through insulating materials including air, capacitive systems can measure the capacitance of a finger that is actually touching the sensor or that is simply in the proximity of the sensor. (*Id.*) In practice, some detection threshold must be established to determine how close a finger should be before the system considers it to be activating the sensor. (*Id.*)

71. **Light-beam technologies** are among the earliest touch technology

system to enjoy widespread use. Generally, these are called "infrared" touch sensors since they use infrared light beams to detect a touch. (Ex. 1052, Carroll, at 1:1-34, 3:45-7:4; Ex. 1075, Sears, at 21.) A well-publicized early educational software system from the University of Illinois called PLATO used infrared touchscreens in the 1970s. (Ex. 1053, Edwards.) Most infrared touchscreens use a matrix configuration where light emitters (infrared LEDs) are placed along the bottom and one side of the screen and infrared detectors (phototransistors or photodiodes) are placed along the top and other side. (Ex. 1052, at 1:1-34, 3:45-7:4.) The light emitters are pulsed to shine a light across the screen. (*Id.*) If a finger is present in between a light emitter and its corresponding detector, then the light beam is broken and a touch is detected in that row or column. (*Id.*) Because mechanical limitations generally require some distance between the touch surface and the light sensors (such as 0.25"), infrared touch sensors could generally detect a touch or a near touch. (*Id.*)

72. **Surface Acoustic Wave (SAW) technology** has also been used to produce commercial touchscreens since at least the late 1980s. (Ex. 1075, Sears, at 20-21.) SAW technology uses a piezoelectric transducer to create an ultrasonic pulse that travels along the surface of a glass plate or other smooth surface. (*Id*; Ex. 1050, Huang, at 3:42-5:34.) The ultrasonic pulse reflects off of a finger and produces a reflected sound back to the transducer. (*Id.*) The general principle is

similar to that used in a medical ultrasound machine. The distance from the transducer can be calculated from the time required for the pulse to be reflected. By using multiple transducers at, for example, the corners of the screen, the location of a touch can be determined.

73. **Image-based touch sensing** uses a camera, such as a video camera, to create a pixelated image of the touch surface. (Ex. 1043, Waters, at 1:42-2:12.)Various commonly known image processing techniques can then be used to detect and /or track a finger within this image. (*See Id.* at 2:29-4:46.)

C. Touchpads and Touchscreens

74. The development of touch sensitive devices has included both touchscreen sensors that overlay display and touchpad sensors that stand alone. (Ex. 1047, Wolfe, at 1:17-3:5.) The development and deployment of both technologies has been highly intertwined for decades. In both types of devices, the initial objective is to reliably and quickly detect the position of a finger (or a stylus that is acting in its stead) that is touching the device. (*Id.*) Once the position of the finger is detected, that position can be used to trigger an event or place a cursor. (*Id.*) Subsequent measurement can be used to detect and measure motion which can then be used to move a cursor, drag an object, or draw. (*Id.*) Various motions can also be interpreted as gestures in order to signal mode changes or trigger events. (*Id.*)

75. Touchscreens are generally partially or completely transparent in order that the underlying display can be viewed. Touchpads may be transparent or opaque. Touchscreens often use "absolute" positioning whereby the computer responds to touching a particular spot on the screen. (*Id.*) Touchpads often use "relative" positioning whereby, for example, the distance, speed, and direction of motion are used to move a cursor or other screen object. (*Id.*) However, both devices have been used in a wide variety of ways to control user interactions with content on a screen. Touchpads are also sometimes used without any on-screen feedback, for example as a volume control.

76. Despite these minor differences, touch systems basically all have the same structure. A sensor is used to generate a signal that corresponds to the location of the touch. (Ex. 1047, Wolfe, at 1:17-3:5.) A touch controller generally provides three functions; generating any stimulus or timing signals necessary to operate the sensor; measuring and conditioning the signal from the sensor to determine the presence of and location of a touch; and formatting the measurement data for use by another microprocessor or other software on the same microprocessor. (*Id.*) The same sensor and controller technologies can be used for both touchpads and touchscreens, although the form factor and the materials in the sensor may change based on size and placement. Both touchpads and touch sensors can designed to measure position and motion in one dimension (like a strip or bar

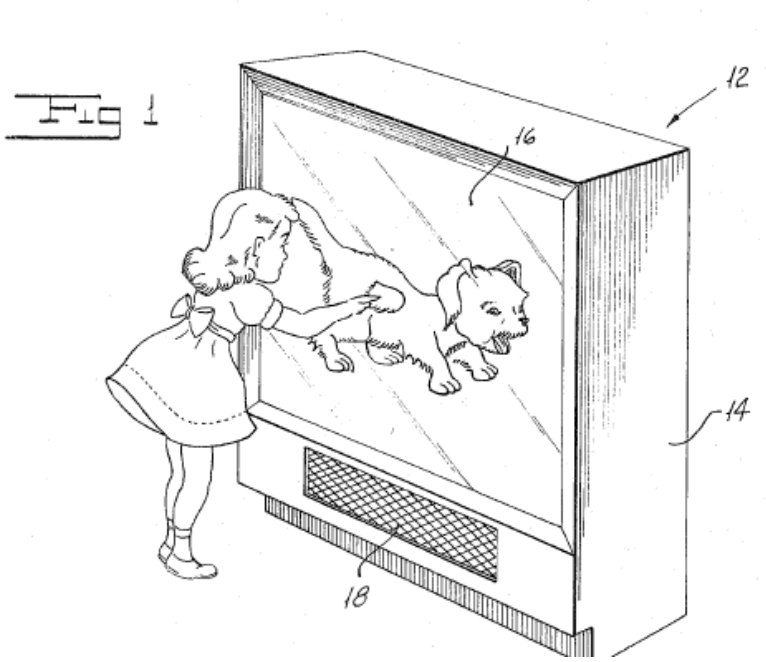
which might be ideal for a volume control) or in two dimensions (like a tablet computer). (*Id.*)

D. Exemplary Touchscreens

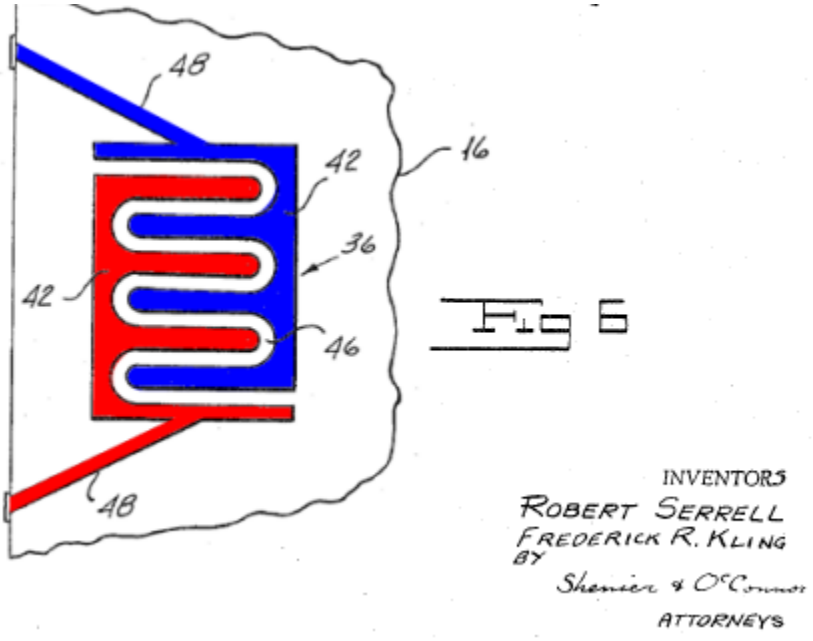
77. Touchscreens have been used for nearly 50 years as a way to provide simplified input for unsophisticated computer users or for more sophisticated users who are engaged in other tasks and need a simplified way to interact with a computer. This interaction between a user and a computer is called the "user interface." In its simplest form, the user desires the computer to respond in a particular way such as showing the next picture, moving some text, or accepting input to a form. The user touches a section of the screen or moves his finger in a particular direction on the screen to signal this desire to the computer and the computer responds.

78. For example, one of the earliest uses of touchscreens was to obtain input from children. For example, the figure shown below shows a transparent mutual capacitance touchscreen from U.S. Patent No. 3,382,588, filed in 1965. (Ex. 1017, Kling, Figs. 1, 6.) This patent was filed by Educational Testing Service ("ETS"), the company well known for administering the SAT exam. (*Id.*, at 1:4-6.) This touchscreen system used a slide projector and a tape recorder to present children with questions in a testing environment. (*Id.*, at 2:37-51, 5:16-6:10.) The device would record where the child touched the picture in response. (*Id.*) No

computer was even necessary. (*Id.*)

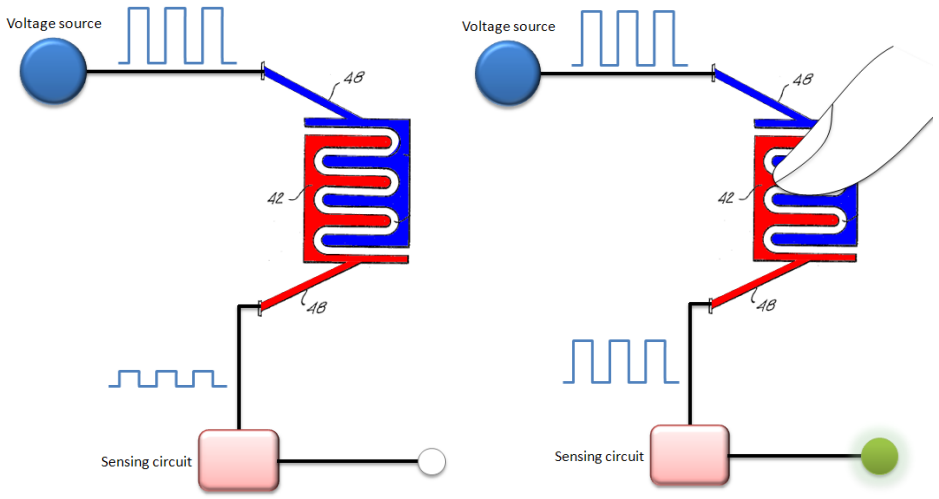


(Fig. 1 (Kling).)



(Annotated Fig. 6 (Kling).)

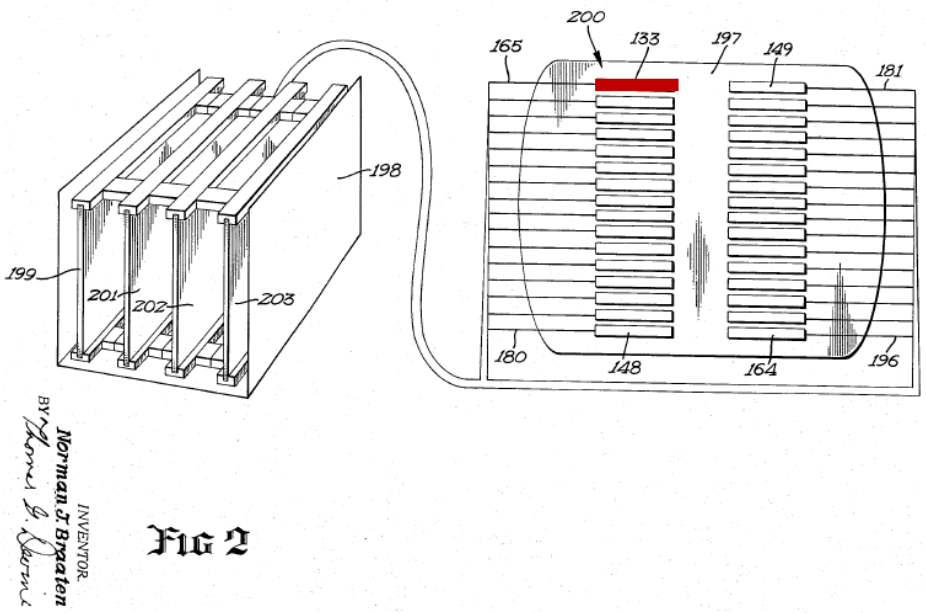
79. The touch-sensing surface used a mutual-capacitance system based on interdigitated, transparent electrodes. (*Id.*, at 3:1-4:25.) The portions of each sensing location that I have identified above in red and blue are separate electrodes. (*Id.*, at Fig. 6.) The blue electrode is driven, and the red electrode is sensed. (*Id.*, at 3:1-4:25.) When a finger approaches the electrodes, as illustrated in the modified reproductions of Fig. 6 below, the capacitance of the finger allows a signal to flow from the blue electrode to the red which can then be detected. (*Id.*)



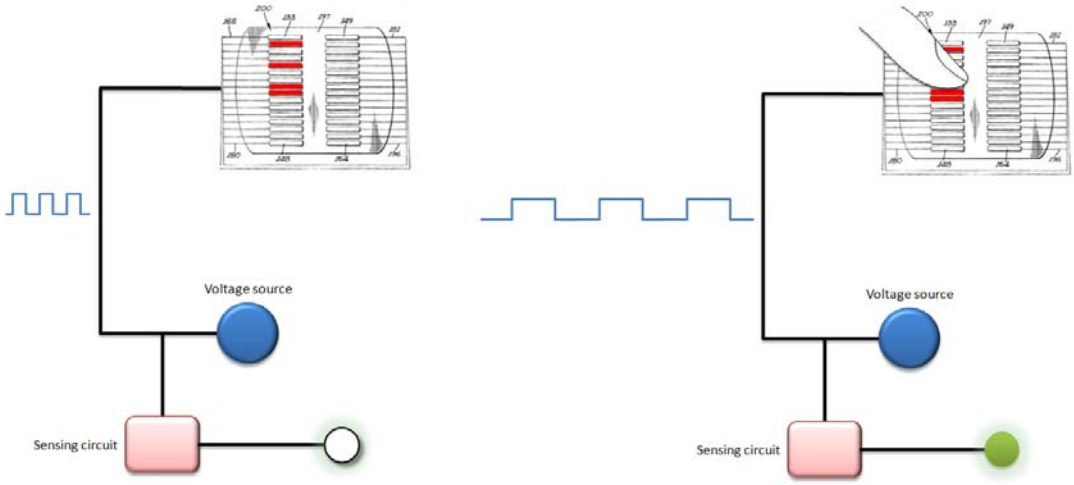
(Fig. 6 (Kling).)

80. Other capacitive touch systems used different circuitry with a higher density of measurement points to distinguish each line of text on a display. For example, the figure shown below depicts a self-capacitance touchscreen U.S. Patent No. 3,696,409, filed in 1970. (Ex. 1018, Braaten.) Each of the rectangles (e.g., 133, 149, 148, 164) is a separate electrode corresponding to one line of text

on either the left or right side. (*Id.*, at 3:28-49, Annotated Fig. 2.) I have added red color to one of the sensing electrodes depicted in the figure for purposes of illustration. When a finger approaches the touch screen near one of the rectangular sense electrodes, the capacitance to ground of that electrode (and possibly other nearby electrodes) changes. (*Id.*, at 6:31-11:22.)



(Annotated Fig. 2 (Braaten).) The information about which electrode(s) was touched is sent to a computer, which interprets the change in capacitance of the various electrodes to determine where in the X-Y plane of the touch screen a touch has occurred and the magnitude of that touch. (*Id.*) This operation is diagrammed schematically in my illustrations below.



81. As computers became capable of placing more detail on a display, the resolution and speed of touchscreens increased to keep pace. High-resolution infrared light-beam touch screens date back to at least 1972 when a touch-screen based computer terminal called Plato IV was introduced at the University of Illinois as an interactive educational computer. (Ex. 1053, Edwards.) Plato IV terminals were made available to educational researchers at several universities in the early 1970s. (Ex. 1078, Bitzer.) I first used a Plato IV touchscreen as a participant in such a study around 1974, sparking my own interest in touch-screen technology and my later involvement in the field. The Plato IV could detect approximately 1000 distinct touch locations. (*Id.*)

Plato IV touch terminal circa 1972. (Ex. 1077, GUIFX.)

82. HP introduced a touchscreen based PC for consumers using this type of infrared scanning touchscreen around 1983. (Ex. 1054, HP-150.)

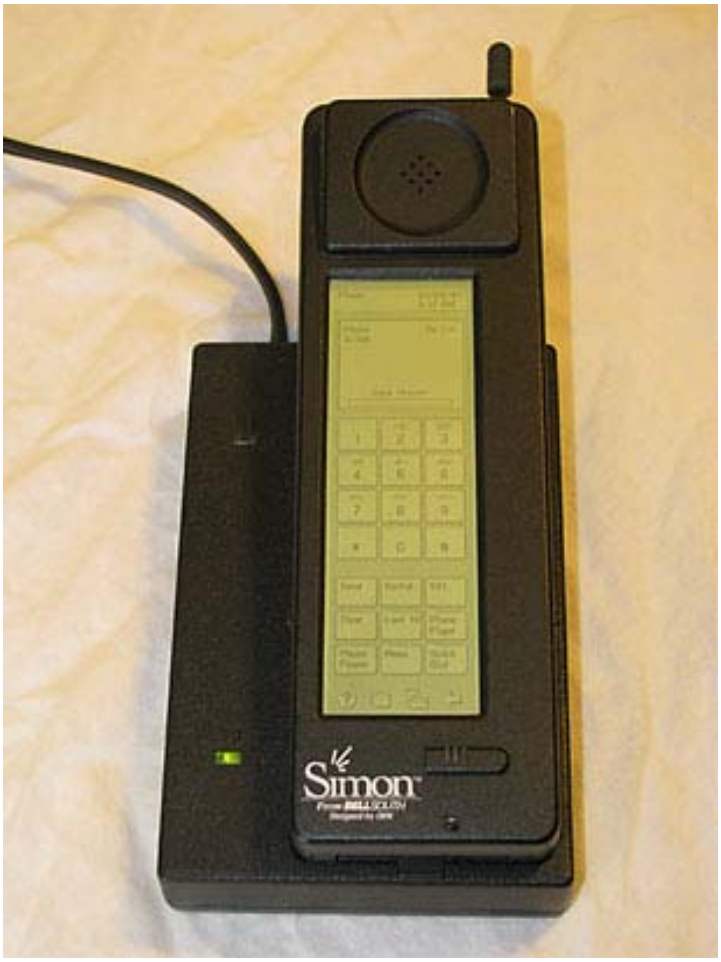
HP 150 Touchscreen PC circa 1983. (Ex. 1054, HP-150.)

83. In the 1980's this technology migrated to handheld devices and the speed and resolution was improved in order to be able to detect signatures and handwriting. For example, in 1985, I developed the sensor technology for what I believe to be the first commercial keyboardless tablet-style computer, the Linus Write-Top. While the commercial product used a pen-based input sensor that I developed, earlier versions of the product used a conventional touchscreen. Both embodiments are discussed in U.S. Patent 4,972,496, which is related to this device. (Ex. 1051, Sklarew.) The Linus Write-Top is illustrated below. The Linus Write-Top could resolve over 1 million distinct touch locations and measure

movement every 5-10ms. (*Id.*)

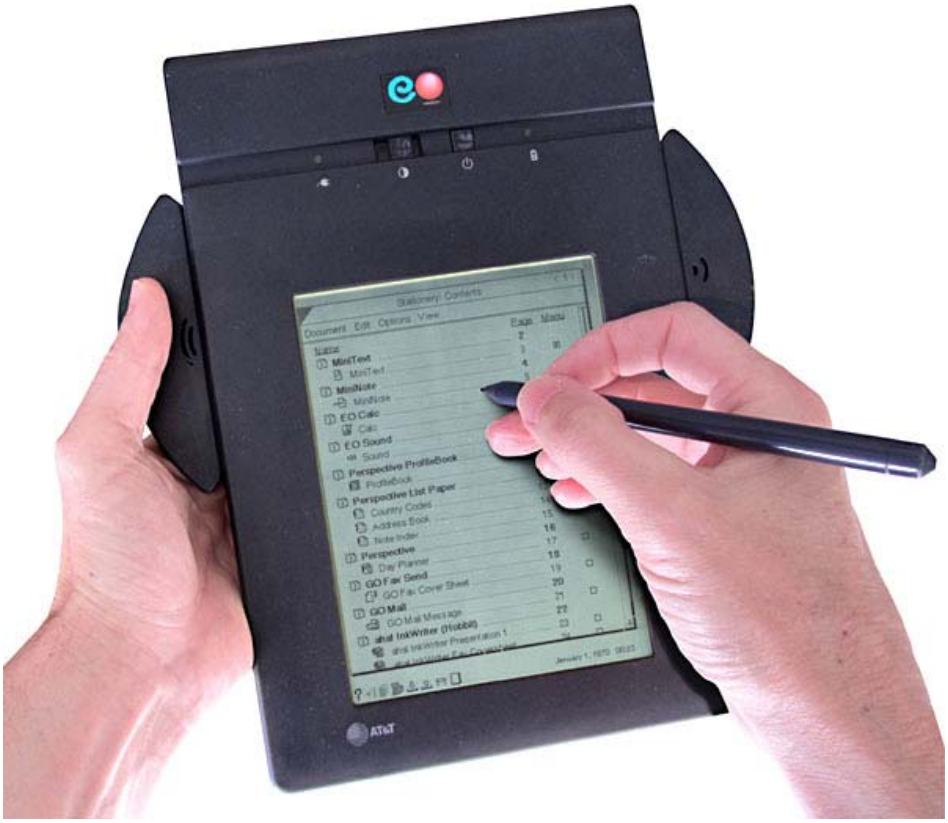
(Ex. 1055, Linus.)

84. Similar touchscreens were used in smaller devices as well. The IBM/BellSouth Simon mobile phone used a touchscreen over an LCD and was first shown in 1992. (*See* Ex. 1020, O'Malley; Ex. 1021, Ha - Simon.) I personally developed touchscreen prototypes for the IBM Simon. The Simon device is illustrated below.



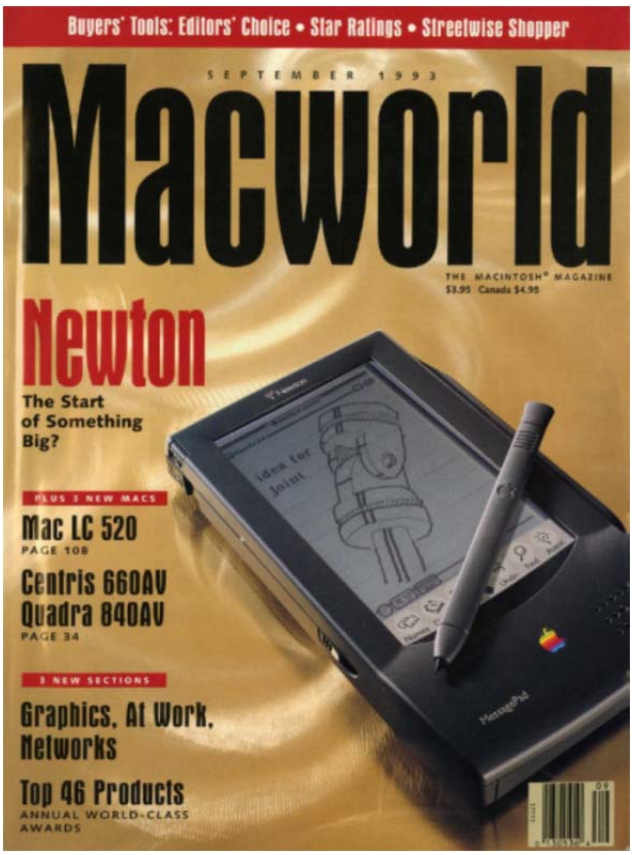
(Ex. 1021, Ha - Simon.)

85. In 1993, AT&T introduced the EO 440 and EO 880 tablet computers which included an optional cellular phone module. (Ex. 1081, Cullen.) These devices used the PenPoint operating system. (*Id.*, at 3, 29.) The EO was controlled though a tablet-style pen-sensitive display. (*Id.*, at 33-36.) By moving the pen on the screen in a particular direction (up, down, left, or right) as a gesture, the data presented in certain screens would scroll in response. (*Id.*) The EO 440 device is illustrated below.



86. The Apple Newton and the Pilot 1000 (later called the Palm Pilot) were also introduced in the early and mid-90s. (Ex. 1057, Ha – Palm Pilot; Ex. 1034, Newton.) These devices were personal organizers that also used touchscreens over an LCD display for user input and to control the user interface. (Ex. 1057, Ha – Palm Pilot; Ex. 1034, Newton.)

(Ex. 1057, Ha – Palm Pilot.)



(Ex. 1080, 1993 Macworld.)

87. U.S. Patent No. 5,710,844 to Capps discloses a touchscreen hand held device configured to selectively display content. (Ex. 1037, Capps.) Capps teaches using a touch screen portable device to selectively display and search through text, for example, by highlighting search results within the text while scrolling through multiple files or pages.

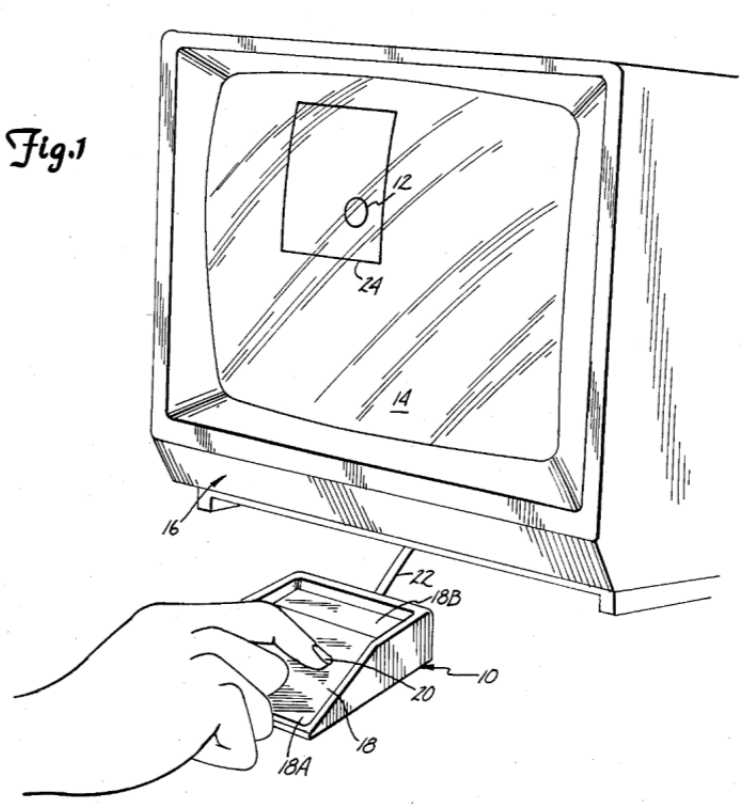
88. U.S. Patent No. 5,745,116 to Huffman discloses an electronic book with two housing structures, each with a touchscreen interface on a top surface. (Ex. 1031, Huffman, at 3:64-4:3, 4:25-67, Figs. 1, 2.) The two housing structures are coupled together such that they can be opened and closed like a book. (*Id.*) When open, the pages of the book are displayed and available for interaction on the touchscreen display(s). (*Id.*) Specifically, referring to Fig. 19 reproduced below Huffman discloses that "a portion of page or text" may be "selected by a user-initiated event of sliding his finger 212…from a first position 332 to a second position 334. Upon its selection, the portion 330 of the text is highlighted in a predetermined manner." (*Id.*, at 13:45-50.)

E. Exemplary Touchpads

89. The same basic technology that provided touchscreens in the 1980s and 1990s was used for touchpads as well. Touchpads were developed for use as stand-alone computer peripherals, integrated control devices within keyboards, and integrated control devices within mobile devices. Commercial interest in touchpads

increased in 1983 and 1984 with the introduction of the Microsoft Mouse and the Apple Macintosh. (Ex. 1068, Computer History Timeline.) Touchpads offered a more compact and at the time more reliable means of cursor control.

90. For example, U.S. Patent 4,550,221, filed in 1984, shows a touchpad peripheral in use with a computer system for controlling the position of objects on the computer display. (Ex. 1022, Mabusth.)



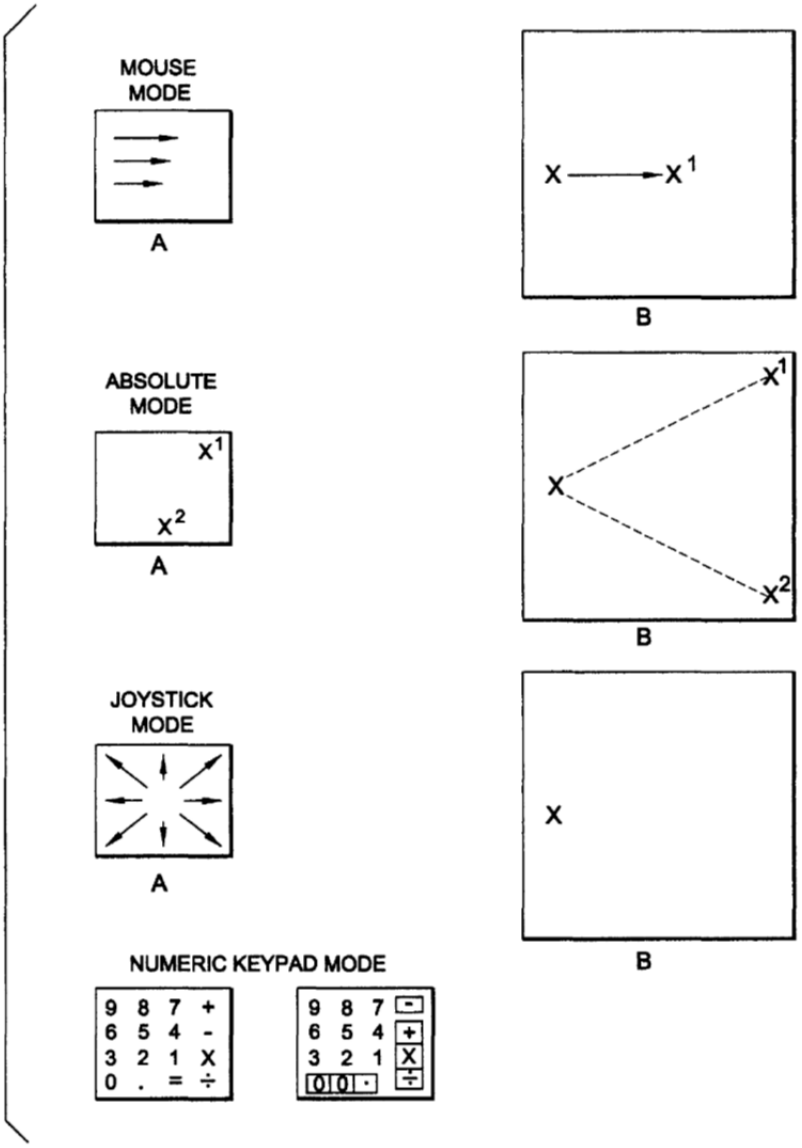
(Mabusth (Fig. 1).)

91. The Gavilan SC laptop computer, also introduced in 1983, included a touchpad controller and touch-sensitive buttons below the display screen for use in

controlling the cursor or otherwise providing directional control to computer programs. (Ex. 1058, Lemmons.)

(*Id.*)

92. One of my own patents, U.S. Patent 6,037,930, was filed on November 28, 1984. (Ex. 1047, Wolfe.) This patent disclosed a touchpad device which included a variety of control modes for cursor control. (*Id.*) This illustrated that the same raw data from the touch sensor could be used to provide a wide range of control signals to the computer.


MOUSE MODE
A
X
X 1
B
ABSOLUTE MODE
X 1
X 2
A
X 1
X
X 2
B
JOYSTICK MODE
A
X
B
NUMERIC KEYPAD MODE
9 8 7 +
6 5 4 -
3 2 1 X
0 . = ÷
9 8 7
6 5 4
3 2 1
0 0 .

(Fig. 1 (Wolfe).)

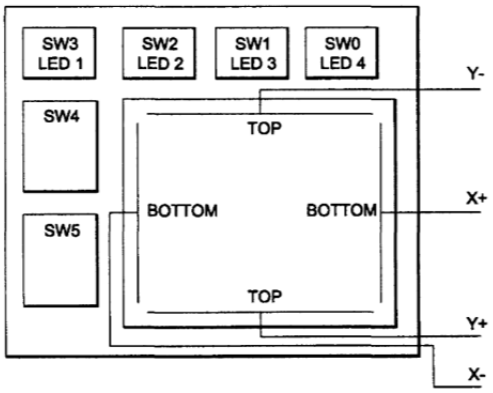


FIG. 3

(Fig. 3 (Wolfe).)

93. In 1993, U.S. Patent No. 5,889,236 to Gillespie disclosed a touch-sensitive input device with an array of touch sensitive strips for gesture-based control of user interfaces (i.e., scrolling, tapping, and double tapping selection features) in hand held devices. (Ex. 1011. at 26:25-41.)

94. Another patent, U.S. Patent 5,856,822, filed in 1995, describes a similar external touchpad device for controlling software. (Ex. 1024, Du.) Although the illustrated device is external to the computer, the patent specification clearly explains that integrating the touchpad into the main housing is an alternative design choice that makes sense for a portable device. (*Id.*, at 4:3-12.)

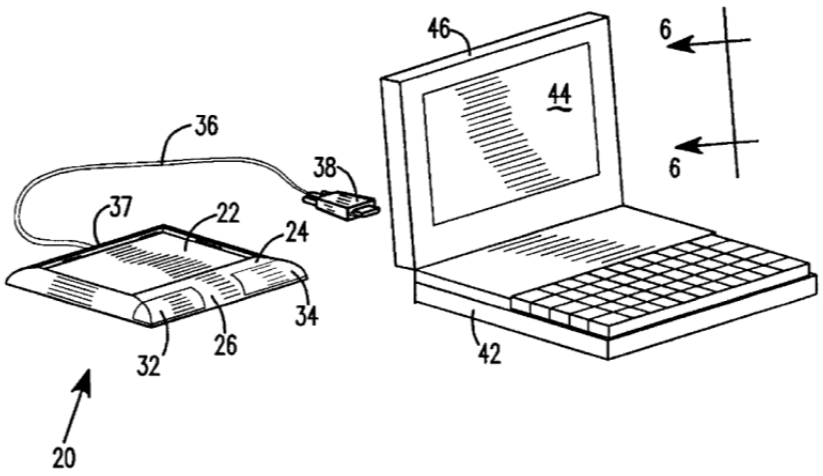


FIG. 1

(Fig. 1 (Du).)

95. U.S. Patent 5,543,588 filed in 1993 illustrates a touchpad placed on the back surface of a small, handheld device for cursor control. (Ex. 1025, Bisset - 588.) This small device had similar proportions to a modern smartphone. (*Id.*)

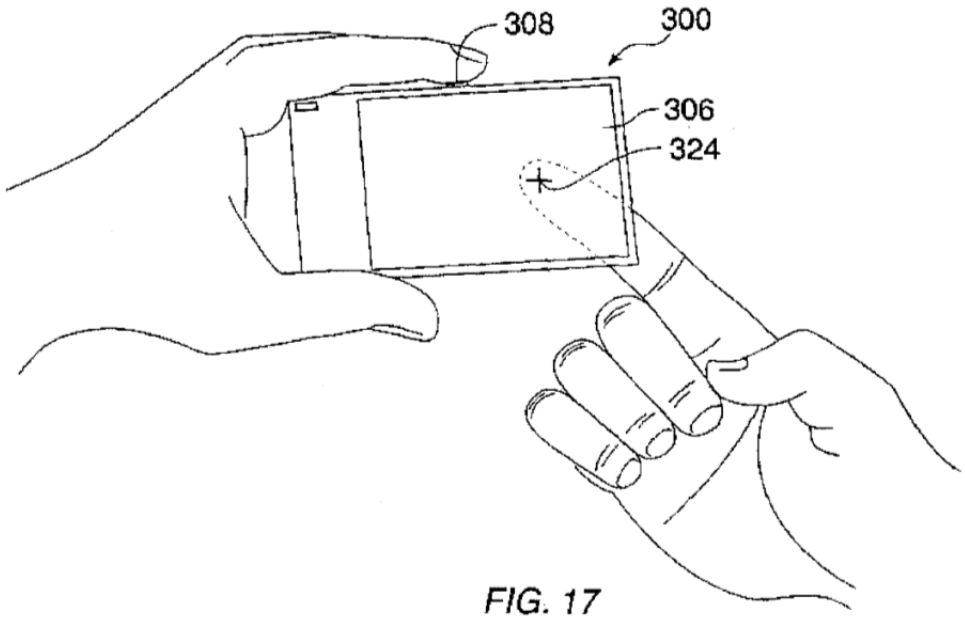


FIG. 17

(Fig. 17 (Bisset).)

96. While many touchpad devices, especially those that have cursor control as one of their functions, detect and report motion in two dimensions, there are also a number of applications where a one dimensional touchpad device makes more sense. In particular, a one-dimensional touchpad is well-suited to scrolling documents or lists. For example, a paper entitled “A STUDY IN TWO-HANDED INPUT” published in 1986 measured the efficiency of using a device with two one-dimensional touchpad strips where one of the strips was used for smooth scrolling of content. (Ex. 1026, Buxton.)This device is shown below.

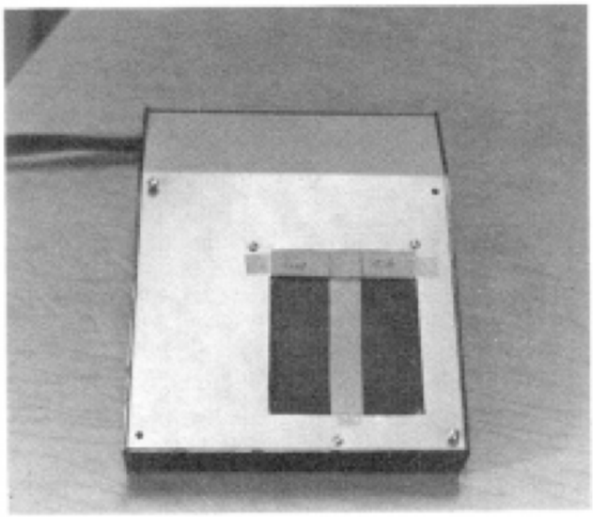


Figure 6: The Touch-Sensitive Tablet

The tablet surface is partitioned by a template into two virtual devices. The left one is a position-sensitive strip used to jump to specific locations in the document. The right one is a 1-D relative device used to smooth scroll the document in the window. See Buxton, Hill and Rowley (1985) for additional information on the use of touch-tablets.

(Fig. 6 (Buxton).)

97. Similarly, U.S. Patent 4,566,001 to Moore, filed in 1983, also teaches a one-dimensional touchpad strip for scrolling a screen-based telephony device. (Ex. 1012, Moore.)

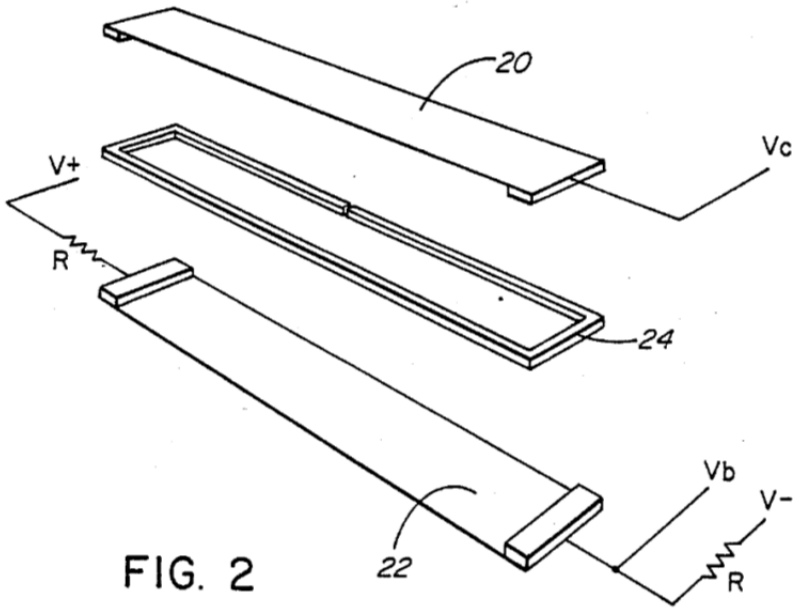


FIG. 2

(Fig. 2 (Moore).)

98. Similarly, U.S. Patent No. 5,748,185 to Stephan also discloses a touch pad device with multiple regions. (Ex. 1036, Stephan.) In particular, Stephan discloses a touch pad input device with a cursor control region flanked by a scroll

control region. (*Id.*, at 5:40-6:15.) Moving contact along the scroll control region can scroll content on a computer display. (*Id.*) This touch pad configuration with a scroll control region is illustrated below.

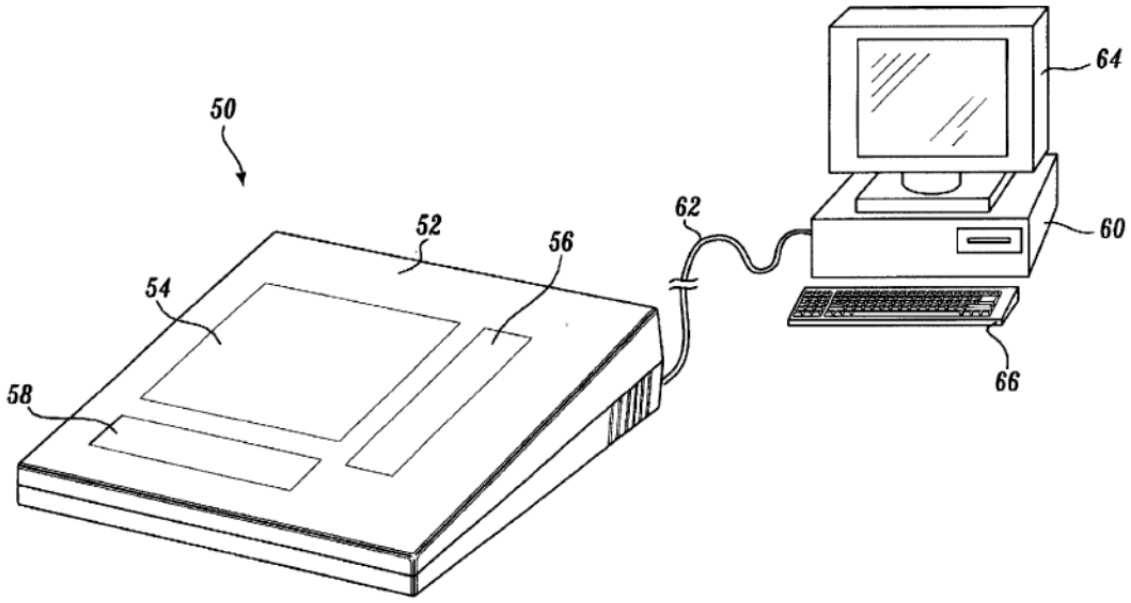


Fig. 2.

(Fig. 2 (Stephan).)

99. Stephan teaches that these touch pad detection devices "may also be directly incorporated into a touchscreen on a computer." (*Id.*, at 12:35-38.) This configuration is demonstrated in Fig. 13 from Stephan, reproduced below.

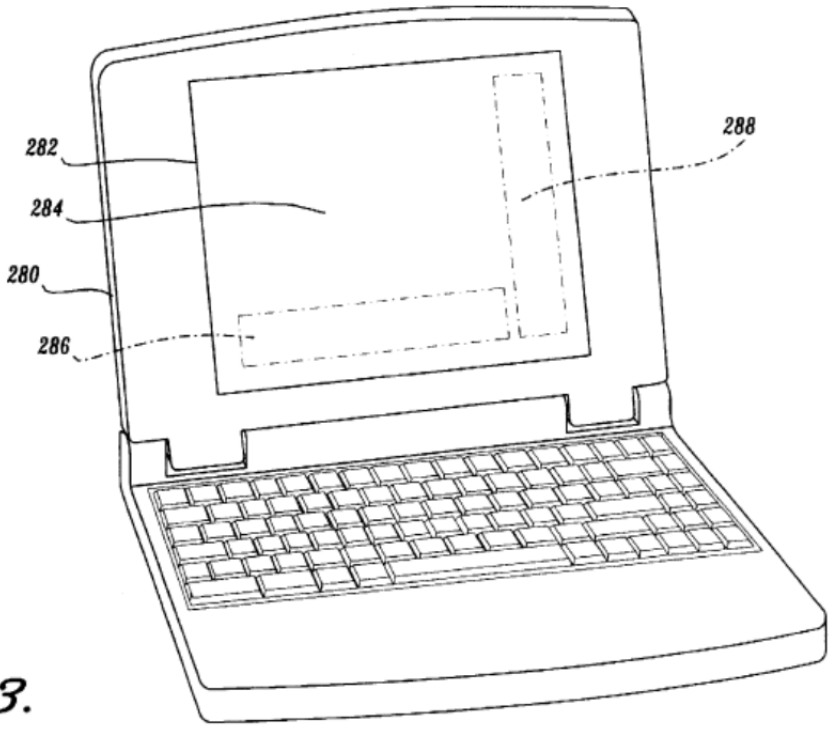


Fig. 13.

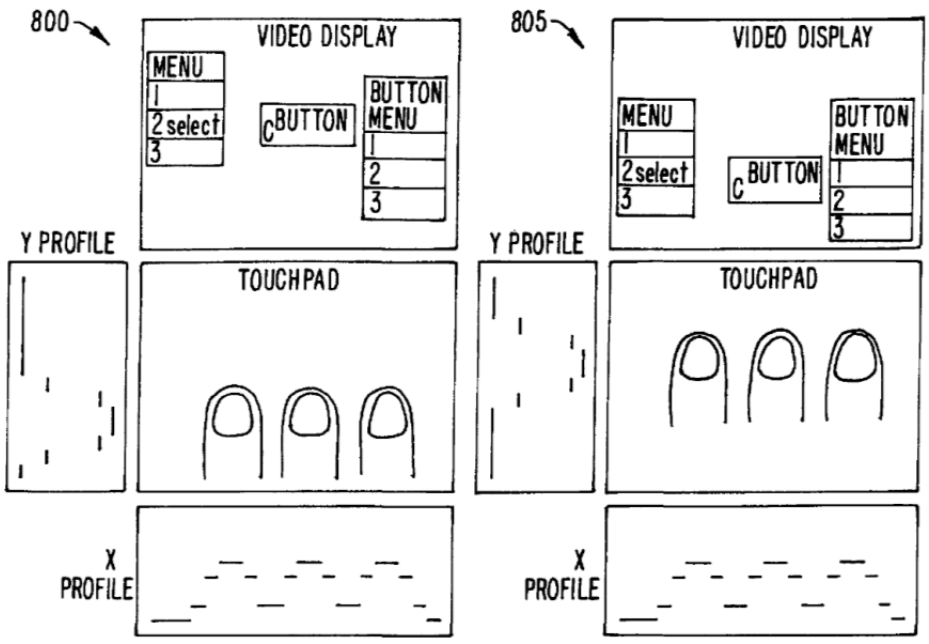
(Fig. 13 (Stephan).)

F. Touch User Interfaces and Scrolling

100. Touchpads and touchscreens are very flexible control devices. They can provide continuous information about the location of touch contact which can then be further processed to calculate the speed, distance, and direction of motion. This information can then be used in many ways to control a computer-based system. Three particular forms of control have been very common. These are: (i) selection (i.e. pressing a virtual button); (ii) cursor positioning, similar to the use of a mouse; and (iii) scrolling, similar to moving a lever or spinning a dial. Scrolling,

in particular, was common and well documented in the mid-90s. (See, e.g., Ex. 1012, Moore; Ex. 1027, Bisset; Ex. 1028, Allen; Ex. 1030, Bertram; Ex. 1031, Huffman; and Ex. 1036, Stephan.)

101. U.S. Patent 5,825,352, filed in 1996, discloses a scrolling gesture on a touchpad device. (Ex. 1027, Bisset.) This particular touchpad, from Logitech, was capable of responding to multiple-finger gestures. (*Id.*, at 2:18-4:11.) When three fingers were placed on the touchpad and moved up or down, the currently selected document would scroll accordingly (*Id.*, at 13:32-44.)



(Fig. 7E (Bisset).)

102. U.S. Patent 5,943,052, filed in August 1997, discloses a touchpad device with a portion of the touchpad dedicated to scrolling control. (Ex. 1028,

Allen.) This particular touchpad, from Synaptics, included a region, illustrated on the right, which would detect vertical motion and use that input to proportionally control the scrolling of a document or list in a window. (*Id.*)

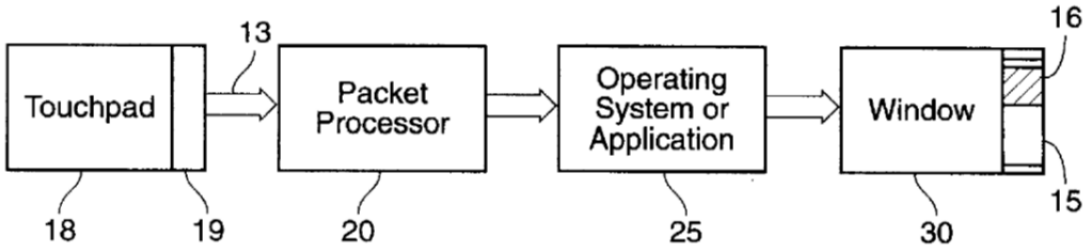


FIG. 2

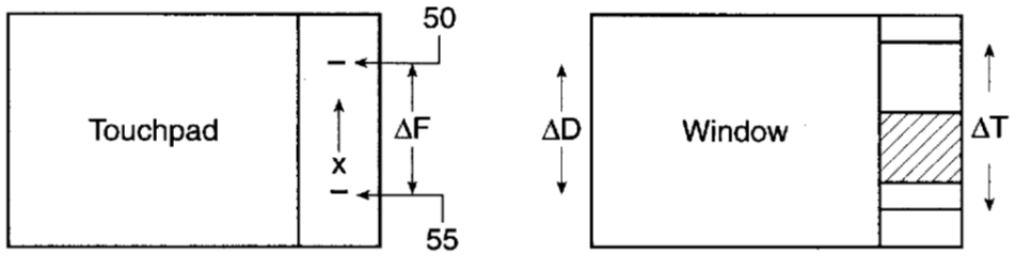
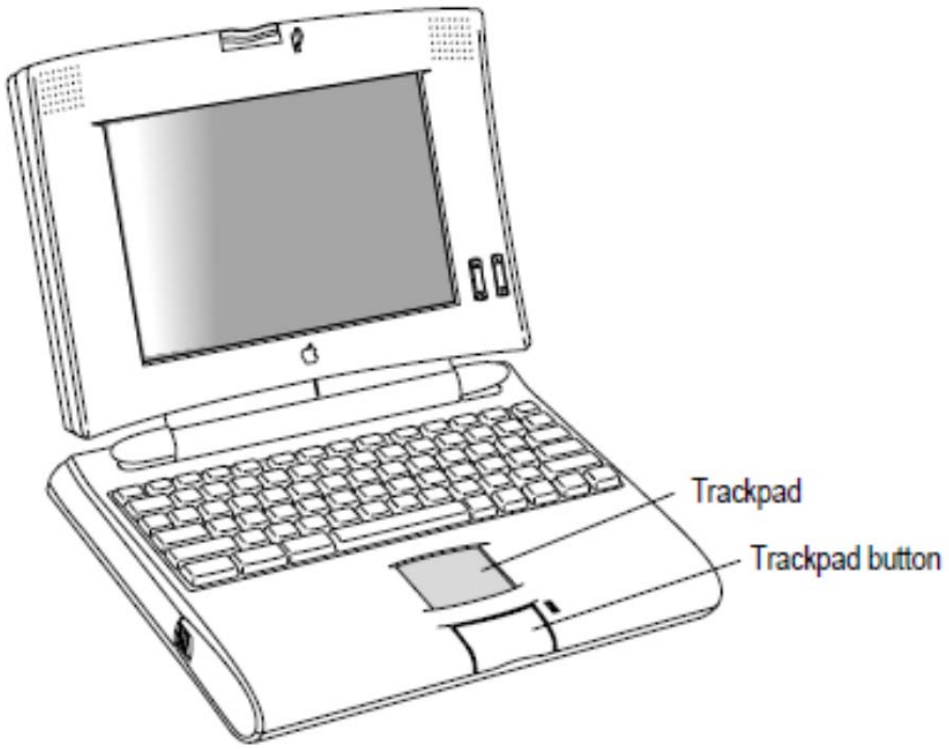


FIG. 3

(Figs. 2 and 3 (Allen).)

103. In the 1990s, laptop computers and tablets could similarly translate finger motion into scrolling simply by dragging the "scrolling box" control within the scroll bar in a window. If the window supported vertical scrolling, it would include a vertical scroll bar control on the right side. Within that scroll bar would be a scrolling box which could be dragged up or down to scroll the window. Positioning the cursor over this box with the touchpad or touchscreen then dragging the box up or down would scroll the window accordingly. For example,

the Apple Powerbook 500 series, introduced in 1994, included a touchpad controller that was used in this manner. (Ex. 1059, Power Book User's Guide; Ex. 1060, PowerBook 540 Specifications.) The touchpad could be used to select the scroll control and to scroll a window.



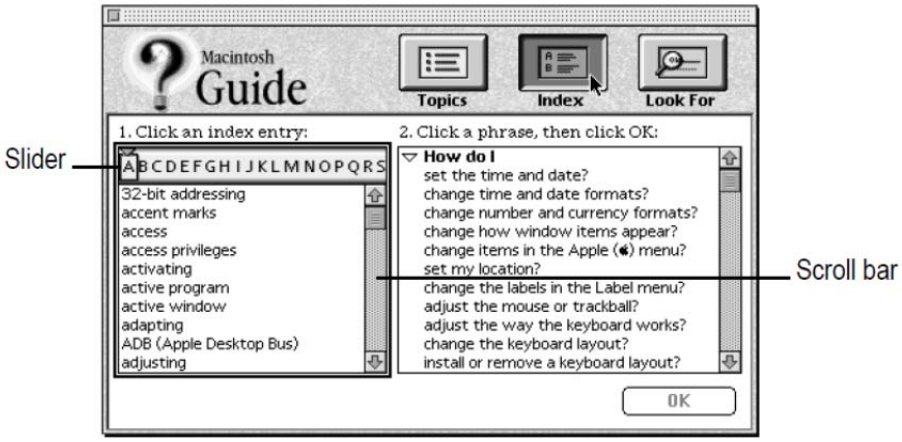
(Ex. 1059, Power Book User's Guide, at 15.)

104. The user's manual for the Powerbook 500 series explained that to scroll through a list; one could use the scroll bar. (*Id.*, at 26.) The touchpad would control the motion of the scroll bar. (*Id.*)

Getting answers with the Index button

1 **In the Macintosh Guide window, click the Index button.**

An alphabetical list of subjects appears on the left side of the window.



2 **Scroll through the alphabetical list until the phrase "background pattern" is visible.**

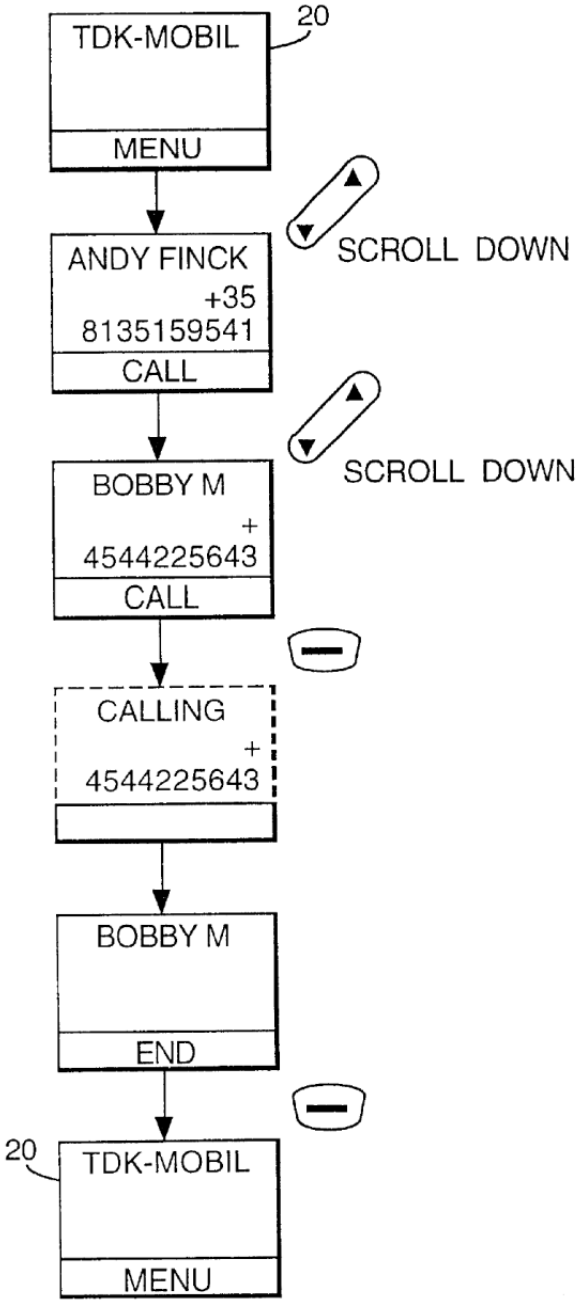
You can scroll through the list either by dragging the slider to the letter *B* or by using the scroll bar at the right of the list.

(*Id.*)

105. The IBM Thinkpad 360PE, introduced around 1995, provided similar functionality using the Windows operating system but had a different form factor. (Ex. 1061, Thinkpad 360PE – Ebay.) The IBM Thinkpad 360PE could be used as a laptop or converted into a tablet. A touchscreen over the display provided input capabilities. (*Id.*) When a Windows application provided a list or a scrollable document, one could place the stylus over that control and move up or down to scroll the document accordingly. (*Id.*)

(*Id.*)

106. U.S. Patent 6,363,259, filed in November 1997, discloses a user interface for a mobile phone. (Ex. 1033, Larsen.) Since the LCD display on the phone is a computer-controlled display, it takes advantage of scrolling much like any other computer display. (*Id.*) In particular, Fig. 5 illustrates that one can scroll between stored phone numbers in the directory.



(Larsen (Fig. 5).)

107. U.S. Patent 5,923,861, filed in March 1997, also discloses a user interface for a mobile phone. (Ex. 1030, Bertram.) Bertram includes a larger LCD display on the phone that looks more like a Windows or Macintosh display. (*Id.*) It

also takes advantage of scrolling much like any other computer display. Fig. 1 illustrates the device while Figs. 8-13 illustrate scrolling.

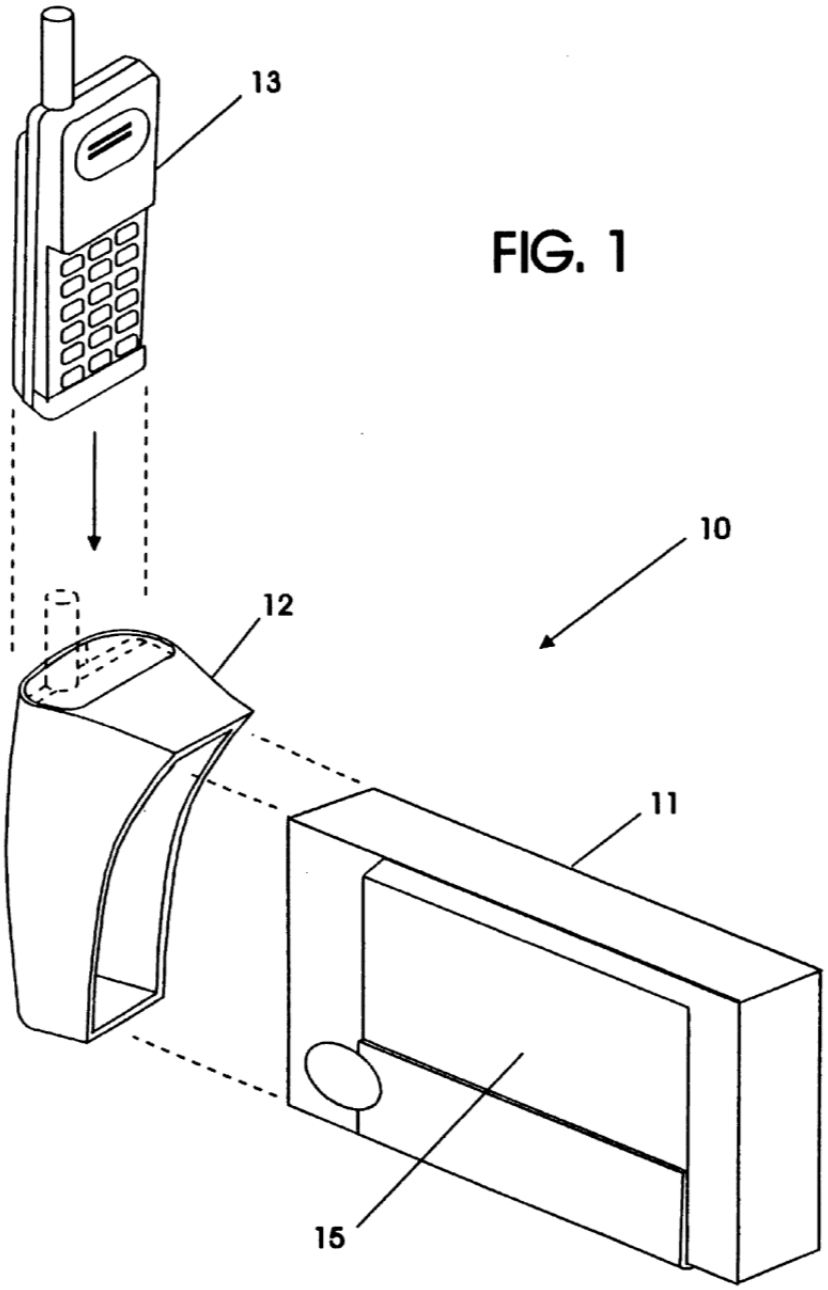
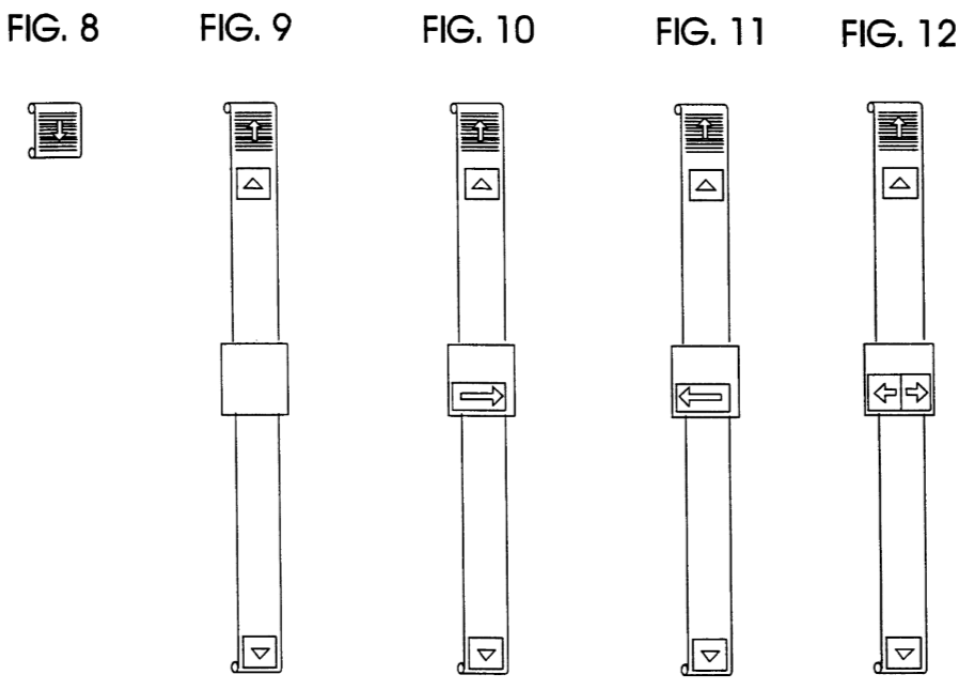


FIG. 1

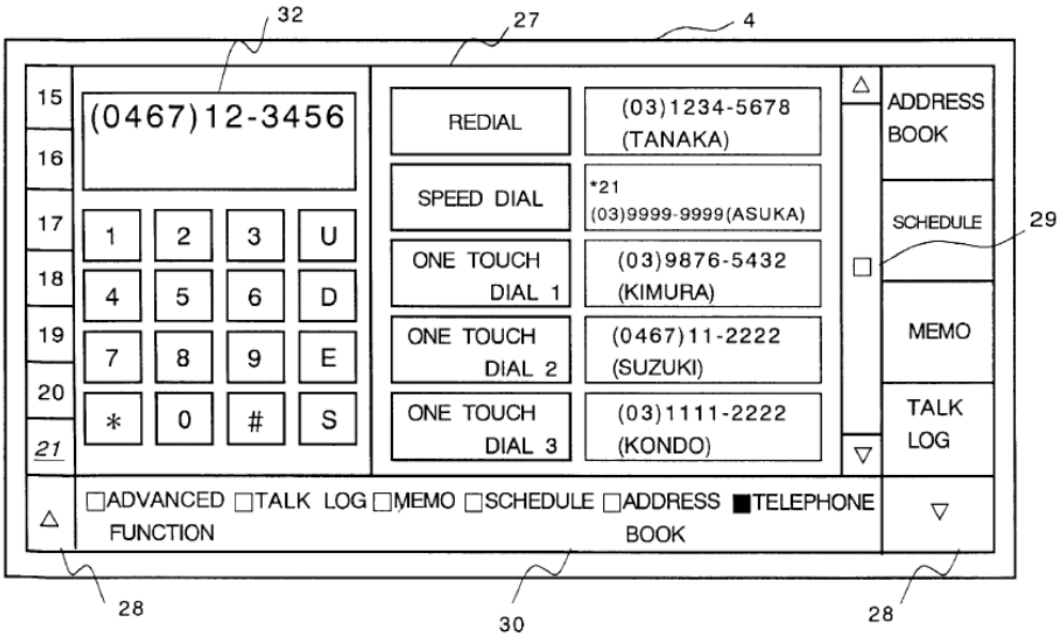
(Bertram (Fig. 1).)



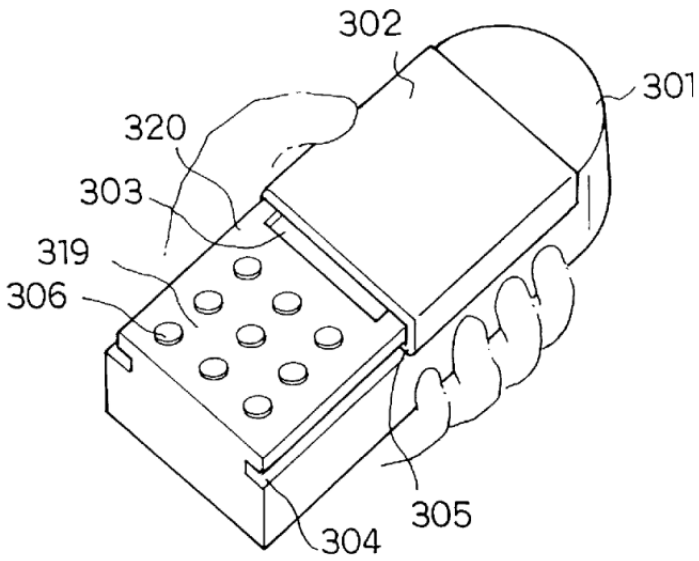
(Figs. 8-12 (Bertram).)

108. U.S. Patent 6,009,338, filed in April 1997, also teaches a touch-based user interface for a mobile phone. (Ex. 1029, Iwata.) Iwata Figs. 6-12 show scroll bars that resemble the Windows or Macintosh scroll bars and can be controlled in the same way. (*Id.*, at Figs. 6-12.) Iwata discloses a "contact-sensitive transducer" embodied as a touchscreen display, an interpretation Ericsson has implied in its Infringement Contentions (Ex. 1003). (Ex. 1029.) Iwata also shows a touchscreen cover in Figs. 47 and 48 that connects to a cover switch that can disable responses to the touchscreen in a covered mode. (*Id.*, Figs. 47-48.)

Fig.12

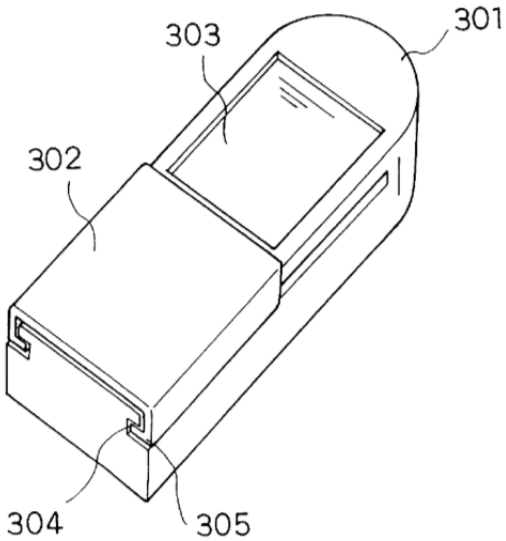


(Fig. 12 (Iwata).)



(Fig. 47 (Iwata).)

Fig.48



(Fig. 48 (Iwata).)

109. U.S. Patents 5,892,475 to Palatsi ("Palatsi") was filed by Nokia on June 23, 1997. (Ex. 1087.) Palatsi discloses a mobile telephone (i.e., a portable telephone) that incorporates a "scroll-and-select menu system" configured to "scroll through menu items" on a display, "select the desired one," and control the telephone transceiver unit, display, or other features of the telephone based on the selection. (Ex. 1087, at Abstract, 1:5-20, 2:17-29, 2:60-3:19, Figs. 1-4.) Palatsi also teaches that a touch sensor may be used for one or more input keys, for example, to control menu selection or scrolling. (*Id.*, at 4:14-23.)

110. These examples illustrate that the art was both quite mature at the time of the '931 filing and also being used in a great variety of ways. Touchscreens and touchpads were well-developed technologies for both desktop and portable devices. Touch-based user interfaces were in use that provided for scrolling and other control functions. Touch sensors were placed in various locations on the housing including over and near the display and could be enabled by a user-controlled switch.

G. Unresponsive Mode of Operation

111. During prosecution of the '931 Patent, the Examiner initially maintained rejections of all the claims as obvious over various combinations of prior art that disclosed mobile phones and various touchscreen technologies for controlling the graphical user interface, as I discuss in more detail in section IV

below. Ultimately, the patent owner added a limitation to all of the claims that recites "the controller [has] a first mode wherein the controller is responsive to contact with the contact-sensitive transducer and a second mode wherein the controller is unresponsive to contact with the contact-sensitive transducer, the second mode being entered in response to an input from a user." ('911 Patent, Claim 1.)

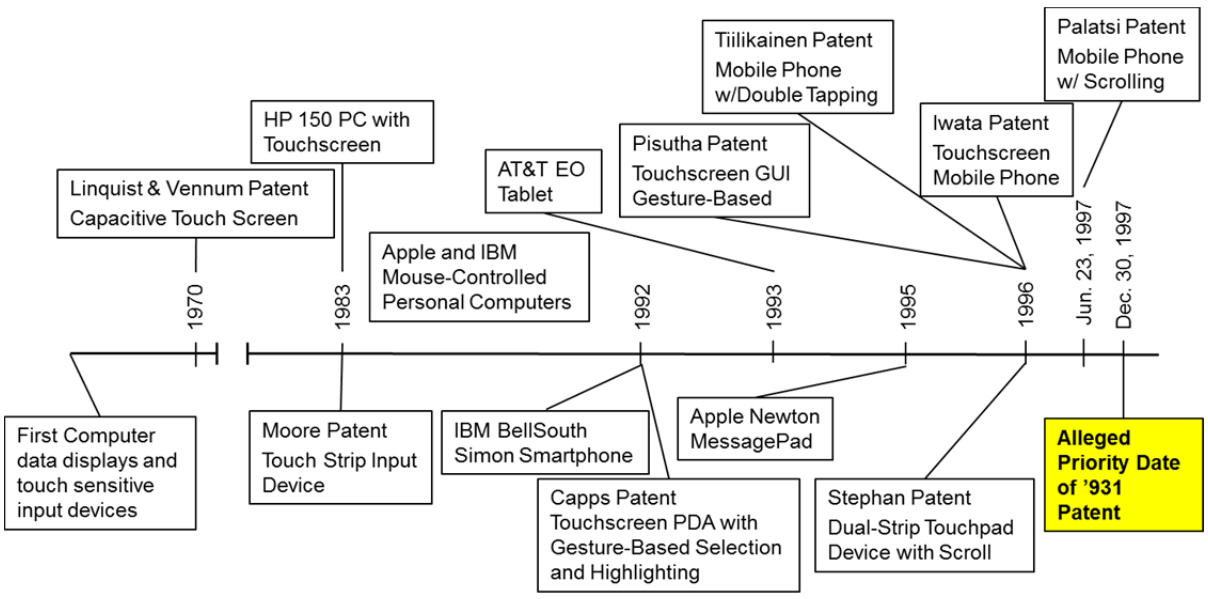
112. This type of functionality was also well known in the art at the time the parent to the '931 Patent was filed. For example, the mobile phone described above in Iwata enters a "sleeping" status in response to user input (i.e., sliding the phone's cover.) In addition, U.S. Patent No. 5,526,422 to Keen, filed June 20, 1994 and issued June 11, 1996, describes a "system and method for enabling a user to clean a touch screen device's display screen without inadvertently activating any of the device's features (other than the "clean screen" feature), and without removing power from the device or from the display screen." (Ex. 1081, Keen, at 2:42-46.) Specifically, Keen states:

> When a user presses the "clean screen" button 308, the processor 104 enables the user to clean the display screen 118 without inadvertently activating any of the features of the telephone 102 (other than the "clean screen" feature), and without removing power from the telephone 102 or from the display screen 118. Preferably, this task is automatically performed by the processor 104 operating in accordance with the control logic 110. Alternatively, the telephone 102 is made to

perform this task using hardware components only, such as a hardware implemented state machine.

(*Id.*) Accordingly, Keen discloses a mobile phone with a touch screen display that may be temporarily made unresponsive to user contact. Moreover, this unresponsive mode is entered into by user input to a "clean screen" button.

113. The following is a demonstrative timeline showing the public disclosure and/or 102(e) date for each of the technologies described above in comparison with the Alleged Priority Date for the '931 Patent (December 30, 1997):



VIII. THE '931 PATENT

114. The '931 Patent is entitled "Radiotelephones Having Contact-Sensitive User Interfaces and Methods of Operating the Same." The '931 Patent is

directed towards cellular phones that include a “contact sensitive transducer” to control various functions of the graphical user interface (GUI), including scrolling, tapping, and double tapping selection features. As originally filed, and throughout the prosecution of the reissue application, the basic features claimed by the applicant were a cellular telephone with a touch strip on the side (or later, through the reissue process, on the front) of the cellular telephone’s housing. For example, the touch strip is illustrated as item 150, highlighted with the red box, in the figures from the ’931 Patent that are reproduced below.

115. It is my understanding that during the Ericsson Litigation, Ericsson has asserted that the touch strip is actually a touch screen interface. No matter how Ericsson tries to characterize the touch strips, the technology for both cellular phones that incorporate touch sensitive interfaces, whether touch strips or touch screens, was well known in the art at the time the parent application to the ’931 Patent was filed.

116. Claims 1, 16, 30, 33, 58, and 64 of the ’931 Patent are independent claims, and each of claims 2-15, 17-29, 31-32, 34-57, 59-63, and 65-69 depends from one of the independent claims listed above. Claim 1 is representative and recites a radiotelephone that includes a housing that supports a display, a transceiver, a controller, and a contact sensitive transducer disposed at a front surface of the housing that produces an output signal in response to moving contact

along a surface of the contact-sensitive transducer. Claim 1 further recites that the controller is operative to scroll rows displayed on the display based on the output signal, and that the controller has a second mode in which the controller is unresponsive to contact along the contact sensitive transducer, the second mode being entered based on an input from a user.

117. The specification of the ’931 Patent recites a “contact-sensitive transducer” as a touch sensitive strip that produces an output signal that characterizes a contact with the contact-sensitive transducer. (’931 Patent, 5:22-35.) As disclosed, the contact-sensitive transducer is located either on the side of the cellular phone, or on a front surface of the cellular phone beneath a display. For example:

> [T]he contact-sensitive transducer 150 produces an output signal 155 that characterizes contact of an object, such as a user’ s finger 210, along an axis 150a of the transducer 150. A controller 220 is responsive to the output signal 155 and operatively associated with the display 120 and a radiotelephone communications transceiver 230. The controller 220 selectively display an image, such as one or more rows 240 of alphanumeric characters, on the display 120 based on the output signal 155 produced by the contact sensitive transducer 150. The controller also controls the radiotelephone communications transceiver 230 according to the output signal 155. The contact-sensitive transducer 150 may comprise a variety of different contact-sensitive devices, including resistive, capacitive or semiconductive

strips.

(*Id.*)

118. Ericsson's infringement contentions in the Ericsson Litigation, however, assert that the contact sensitive transducer is a touch screen disposed on a front surface of a cellular phone. (See Ex. 1003, Ericsson's Infringement Contentions.)

119. The '931 Patent was filed March 11, 2005 as a reissue of United States Patent No. 6,278,888 (the "'888 Patent", Ex. 1004), and claims priority back to United States Patent Application No. 09/001,173 filed December 30, 1997, now United States Patent No. 6,131,047 (the "'047 Patent", Ex. 1005).

120. None of the claims of the '888 Patent were rejected or objected to during prosecution, other than an obviousness type double patenting rejection that was overcome with a terminal disclaimer. " (See, generally, Ex. 1006, '888 Patent File History.)

121. The reissue application of the '888 Patent that resulted in the '931 Patent faced three rounds of prosecution prior to allowance. The reissue was filed because the '888 patent claimed more or less than the patentee was entitled to, for example, "Claim 30 of the patent is believed to be wholly or partially invalid in that it claims, more than patentee is entitled to." (Ex. 1007, '931 Patent File History, at 712-14.) Specifically originally issued claim 30 lacks the limitation of a

"'housing configured to be held in a user's hand such that the rear surface confronts the user's palm.'" (*Id.*)

122. The first round of prosecution culminated on August 6, 2007 with a pre-appeal panel withdrawing pending obviousness rejections over O'Hagan that discloses a cell phone with a thumb wheel and Yaniv that discloses a device with a touch screen that was not disclosed as capable of scrolling. (*Id.*, at 617-19.)

123. In the second round of prosecution ending October 13, 2010, the examiner continued to use O'Hagan as a primary reference, and cited Allard that disclosed a scrolling capability. (*Id.*, at 590-610.) The applicant argued that Allard requires a user to push a button to scroll, as opposed to using a dragging gesture. (*Id.*, at 569-75.) The Allard reference was subsequently dropped by examiner and replaced with a combination of Gillespie that discloses a touchscreen and Moore that discloses the use of touch strips to affect scrolling based on moving contact along those strips. (*Id.*, at 514-41.) The examiner further rejected all the '931 Patent's claims as an improperly broadened reissue application pursuant to 35 U.S.C. § 251, alleging that replacing the phrase "that characterizes" with "in response to moving" extended beyond the scope of the '888 patent. (*Id.*) On appeal, the obviousness rejections were maintained, but the Board reversed the improperly broadening reissue rejection. (*Id.*, at 398-99.)

124. The third round of prosecution started with a request for continued

examination in which the applicant added limitations requiring a second, non-responsive mode that is entered in response to user input, and moved the contact-sensitive transducer to the front surface. (*Id.*, at 348-64.) The examiner continued to cite O'Hagan, along with other references, to support obviousness rejections, and also re-asserted the broadening reissue rejection based on the new amendments. (*Id.*, at 251-79.) Specifically, the examiner cited Jeong, which recited an unresponsive mode of operation. (*Id.*, at 255-56.) The applicant argued that Jeong merely disclosed the unresponsive mode was caused by a lack of user input for a predetermined length of time, and was not entered in response to user input. (*Id.*, at 235.) The third round of prosecution culminated in another appeal in which the applicant argued that the Board had already addressed the improperly broadening reissue rejection, and that only narrowing limitations had been added since that time, but noticeably failed to address the fact that the new amendments moved the contact sensitive transducer to the front surface of the radiotelephone. (*Id.*, at 66-100.) Before the Board could consider the appeal, the examiner issued a notice of allowance. (*Id.*, at 42.)

IX. KEY CLAIM TERMS

125. For purposes of this IPR, I have been advised by TCL's attorneys that each challenged claim must be given "its broadest reasonable construction in light of the specification." 37 CFR § 42.100(b); *see also In re Cuozzo Speed Tech*, 778

F.3d 1271, 1279 (Fed. Cir. 2015). I have further been advised that the broadest reasonable construction standard requires that claim terms be "given their ordinary and customary meaning," as would be understood by a POSITA in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007) (quoting *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc)). I have further been advised that a special definition for a claim term must be set forth in the specification with "reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

126. Independent claim 1 requires a "contact-sensitive transducer…which produces an output signal," and most of the claims that depend therefrom refer back and add additional limitations to the contact sensitive transducer. Under the broadest reasonable construction, I propose that the term "contact sensitive transducer . . . which produces an output signal" should be interpreted as "*a device that converts physical contact of an object with the device to an electrical signal*." In particular, as illustrated in Figs. 2, 7B, and 7C reproduced below with **red** boxes highlighting the described feature, the '931 Patent states that "the contact-sensitive transducer 150 produces an output signal 155 that characterizes contact of an object, such as a user's finger." ('931 Patent, 5:22-25.)

127. The '931 Patent does not define "transducer." However, as was generally known in the art at the time of the Alleged Priority Date (December 30,

1997), a "transducer" means a device that receives a signal in the form of one type of energy and converts it to a signal in another form of energy. For example, the "the Art of Electronics", written by Paul Horowitz and Winfield Hill with a second edition being published in 1989, defines "transducers" as "devices that convert some physical quantity . . . to a voltage or some other electrical quantity." (Ex. 1016, at 987.) Accordingly, in view of the description from the '931 Patent specification and the understood definition of "transducer," the contact-sensitive transducer converts physical contact of the object (e.g., a user's finger) to a voltage/electrical energy.

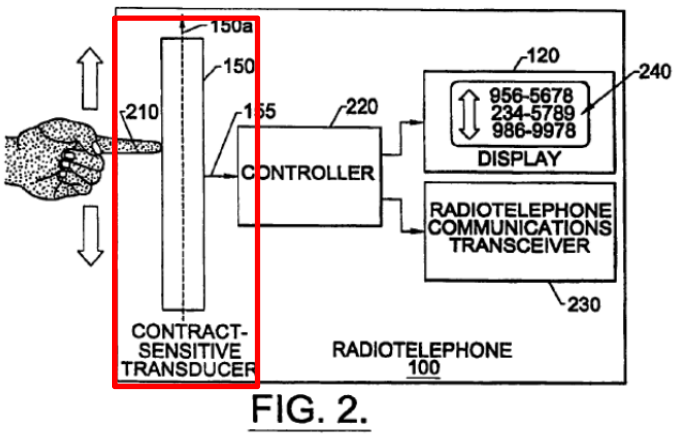


FIG. 2.

(Annotated Fig. 2 ('931 Patent)

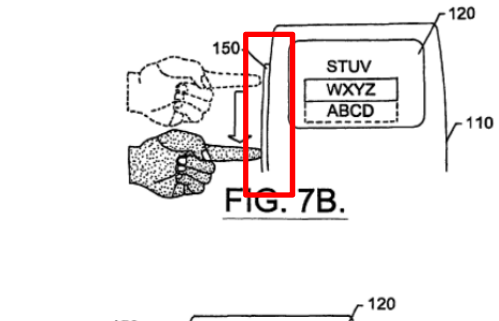


FIG. 7B.

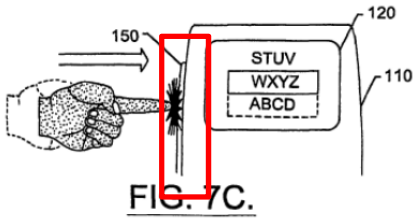


FIG. 7C.

(Annotated Figs. 7B,7C ('931 Patent).)

128. Furthermore, the '931 Patent's specification describes that the "contact-sensitive transducer 150 may comprise a variety of different contact-sensitive devices, including resistive, capacitive or semiconductive strips." (*Id.*, at 5:33-35). A POSITA would have recognized that resistance, capacitance, and

conductance refer to electrical properties. (*See* Ex. 1016, Horowitz, at 7, 61-79, 987-88.) It follows that a resistive, capacitive, or semiconductive transducer is a transducer that "convert[s] some physical quantity" to an "electrical quantity." (*Id.*)

129. Moreover, signals, in the context of electronics, can include "voltages that change in time in a particular way." (*Id.*, at 15.) Voltage is an electrical quantity as outputted by transducer. Indeed, the '931 Patent's specification describes measuring the output from the transducers as sampling "[v]oltages between the nodes R_1 and R_c and nodes L_1 and L_c" of the transducers over time. ('931 Patent, at 5:53-55.) Accordingly, the output signal described in the patent is a change in voltage—an electrical quantity, and the "contact-sensitive transducer" converts the physical contact of an object to an electrical signal.

130. Claims 4 and 6-11 recite the term "graphical object(s)." Under the broadest reasonable construction, I propose that the term "graphical object(s)" should be interpreted as "*visual element(s) including image(s) and/or row(s) of alphanumeric character*." In particular, the '931 Patent describes that "the controller is configured to selectively display an image, e.g., a graphical object such as a row of alphanumeric characters, on the display responsive to the output signal of the contact-sensitive transducer. " (*Id.*, at 2:54-62.) Thus, as used in the '931 Patent, row(s) of alphanumeric characters is(are) visually observable graphical object(s), and both are images.

X. PRIOR ART

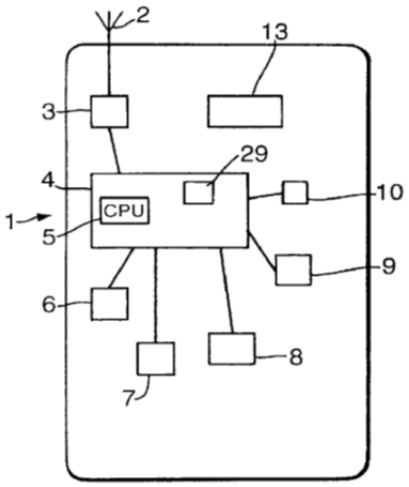
A. U.S. Patent 5,892,475 ("Palatsi")

131. U.S. Patent 5,892,475 **("**Palatsi**")** is entitled "User Interface for an Electronic Device." (Ex. 1087.) It was filed on June 23, 1997 and issued on April 6, 1999 and thus is prior art under 35 U.S.C. 102(e). The named inventor is Mikko Juhani Palatsi. The patent is assigned to Nokia Mobile Phones, LTD.

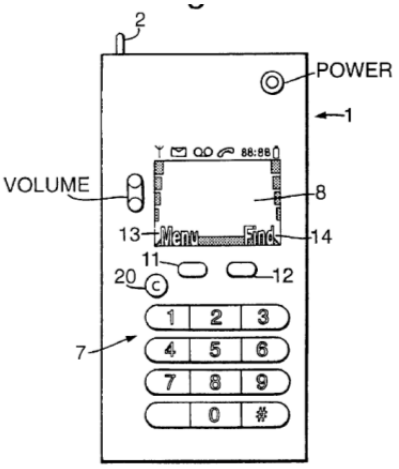
132. The Palatsi patent is one of many patents directed towards Nokia's line of mobile telephones that were available as of the Alleged Priority Date. For example, U.S. Patent No. 6,363,259 to Larsen ("Larsen") was filed by Nokia prior to the Alleged Priority Date and describes features of the Nokia line of mobile phones. (Ex. 1033.) Similarly, E.U. Patent No. 0721272 to Tiilikainen (Tiilikainen) was filed by Nokia January 4, 1996 and published July 10, 1996, and also describes features of Nokia's line of mobile telephones (discussed further below). (Ex. 1088.) This same line of mobile telephones is also identified, described, and depicted in photographs in Nokia's 1996 Annual Report (the "Nokia Report") (Ex. 1035). For example, the Nokia Report illustrates users holding mobile telephones similar to those disclosed in Palatsi, Larsen, and Tiilikainen.

133. In particular, Palatis discloses a mobile telephone (i.e., a "portable telephone") that incorporates a "scroll-and-select menu system" configured to "scroll through menu items" on a display, "select the desired one," and control the

telephone transceiver unit, display, or other features of the telephone based on the selection. (Ex. 1087, at Abstract, 1:5-20, 2:17-29, 2:60-3:19, Figs. 1-4.) Specifically, referring to Figs. 1 and 2 (below), Palatsi describes "a portable telephone 1" that includes "an antenna 2 connected to a radio transceiver unit 3," "a digital processing section 4 including a processor 5 [that] is connected to: the transceiver unit,…a LCD display 8 controlled by the processor," a "keypad 7 [that] has at least two 'soft' keys 11, 12," and a "battery 13 [that] is the source of power for the telephone." (*Id*., at 2:17-29.)



(Fig. 1 (Palatsi).)



(Fig. 2 (Palatsi).)

134. Palatsi discloses that the soft keys 11, 12 can be used for scrolling and/or selecting displayed menu items. Specifically, the "user can scroll through the menu items and then select the desired one." (*Id*., at 2:41-43.) For example, the menu items available for selection may include functions such as "Messages", "Lights", and "Last Calls Redial", and once selected, the user may scroll through submenu ("next scroll-and-select menu level") items such as "On" or "Off" with

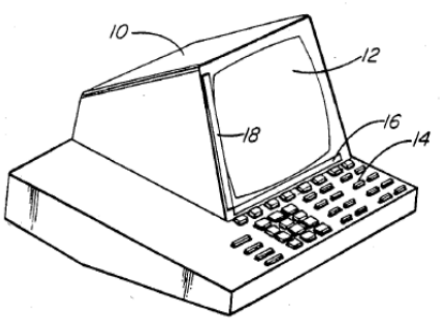
respect to the "Lights" using the soft keys 11, 12. (*Id*., at 2:60-63; 3:20-42, Figs. 3,4.)

135. Although the soft keys 11, 12 disclosed in the illustrated embodiments of Palatsi are push-type keys, Palatsi discloses that the soft keys 11, 12 could include "one or more touch sensors…." (*Id*., at 4:14-23.) Furthermore, those "soft keys are located close together to minimise finger movement." (*Id*., at 2:38-39.)

B. U.S. Patent No. 4,566,001 ("Moore")

136. U.S. Patent 4,566,001 ("Moore") is entitled "Touch Strip Input for Display Terminal." (Ex. 1012.) It was filed on February 8, 1983 and issued on January 21, 1986 and thus is prior art under 35 U.S.C. 102(a). The named inventors are Timothy G. Moore, Kanata Dockendorff, and Stephen J. Harris. The patent is assigned to Northern Telecom Limited.

137. Moore discloses an interactive display terminal flanked by touch strips used to provide, e.g., menu selection, scrolling, and cursor generation. (Ex. 1012, at Abstract, 1:27-35, 3:18-25, 3:54-4:28, Fig. 1.) Disposing touch strips at the side of a display (contrary to terminals in which a touch sensor is overlaid on the display) enables control of the display without unduly distorting displayed images due to the touch sensor itself, dirt, and/or oil. (*Id*., at 1:36-59.) The orientation of touch strips 16 and 18 relative to display 12 is illustrated in Fig. 1 of Moore, (below).



(Fig. 1 (Moore).)

138. The touch strips comprise resistive material spaced from conductive material, and are controlled by applying a voltage gradient along the resistive strips and reading an output voltage that correlates to position. (*Id*., at 1:60-2:5, 2:38-67, 4:37-41.) Alternatively, the touch strips may comprise a "linear array of discrete [capacitive] touch sensitive areas." (*Id*., at 4:41-48.) Moore also discloses processing output signals from the touch strips using a controller that comprises "a multiplexer" and a "microprocessor." (*Id*., at 4:37-48.)

139. Moore further discloses scrolling displayed items based on a moving-touch along the touch strips, i.e., in "scrolling mode…the user merely strokes the touch strips along their length in the direction in which the displayed field is to move." (*Id*., at 4:20-28.) Additionally, the touch strips of Moore can be responsive to a press-touch, i.e., "[b]y pressing the menu selection function key, a program is selected which enables the user to select one title from a list of displayed titles merely by pressing the touch strip (usually the vertical extending touch strip) at a location adjacent to the particular displayed title. (*Id*., at 3:45-49.) Moreover, the

touch strips can control specific functions of a telephone. Specifically, a touch strip can control "sound volume (for telephone ringing or voice) and display brightness, contrast or colour determinants" through graded control in response to moving contact along the touch strip. (*Id*., at 4:10-15.)

140. Moore also teaches activating and deactivating touch strips. Specifically, with respect to one embodiment, Moore describes using "keys associated with [a] functional keyboard" to "switch[] between different [] banks of touch strips." (*Id*., at 4:33-36.) These "functional keys" may be programmed to correspond to predetermined locations on the touch strips themselves, such that user input on the touch strips may be used to switch between modes of operation whereby different banks of touch strips are enabled or disabled. (*Id*., at 3:22-25, 4:33-36.)

141. A POSITA would have been motivated to combine the teachings of Palatsi and Moore as of the Alleged Priority Date because both are directed to improving a user interface, e.g., how a user can efficiently control various functions and interact with (e.g., scroll and select) displayed items using various input methods. Thus, a POSITA would have looked to Moore for alternative input methods in order to improve Palatsi's user interface, i.e., by using Moore's touch strips in place of Palatsi's push-type keys. *KSR*, 550 U.S. 398, 417 (2007) ("When a work is available in one field of endeavor, design incentives and other market

forces can prompt variations of it, either in the same field or a different one.”))

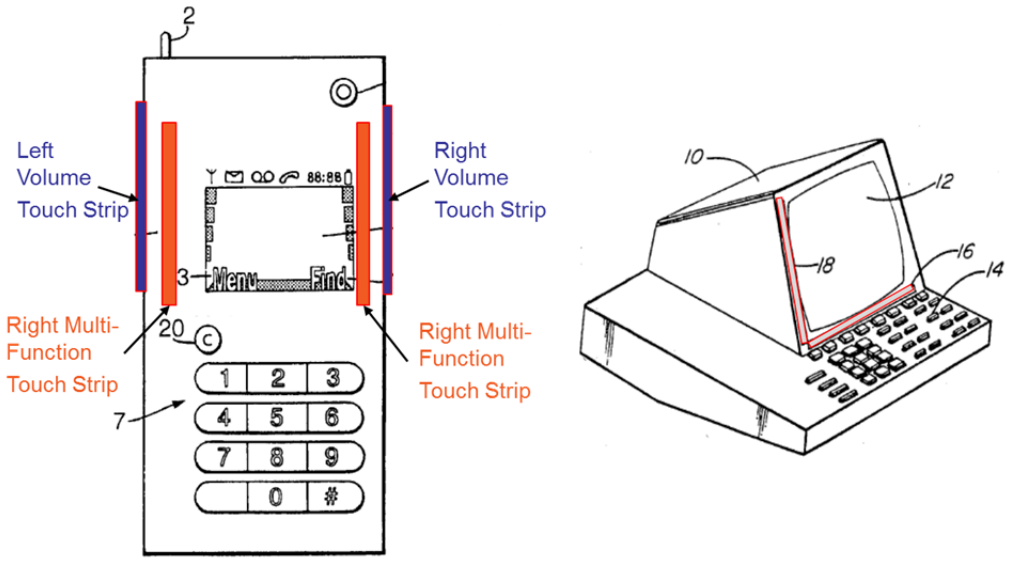
142. This is especially true because, as discussed *supra* in Section X.A, Palatsi already contemplates substituting “one or more touch sensors” to replace “one or more keys” used for input to the telephone (e.g., the soft key). (Ex. 1087, at 4:15-23.) So, it would have been obvious for a POSITA to try the proposed modification of replacing Palatsi’s keys/touch sensors with Moore’s touch sensors. *KSR*, 550 U.S. at 417.

143. Moreover, a POSITA would have appreciated that the proposed modification fulfills one of the needs identified in Palatsi, namely, providing efficient input mechanisms that increase UI control functionality while reducing the consumption of space. Specifically, Palatsi teaches that “[t]here is a need for portable telephones (especially hand-held portable telephones) to be smaller, to make them more convenient to carry,” while still maintaining ease of use by not making the input keys too small. (Ex. 1087, at 1:21-29.) Palatsi relies on programmable soft-keys having multiple functions (instead of function-dedicated keys) to avoid overcrowding the front housing of the mobile telephone. As discussed above, Moore discloses that the touch strips can be responsive to multiple types of touches including moving (i.e., stroking) touches and momentary contact (i.e., pressing). (Ex. 1012, at 3:45-53, 4:20-29.) Therefore, one touch strip of Moore could cover the functionality of multiple ones of Palatsi’s push-type keys

(e.g., keys 11, 12 for scrolling and selection).

144. Finally, a touch strip provides for a more intuitive method of scrolling/moving between menu items versus push-type keys. For these reasons, a POSITA would have been strongly motivated to modify the mobile telephone of Palatsi by replacing the push-type keys with one or more touch strips taught by Moore. *KSR*, 550 U.S. at 417.

145. A POSITA would have known to modify the mobile telephone of Palatsi by replacing the horizontally-arranged soft keys 11, 12 located below the display 8 with a first touch strip of Moore, and to replace the vertically-arranged volume control keys located to the left of the display 8 with a second touch strip of Moore. Such a modification is illustrated in Demonstrative Fig. 2 of Palatsi (below).



(Demonstrative Fig. 2 (Palatsi modified by Moore).)

146. As illustrated, banks of touch strips of Moore is located are located on each side of the housing, flanking the display, with a multi-function touch strip on the front surface of the housing flanking either side of the display, shown in **orange**, and a volume control touch strip on either side of the housing, shown in **blue**. (referred to hereinafter as the "proposed modification to Palatsi by Moore"). It would have been intuitive for a POSITA to make this proposed modification because the modified arrangement would "minimise finger movement when using those" touch strips by locating a set of touch strips (one volume control and one multi-function) in a location accessible to a holding hand, whether that holding hand is the left hand or the right hand. (Ex. 1087, at 2:38-39.) The configuration also enables both volume control (through the volume touch strips) and scroll control and selection (through the multi-function touch strips).

147. Indeed, Moore teaches that it is preferred to "stroke the touch strip" vertically, such that the touch strip would be oriented vertically. (Ex. 1012, at 4:20-28.) Moreover, two vertically-oriented touch strips could be implemented on either side of display 8 (one for right-hand use and one for left-hand use). Indeed, Moore teaches mounting touch strips such that the "extend along all the edges of the screen," with "a bank of touch strips mounted along each edge." (Ex. 1012, at 4:29-34.) Such an arrangement would again "minimise finger movement" by negating the need for users to engage a touch strip potentially located opposite

their dominant hand (and also potentially obscure the display). (Ex. 1087, at 2:38-39.)

148. Furthermore, in view of Moore's teaching that "the functional keyboard must permit switching between different ones of the banks of the strips" (Ex. 1012, at 4:34-46), either the right bank of strips, or left bank of strips, illustrated in Demonstrative Fig. 2 above, could be activated or deactivated to avoid accidental contact with the strips that are not in use (i.e., the left-side touch strips should not be active when in right-hand mode). Thus, in view of the analysis above, combining Palatsi with Moore to arrive at the modified mobile phones illustrated in Demonstrative Fig. 2 of Palatsi above amounts to nothing more than employing a "predictable use of" touch strip sensors, as known in the art, to accomplish their "established function[]. *KSR*, 550 U.S. at 417.

C. E.U. Patent No. 0721272 A2 ("Tiilikainen")

149. E.U. Patent No. 0721272 A2 ("Tiilikainen") is entitled "Speed Dialing Method." (Ex. 1088.) Tiilikainen was filed January 4, 1996 and published July 10, 1996, making it prior art under 35 U.S.C. § 102(a). The named inventor is Ilkka Tiilikainen. Tiilikainen is assigned to Nokia Mobile Phones LTD.

150. Like Palatsi, Tiilikainen is also a Nokia patent directed towards a mobile telephone that incorporates a GUI responsive to scrolling. (Ex. 1088, Abstract, at 1:3-22, 3:9-4:4, Figs. 1-3.) Specifically, referring to Fig. 1 (below),

Tiilikainen describes a "[m]obile phone 10 [that] is equipped with an alphanumerical display 11…and a scrolling key 12." (*Id*. at 1:19-22.) Tiilikainen further describes a "method of quick-dialing a telephone number" by scrolling to display a desired contact, and then selecting a column on the display corresponding to a particular type of stored telephone number (e.g., work, home, or mobile). (*Id*., at 1:3-4, 3:9-4:4, Figs. 2, 3.) Referring to Fig. 2 (below), Tiilikainen further describes that, in "quick dialing mode," a user brings the required contact "to field 24 of the display 28 with the scrolling key 12," and presses "the corresponding column 25, 26, or 27" with a finger or pen to initiate a call to the contact's work [col. 25], home [col. 26], or mobile [col. 27] number. (*Id*., at 3:13-22, Fig. 2.) "Alternatively, the selection can be thought of as being activated by double-pressing, i.e. pressing the required column quickly two subsequent times." (*Id*. at 3:22-24.)

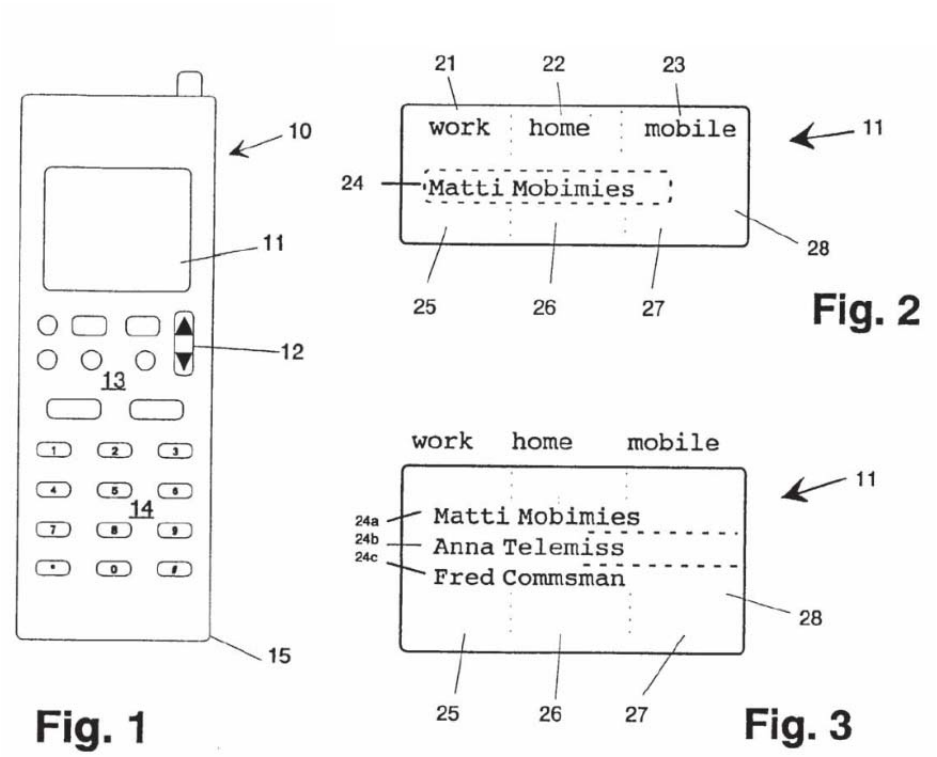


Fig. 1

Fig. 2

Fig. 3

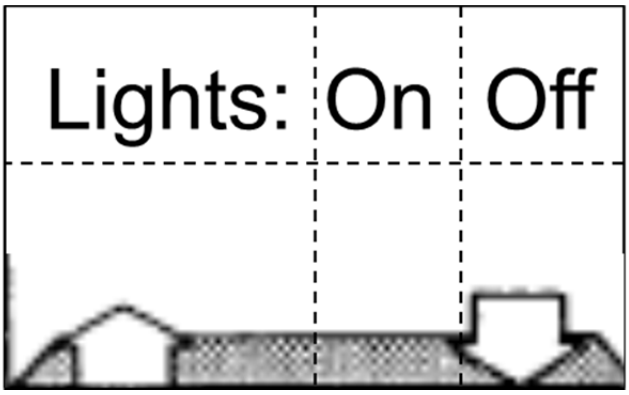
(Figs. 1-3 (Tiilikainen).)

151. Combining Palatsi with Moore would have been obvious as of the Alleged Priority Date for the reasons described above with respect to Ground 1. Similarly, it would have also been obvious to a POSITA to combine Tiilikainen with Palatsi and Moore to further simplify the user interface, baking it both "more basic" and "user-friendly," in line with the stated goal of Palatsi. (Ex. 1087, at 1:24-29.) Palatsi and Tiilikainen are both Nokia patents directed towards mobile telephones (e.g., Nokia's lines of mobile telephones available in the mid-1990s). (*See* Ex. 1033, Ex. 1035, Ex. 1087.) As such, both references were clearly directed towards improvements to the same technology (e.g., improving a Nokia's portable telephones) , and would have both been available and known by a POSITA.

Moreover, Palatsi describes the state of mobile telephone technology as requiring "more basic" and "user-friendly" GUI control systems to maintain functionality (i.e., scrolling through and selecting options from lists and menus) while counteracting the problem of reduced keypad sizes in increasingly smaller portable telephones, such that the smaller keys are difficult for users to activate (Ex. 1087, at 1:21-29.) Palatsi addresses this goal by incorporating "soft keys" that may be programmed with multiple functions within a "scroll-and-select menu system." Moore further enhances this solution by substituting one or more touch strips for the "soft keys" of Palatsi with one or more touch strips to facilitate swipe-based scrolling, and reducing the overall number of keys required on the front surface of the housing. Tiilikainen' s multi-column display mechanism further "enhance[s] user-friendliness" of the mobile telephone GUI with its intuitive grid-based "quick-dialing" method that enables users to select and call a number within a plurality of numbers identified on a single row, as opposed to having to enter a sub-menu to make the selection (i.e., a contact's work number may be dialed directly from a display showing the contact with a work, home, and mobile number). (Ex. 1088, at 1:1-46, Figs. 2, 3.)

152. Similarly, it would have been intuitive to a POSITA to use the same "quick-dialing" method described in Tiilikainen to enhance the dialing method in Palatsi, e.g., calling a "Last Calls Redial" contact illustrated in Fig. 3 by directing

the call to either a mobile, home, or work number by selecting the corresponding column in a grid, as described in Tiilikainen. Furthermore, as illustrated in Demonstrative Fig. 4 of Palatsi as modified by Tiilikainen (below), it would have been equally intuitive to use the same grid-based menu interaction system to select menu options in the mobile telephone of Palatsi, without needing to enter a submenu, for example, by selecting "On" or "Off" directly from the function menu without having to enter the "Lights" submenu simply by selecting a column representing "On" or "Off" within the row showing the menu item of "Lights." Thus, combining Palatsi and Moore with Tiilikainen amounts to nothing more than employing a "predictable use of" a method of selecting information displayed on mobile telephone GUI, as known in the art, to accomplish its "established function[]." *KSR*, 550 U.S. at 417.



(Demonstrative Fig. 4 (Palatsi modified by Tiilikainen).)

XI. OPINIONS IN SUPPORT OF GROUNDS FOR UNPATENTABILITY

A. Independent Claim 1 is obvious over Palatsi in view of Moore

153. The preamble of Claim 1 recites: "A radiotelephone." Palatsi describes a "portable telephone" with "a radio transceiver unit." (Ex. 1087, at 2:17-18.) The portable telephone of Palatsi is a radiotelephone.

154. **Claim 1a** recites: "a housing having a front surface, a rear surface and first and second side surfaces adjoining respective opposite edges of the front surface and extending from the respective opposite edges of the front surface to respective opposite edges of the rear surface, the housing configured to be held in a user's hand such that the rear surface confronts the user's palm." Palatsi discloses or renders obvious this limitation.

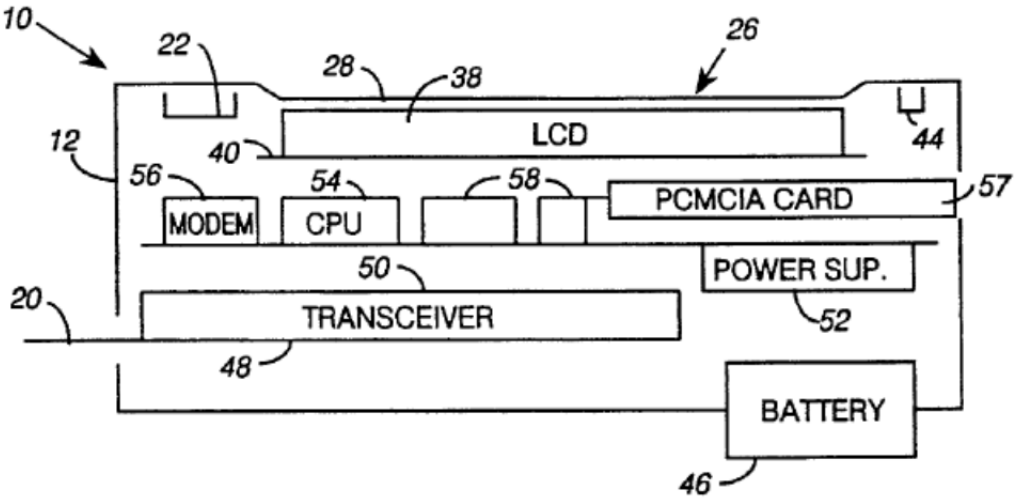
155. First, Palatsi discloses or renders obvious "a housing having a front surface, a rear surface and first and second side surfaces adjoining respective opposite edges of the front surface and extending from the respective opposite edges of the front surface to respective opposite edges of the rear surface." Fig. 2 of Palatsi (above) above, illustrates the front surface of the radiotelephone. (*Id*.) Moreover, Palatsi teaches that "[t]here is a need for portable telephones (especially hand-portable telephones) to be smaller to make them more convenient to carry." (*Id*.; Ex. 1087, 1:21-24.) Accordingly, the radiotelephone of Palatsi would be understood by a POSITA to fit in a user's hand and would have a housing capable of securely containing electronic components therein (e.g., by holding the components illustrated in Annotated Fig. 1, below, in place within a housing with a

front, rear, and side surfaces).

156. Indeed, it was well understood in the art as of the Alleged Priority Date that radiotelephones would include a housing that includes a rear surface and side surfaces adjoining the rear surface to a front surface. For example, the Nokia's 1996 Annual Report illustrates a line of Nokia mobile telephones, similar to the mobile telephone disclosed in Palatsi (Nokia's own patent), that are held in a user's hand and have housings comprising front, rear, and side surfaces. (*See* Ex. 1035, at 1,2, 17, 19.) Similarly, the IBM Simon was released in 1992 and included a housing, configured to be held in a user's hand, that comprised a front surface, rear surface, and side surfaces adjoining the front surface to the rear surface. The IBM Simon mobile telephone technology is described further in U.S. Patent No. 5,615,384, which also illustrates the mobile telephone as having a housing with front surface, rear surface, and side surfaces adjoining the front surface to the rear surface. (Ex. 1010, Fig. 2.) Pictures of the Nokia mobile telephone and IBM Simon mobile telephone are included below for reference.

(Nokia Report, Ex. 1035, at 17.)

(IBM Simon, Ex. 1021.)



(Allard, Ex. 1010, Fig. 2.)

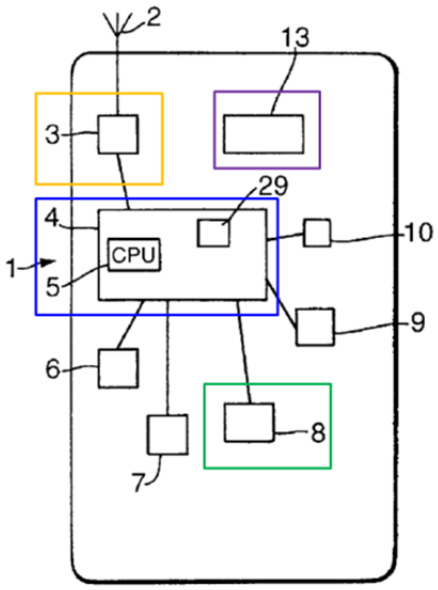
157. Second, Palatsi discloses or renders obvious that the housing is "configured to be held in a user's hand such that the rear surface confronts the user's palm." By virtue of the radiotelephone housing of Palatsi being small enough to be held in a user's hand, a POSITA would have understood that the housing would be held with the rear surface confronting the palm of the user's hand in order to interact with the keys and/or display on the front surface. Thus, Palatsi discloses or renders obvious Claim 1a.

158. **Claim 1b** recites "a radiotelephone communications transceiver, supported by the housing." Palatsi discloses or renders obvious this limitation.

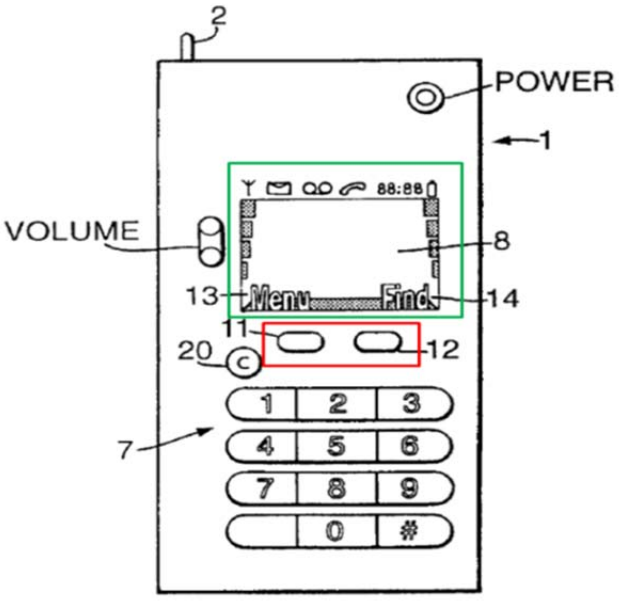
159. First, Palatsi discloses "a radiotelephone communications transceiver. Specifically, "portable telephone 1 shown in FIGS. 1 and 2 has… a radio transceiver unit 3." (Ex. 1087, at 2:17-18, Figs. 1, 2 (below, with the transceiver highlighted in **orange**).) The radio transceiver unit of Palatsi is a radiotelephone

communications transceiver.

160. Second, Palatsi discloses or renders obvious that the radiotelephone communications transceiver is "supported by the housing." Specifically, a POSITA would have appreciated that the housing of Palatsi would support the internal electronics, including the radio transceiver unit. For example, if components were not supported by the housing, either directly or indirectly e.g. by being affixed to a circuit board that is supported by the housing, they would move within the housing resulting in potential damage to the components themselves or other components. Thus, Palatsi discloses or renders obvious Claim 1b.



(Annotated Fig. 1 (Palatsi).)



(Annotated Fig. 2 (Palatsi).)

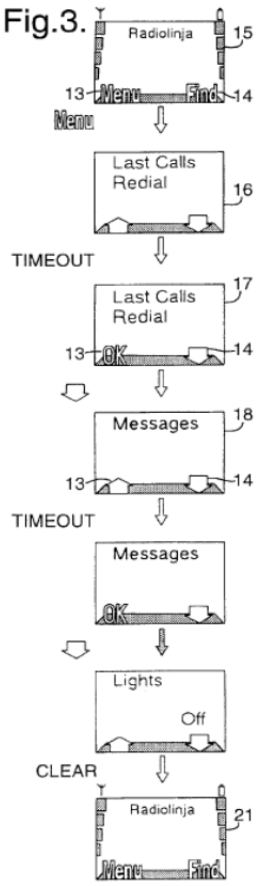
161. **Claim 1c** recites "a display, supported by the housing, that displays an image at the front surface of the housing." Palatsi discloses this limitation.

162. First, Palatsi discloses that "portable telephone 1" has "an LCD

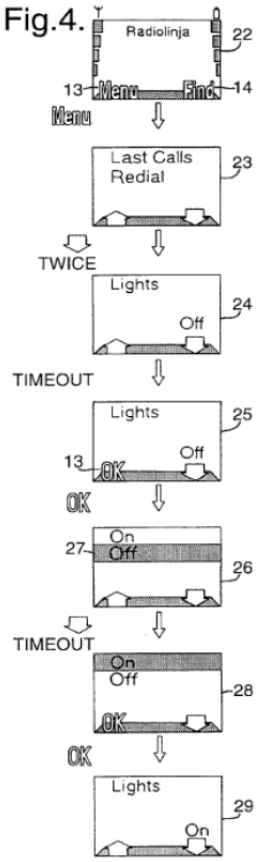
display 8." (Ex. 1087, at 2:24, Figs. 1, 2 (above, with the display highlighted in **green)**.)

163. Second, Palatsi discloses that the display is supported by the housing. Specifically, as illustrated in Fig. 2 of Palatsi, the display is contained within an opening in the front surface of the housing such that it would be supported by the housing e.g. by being affixed to or held in place by the housing, or held in place by a circuit board that is supported by the housing, such that the display is restrained from moving relative to the housing when the portable telephone is in use or being moved. (*Id*., at Fig. 2) In either case, a POSITA would have understood that the display is supported by the housing.

164. Third, Palatsi discloses the display of an image at the front surface of the housing. Specifically, Palatsi describes displaying a "scroll-and-select menu system" on the display, e.g., by displaying text and icons (i.e., images) as illustrated in Figs. 3 and 4 (below). (*Id*., at 2:40-59, Figs. 3, 4.) The images are displayed on display 8 illustrated in Fig. 2 (above), which is at the front surface of the housing. (*Id*., at Fig. 2). Thus, the images are displayed at the front surface of the housing. Accordingly, Palatsi discloses Claim 1c.



(Fig. 3 (Palatsi) (cropped).)



(Fig. 4 (Palatsi) (cropped).)

165. **Claim 1d** recites "a contact-sensitive transducer, supported by the housing and having a contact-sensitive surface disposed at said front surface, which produces an output signal in response to moving contact of an object along the contact-sensitive surface of the contact-sensitive transducer." Palatsi in combination with Moore renders obvious this limitation. Specifically, the proposed modification to Palatsi by Moore discloses this feature.

166. First, the proposed modification to Palatsi by Moore discloses "a contact-sensitive transducer…which produces an output signal." The broadest reasonable interpretation of this term is "a device that converts physical contact of

an object with the device to an electrical signal" for the reasons set forth *supra* in Section X.A, Palatsi discloses an input device as "a keypad 7 for providing input to the processor," wherein "keypad 7 has at least two 'soft' keys 11 [and] 12," as illustrated in Fig. 2 (above) with a **red** box highlighting the soft keys. (Ex. 1087, at 2:23-26.) By virtue of the schematic diagram (Fig. 1 of Palatsi, above) depicting keypad 7 connected to processor 5 by a line, a POSITA would understand that input provided to keypad 7 from a user pressing one of the keys (including the soft keys 11 and 12) would be converted to an electrical signal by the keypad and sent to the processor 5.

167. Furthermore, Moore discloses "a display unit having a display screen and a position sensitive touch strip extending along an edge of the screen, the touch strip having an output in response to its being touched by a user, the nature of the output being dependent on the distance along the strip of the position touched by a terminal user." (Ex. 1012, at 1:42-48.) Moore further describes that "[t]ypical functional keys associated with the touch strips are ***soft-key*** designation, menu selection, cursor generation, graded control and scrolling." (*Id*. 3:22-25 (emphasis added).) Furthermore, Moore explains that, "[t]o operate the terminal in [scrolling] mode, the user merely strokes the touch strips along their length in the direction in which the displayed field is to move." (*Id*. at 4:21-28.) Accordingly, each touch strip of either the first or second modification to Palatsi by Moore is a contact-

sensitive transducer that responds to moving contact along its surface and produces an output as "a voltage output which is representative of the distance along it at which it is touched." (*Id*., at 2:22-26.) Voltage is an electrical quantity, and thus, each touch strip of Moore converts a physical contact of an object with the touch strip (i.e., a touch or stroke from a user's finger) to an electrical signal (i.e., voltages representing the distances along the touch strip of the contact point, as the contact point moves).

168. Demonstrative Figs. 2 of Palatsi (above) demonstrate how the touch strips from Moore would intuitively replace the soft keys of Palatsi—notably, a touch strip could also replace graded control devices disposed on the surface of the housing of Palatsi, e.g. the volume control. Thus, a POSITA would have known to combine the touch strips described in Moore with the portable telephone in Palatsi to implement a device capable of producing an output signal in response to moving contact with the touch strips that controls user interface functions on the screen. (Ex. 1087, at 1:21-29.)

169. Second, the proposed modification to Palatsi by Moore discloses that the contact-sensitive transducer is "supported by the housing." Specifically, Fig. 2 of Palatsi illustrates that soft keys 11 and 12 are located on the front surface of the housing. (*Id*.; Ex. 1087, Fig. 2.) As discussed above, it would have been obvious to use the touch strips of Moore in place of the soft keys of Palatsi. In doing so, a

POSITA would have known to place the touch strips of Moore in similar locations as the soft keys in Palatsi, e.g., by flanking the display or locating the touch strips on the edges of the display as disclosed by Moore. (Ex. 1012, at 1:53-59. Notably, Moore teaches that the touch strips are "mounted at positions offset from the screen," "on a bezel surrounding the screen," or "on the screen but at a location so as not unduly to distort or block a displayed image." (*Id*., at 1:53-59.) Thus, Moore teaches touch strips that are mounted to, and thus supported by the housing of a computer. Similarly, a POSITA would appreciate that the touch strips would also be affixed to the front surface of the radiotelephone housing of Palatsi, such that they would not fall off or move relative to the housing when the phone is used. Thus, Palatsi in combination with Moore renders this limitation obvious.

170. Third, the proposed modification to Palatsi by Moore discloses that the contact-sensitive transducer has "a contact-sensitive surface disposed at said front surface" of the housing. Specifically, as described above, it would have been apparent to a POSITA to locate the touch strips of Moore on the front surface of the housing of Palatsi, in place of the soft keys. Indeed, it would have been equally apparent to orient the touch strips such that their contact-sensitive surface faces outward to enable contact with the surface by a user, and thus, the contact-sensitive surface would be located at the front surface of the housing.

171. Fourth, the proposed modification to Palatsi by Moore discloses that

the output signal is produced "in response to moving contact of an object along the contact-sensitive surface of the contact-sensitive transducer." Specifically, Moore teaches that, to cause scrolling of displayed text or graphics, "the user merely strokes the touch strips along their length in the direction in which the displayed field is to move." (Ex. 1012, at 4:20-29.) Moreover, such moving contact produces "voltage output which is representative of the distance along [the strip] at which [the strip] is touched." (*Id*., at 2:22-25.) Accordingly, the touch strip of Moore produce an output signal (electrical signal) in response to moving contact along the strip.

172. Furthermore, gesture based scrolling using touch sensitive input devices had long been known and used to control the display of information on personal computing devices, and was becoming more prevalent in mobile devices at the time the parent application to the '931 Patent was filed. For example, as explained *supra*, devices such as the IBM Simon, AT&T EO, and Apple Newton MessagePad—each available as of the early 1990s—incorporated touchscreen input devices to control scrolling in their respective graphical user interfaces. Moreover, Gillespie, having a priority date of June 8, 1992, describes that "position-sensing technology [was] particularly useful for applications where finger position information is needed, such as in computer mouse or trackball environments." (Ex. 1011, at 5:36-40.) Another reference, Bertram, describes the

use of "scroll bars for display or document navigation." (Ex. 1030, 3:48-49.) Indeed, this touchscreen enabled gesture-based technology had become commonplace in solving the problem of scrolling through large amounts of data on a display with limited space (i.e., a smaller display).

173. Thus, when considering that, as of the Alleged Priority Date, gesture-based scrolling using touch sensitive input devices was becoming more prevalent in mobile devices to solve problems associated with displaying large amounts of data on smaller display, combining Moore with Palatsi to achieve gesture-based scrolling would have been an intuitive solution (using a gestural command to mimic a desired action) to further simplify and make more efficient, Palatsi's user interface. Thus, Palatsi in combination with Moore renders obvious Claim1d.

174. **Claim 1e** recites "a controller, responsive to the output signal and operatively associated with the display and the radiotelephone communications transceiver, which controls at least one of the display and the radiotelephone communications transceiver." Palatsi in combination with Moore renders obvious this limitation. Specifically, the proposed modification to Palatsi by Moore discloses this limitation.

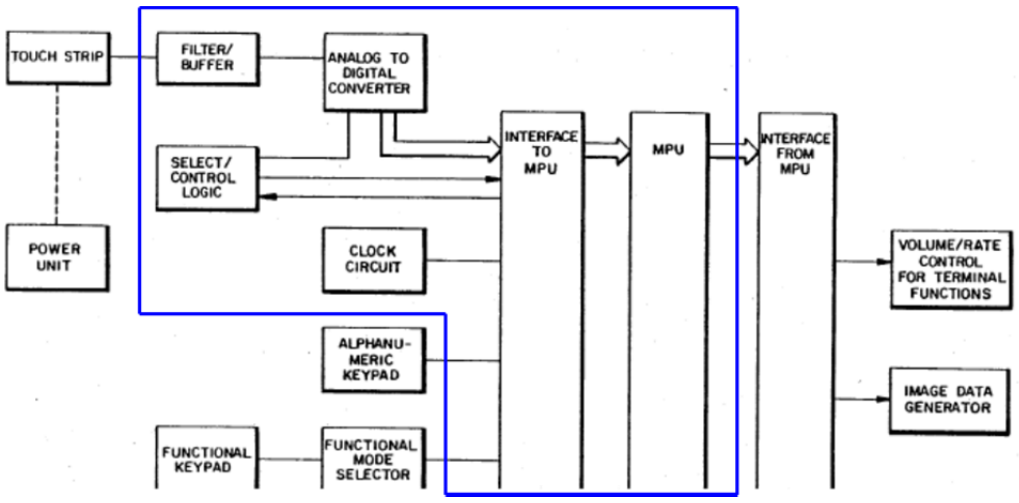
175. First, the proposed modification to Palatsi by Moore discloses a controller that is "responsive to the output signal." Specifically, in reference to Fig. 1 or Palatsi reproduced above with a **blue** box highlighting the disclosed feature,

Palatsi describes that "digital processing section 4 including a processor 5 [] connected to: the transceiver unit" controls the display and receives input from keypad 7." (Ex. 1087, at 2:20-25.) Furthermore, Palatsi explains that a "scroll-and-select menu system" is controlled using soft keys 11 and 12 to scroll or select menu options. (*Id*., at 2:40-3:19.) For example, in one state, "pressing key 12…will cause the processor to restore the up arrow function key." (*Id*., at 3:11-14.) In other words, the processor accepts input from the soft keys (i.e., the output signal) and initiates actions (i.e., changing images on the display) responsive to that output signal. Thus, Palatsi discloses a controller that is responsive to an output signal from the soft keys.

176. Moreover, a POSITA would have known that processor 5 in Palatsi would be responsive to the output signal from the touch strip, just as it is responsive to the output signal from the soft keys. In particular, referring to Fig. 3 of Moore, reproduced below with a **blue** box highlighting the disclosed feature, Moore teaches a microprocessor unit (MPU), in combination with a filter/buffer unit and analog digital converter, that "accept[s] data from the touch strip" and performs functions, such as "menu selection, cursor generation, graded control, or scrolling," based on that data. (Ex. 1012, at 2:38-56; 3:1-4; 3:22-25.) Indeed, it would have been apparent to a POSITA to modify the processor 5 in Palatsi with the microprocessor electronics described in Moore to facilitate the incorporation of

the touch strips of Moore into the radiotelephone of Palatsi. Thus, Palatsi in combination with Moore renders obvious a controller responsive to the output signal.

177. Second, the proposed modification to Palatsi by Moore discloses that the controller is "operatively associated with the display." Specifically, Palatsi describes that the "display 8 [is] controlled by the processor." (Ex. 1087, at 2:24-25.) Furthermore, as described above, it would have been obvious to modify the processor of Palatsi with components of the microprocessor of Moore to control the touch strips. Indeed, Moore also describes that, for example, the microprocessor runs a program that generates a cursor "at a reference position in the terminal display" in response to the output signal of the touch strips. (Ex. 1012, at 3:54-62.) Thus, a POSITA would have appreciated that the combined controller of Palatsi and Moore, as per the proposed modification to Palatsi by Moore, would also be operatively associated with the display.



(Annotated Fig. 3 (Moore).)

178. Third, the proposed modification to Palatsi by Moore discloses that the controller is "operatively associated with the radiotelephone communications transceiver." Specifically, Palatsi describes that the "digital processing section 4 including a processor 5 is connected to: the transceiver unit." (Ex. 1087, at 2:18-20.) Furthermore, Palatsi describes using a "scroll-and-select menu system" to control "functions of the telephone." A POSITA would appreciate that, by virtue of the digital processing section 4 (i.e., the controller) being connected to the transceiver unit, that one of the "functions of the telephone" that the digital processing unit 4 would control, responsive to user input via the "scroll-and-select menu system," would be the transceiver unit (i.e., the radiotelephone communications transceiver). By virtue of Palatsi's description of controlling telephone functions with the digital processing unit 4 responsive to the "scroll-and-select menu system" (e.g., operated via the soft keys 11 and 12), a POSITA would have appreciated that the microprocessor of Moore, as combined with the processor of Palatsi to accommodate the touch strips of the proposed modification to Palatsi by Moore, would also control the radiotelephone communications transceiver in the same way. Thus, Palatsi in combination with Moore renders obvious this feature.

179. Fourth, the proposed modification to Palatsi by Moore discloses that

the controller "controls at least one of the display and the radiotelephone communications transceiver" according to the output signal. Specifically, as discussed above, Palatsi and Moore each disclose a controller that controls the display according to an output signal from an input device (i.e., the soft keys of Palatsi and the touch strips in Moore). (Ex. 1087, at 2:40-3:19, Fig. 3; Ex. 1012, at 3:54-62 Moreover, as discussed below with respect to Claim 1f, the controller of the proposed modification to Palatsi by Moore scrolls displayed rows along an axis of the display based upon the output signal produced in response to moving contact along the contact-sensitive transducer. (Ex. 1205, ¶ 179.) Thus, a POSITA would have appreciated that Palatsi, in combination with Moore, teaches that the output signal that controls the display is in response to moving contact along the contact-sensitive surface. Accordingly, Palatsi in combination with Moore renders Claim 1d.

180. **Claim 1f** recites that the controller "scrolls displayed rows along an axis of the display based upon the output signal of the contact-sensitive transducer." Palatsi in combination with Moore renders obvious this limitation. Specifically, the proposed modification to Palatsi by Moore discloses this limitation.

181. First, Palatsi discloses that the controller "scrolls displayed rows along an axis of the display." Specifically, as described above, Palatsi describes that "in

the scroll-and-select menu mode the soft keys are marked by up and down arrows in the soft key zones and can be used to scroll through the menu options," for example, by "[p]ressing key 11 [to] cause[] the menu item preceding the currently-displayed one to be displayed," and "pressing key 12 [to] cause[] the succeeding item to be displayed." (Ex. 1087, at 2:63-3:2.) Indeed, Fig. 3 of Palatsi, reproduced above, demonstrates this scrolling mode wherein the fifth picture shows the menu option "Messages" displayed, and then, after scrolling down by pressing the soft key under the down arrow icon, the sixth picture shows the menu option "Lights" displayed. (*Id*., at Fig. 3.) Furthermore, in the Lights menu shown in the fifth and sixth pictures of Fig. 4 from Palatsi reproduced above, a user can scroll between "On" and "Off" by selecting the appropriate soft key to scroll up or down, thus highlighting the selection of either "On" or "Off" (i.e., by "us[ing] the soft keys marked by arrows to scroll between the items"). (*Id*., at 3:29-39, Fig. 4.) As further depicted in Figs. 3 and 4 of Palatsi, rows of text (e.g., menu items) extend horizontally across the display, and are scrolled vertically such that one name disappears and another appears in response to either scrolling up or down. (*Id*., at Figs. 3, 4.) Thus, scrolling is along a vertical axis of the display.

182. Second, the proposed modification to Palatsi by Moore discloses that the scrolling of displayed rows is based on the output signal of the contact-sensitive transducer. Specifically, Moore describes that, "[b]y pressing the

scrolling key, the terminal is programmed to permit the displayed text or graphics to be moved vertically or laterally to display adjacent parts of the displayed matter." (Ex. 1012, at 4:20-25.) Moore further describes scrolling rows by "merely strok[ing] the touch strips along their length in the direction in which the displayed field is to move." (*Id*., at 4:21-28.) Thus, combining Palatsi with Moore amounts to nothing more than substituting one known work (the touch strips of Moore) in one field of endeavor for use in either the same or different field for the purposes of simplifying the scroll-and-select menu interface described in Palatsi. *KSR*, 550 U.S. at 417. Accordingly, Palatsi in view of Moore renders obvious scrolling in response to an output signal produced in response to moving contact along the touch strips described in Moore. Thus, Palatsi in combination with Moore renders obvious Claim 1f

183. **Claim 1g** recites that the controller has "a first mode wherein the controller is responsive to contact with the contact-sensitive transducer and a second mode wherein the controller is unresponsive to contact with the contact-sensitive transducer." Palatsi in combination with Moore renders obvious this limitation. Specifically the proposed modification to Palatsi by Moore discloses this limitation.

184. First, the proposed modification to Palatsi by Moore discloses that the controller has "a first mode wherein the controller is responsive to contact with the

contact-sensitive transducer Specifically, for the reasons discussed above with respect to Claims 1d and 1e, the proposed modification to Palatsi by Moore discloses that the "contact-sensitive transducer…produces an output signal in response to moving contact of an object along the contact-sensitive surface of the contact-sensitive transducer" and the controller is "responsive to the output signal." Thus, Palatsi in combination with Moore renders obvious that the controller is responsive, at least, to moving contact with the contact-sensitive transducer by virtue of the controller being responsive to the output signal produced in response to that moving contact.

185. Second, the proposed modification to Palatsi by Moore discloses "a second mode wherein the controller is unresponsive to contact with the contact-sensitive transducer." Specifically, Moore describes that "a bank of [] touch strips can be mounted along each edge" and "keys associated with the functional keyboard [enable] switching between different ones of the banks of touch strips." (Ex. 1012,. at 4:33-36.) As described above in Section X.B, in replacing both the soft keys and volume control illustrated in Fig. 2 of Palatsi with touch strips from Moore, as illustrated in Demonstrative Fig. 2 (above), a POSITA would intuitively locate a first and second touch strip on opposite sides of the display for scrolling or soft key functionality, and a third and fourth touch strip on opposite sides of the housing for volume control. However, by virtue of the ability to hold the portable

telephone in a user's hand with a thumb extending around one side and the thumb extending around the other, as described above with respect to Claim 1a, a configuration with touch strips flanking either side of the display would create a risk of the user accidentally activating an unintended touch strip on the opposite side of the display. A POSITA would have appreciated that switching a non-used bank of touch strips off, such that the non-used bank of touch strips and the controller would be unresponsive to contact with the non-used bank of touch strips, would intuitively solve this problem. Notably, Moore teaches this exact functionality. Specifically, Moore discloses "switching between ones of the banks of touch strips" to disable one bank of touch strips, such that the controller is unresponsive to contact with the one bank of touch strips, while enabling another bank of touch strips, such that the controller is responsive to contact with the other bank of touch strips. (Ex. 1012, at 4:33-36.) Accordingly, Palatsi in combination with Moore teaches a second, unresponsive mode where the controller is unresponsive to contact with the contact-sensitive transducer.

186. This type of suspend or sleep mode was well known in the art at the time that the parent application to the '931 Patent was filed. Notably, as discussed above in Section VII.G, U.S. Patent No. 5,526,422 to Keen, filed by AT&T on June 20, 1994 and issued June 11, 1996, describes a "system and method for enabling a user to clean a touch screen device's display screen without

inadvertently activating any of the device's features (other than the "clean screen" feature), and without removing power from the device or from the display screen." (Ex. 1081, at 2:42-46.) Keen teaches a mobile phone with a touch screen display that may be temporarily made unresponsive to user contact. Moreover, this unresponsive mode is entered into by user input to a "clean screen" button. Thus, it would have been well understood by a POSITA that the sleeping status in Iwata would cause the controller to behave in a similar manner as described in Keen—namely, to make the controller unresponsive to contact with the contact-sensitive transducer. Moreover, a POSITA would have understood that, because the touchscreen 20 is unresponsive to a touch (contact) in the sleep mode, the processor 21 (controller) connected to the touchscreen 20 is likewise unresponsive to a touch with the touchscreen 20 in the sleep mode. Thus, Palatsi in combination with Moore renders obvious Claim 1g.

187. **Claim 1h** recites "the second mode being entered in response to an input from a user." Palatsi in combination with Moore discloses this limitation. As discussed above with respect to Claim 1g, by virtue of Moore's disclosure of switching between banks of touch strips, it would have been obvious to combine Moore with Palatsi to render obvious a second mode wherein the controller is unresponsive to contact with one of the banks of touch strips. Moore further discloses that this second mode may be entered in response to user input.

Specifically, Moore describes that "functional keys" may be programmed to correspond to predetermined locations on the touch strips themselves, such that user input on the "functional keyboard" on the touch strips "permit[s] switching between different ones of the banks of strips" (i.e., enabling or disabling banks of touch strips). (Ex. 1012, at 3:22-25, 4:33-36.)

188. In view of the analysis above, Palatsi in view of Moore discloses or renders obvious each and every limitation of Claim 1.

B. Claim 2 is obvious over Palatsi in view of Moore

189. **Claim 2**, which depends from claim 1, recites that "the contact-sensitive surface, when the housing is held within the user's hand such that the rear surface confronts the user's palm, confronts a finger or a thumb of the holding hand." Palatsi discloses or renders obvious this limitation. (Ex. 1205, ¶ 189.)

190. First, Palatsi discloses or renders obvious holding "the housing [] within the user's hand such that the rear surface confronts the user's palm" for the same reasons as described above with respect to Claim 1a.

191. Second, Palatsi in combination with Moore renders obvious that the "contact-sensitive surface…confronts a finger or a thumb of the holding hand." Indeed, as discussed above with respect to Claim 1d, it would have been obvious to replace the soft keys of Palatsi with the touch strips of Moore, such that the touch strips (contact-sensitive transducers) are supported by the front surface of the

housing. Furthermore, by virtue of the fact that Palatsi teaches minimizing the size of radiotelephones such that they can be easily held by a user, it would have been apparent to a POSITA that a user would be able to hold the radiotelephone of Palatsi by wrapping a finger(s) or thumb of the holding hand around the side of the phone and onto the front surface of the housing to operate the soft keys. (Ex. 1087, at 1:21-25.) Notably, as discussed *supra* with respect to Claim 1a, Palatsi is directed towards similar mobile telephone technology as the mobile telephones that are illustrated in Nokia's 1996 Annual Report. That report illustrates those mobile telephones being held by users with the palms of the users' hands opposing the rear surface of the housing while the users' fingers wrap around the mobile telephone such that they could reach, and thus operate, buttons on the front surface of the housing. (Ex. 1035, at 2, 17, 19.) Thus, a POSITA would have understood that the mobile telephone technology described in Palatsi was intended to be used in the same manner. And, by replacing the soft keys of Palatsi with the touch strips of Moore, a user would have similarly been able to hold the portable telephone of Palatsi such that the rear surface of the housing opposes the user's palm while a thumb wraps around the phone to confront or engage the contact-sensitive surface of the touch strip. Thus, Palatsi discloses or renders obvious this limitation, and Palatsi in combination with Moore renders obvious Claim 2.

C. Claims 3-5 are obvious over Palatsi in view of Moore

192. With respect to **Claims 3-5**, Palatsi in combination with Moore renders obvious that the controller is operative to selectively display an image [Claim 3, depending from Claim 1], a graphical object [Claim 4, depending from Claim 3], or a row [Claim 5, depending from Claim 4] "on the display according to the output signal of the contact-sensitive transducer." Specifically, the proposed modification to Palatsi by Moore discloses these limitations. First, Palatsi describes that menu options "Last Calls Redial", "Messages" and "Lights" can be selectively displayed on the display. (Ex. 1087, at 2:60-63, Figs. 3-4.) Palatsi further explains that"[i]nitially in the scroll-and-select menu mode the soft keys are marked by up and down arrows in the soft key zones and can be used to scroll through the menu options," such that "[p]ressing key 11 causes the menu item preceding the currently-displayed one to be displayed; pressing key 12 causes the succeeding item to be displayed (as illustrated at 17)." (Ex. 1087, at 2:63-3:2; Figs. 3-4.) As depicted, the menu selections (Last Call Redial, Messages, and Lights) are rows of alphanumeric characters. Moreover, as discussed in Section IX *supra*, graphical object(s)s means "visual element(s) including image(s) and/or row(s) of alphanumeric characters." Thus, with respect to **Claim 3**, the rows of alphanumeric characters are images. With respect to **Claim 4**, the rows are also graphical objects. Furthermore, by virtue of the ability to scroll through each menu selection such that only a single selection is displayed on the display at a time based on pressing

either soft key to scroll either up or down, the rows of alphanumeric characters (which are also images and graphical objects) are selectively displayed on the screen. Thus, Palatsi discloses ***selective*** display of images, graphical objects, and rows of alphanumeric characters.

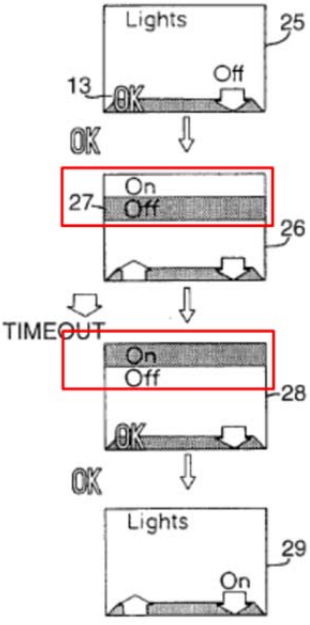
193. Second, the proposed modification to Palatsi by Moore discloses that the selective display is in response to the output signal produced in response to moving contact. A POSITA would have appreciated that control of the selective display of images, graphical objects, or rows disclosed by Palatsi would have been accomplished by stroking the touch strip of Moore as combined with the portable telephone of Palatsi. Thus, Palatsi in combination with Moore renders obvious that the controller is operative to display an image on the display according to the output signal of the contact-sensitive transducer. Accordingly, Palatsi in combination with Moore discloses or renders obvious each and every limitation of Claims 3, 4, and 5, and renders the claims obvious.

D. Claim 6 is obvious over Palatsi in view of Moore

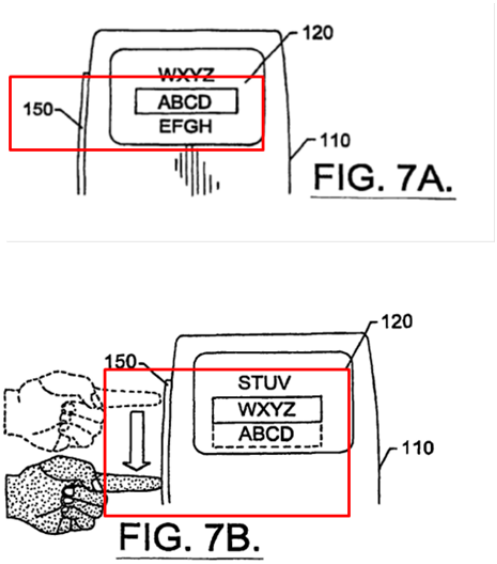
194. **Claim 6**, depending from Claim 4, recites that "the controller is operative to display a plurality of graphical objects on the display and to identify one of the displayed plurality of graphical objects responsive to the output signal of the contact-sensitive transducer." Palatsi in combination with Moore renders this limitation obvious. Specifically, the proposed modification to Palatsi by Moore

discloses this limitation.

195. First, Palatsi discloses displaying "a plurality of graphical objects on the display." Specifically, Fig. 4 of Palatsi, a portion of which is reproduced below with a **red** box highlighting the disclosed feature, illustrates the display of multiple rows of alphanumeric characters with respect to the "Lights" menu (e.g., "On" and "Off"). (Ex. 1087, at 3:20-42.) Moreover, as described above with respect to Claims 3-5, displayed rows of alphanumeric characters are also graphical objects. Thus, Palatsi discloses displaying a plurality of graphical objects on the display (i.e., a first graphical object is a row of alphanumeric characters reading "On" and a second graphical object is a row of alphanumeric characters reading "Off") (*Id.*)



(Fig. 4 (Palatsi).)



(Figs. 7A,7B ('931 Patent).)

196. Second, the proposed modification to Palatsi by Moore discloses identifying "one of the displayed plurality of graphical objects responsive to the

output signal of the contact-sensitive transducer." Specifically, referring to Fig. 4, Palatsi describes that the a "reversed bar 27 highlights the current setting of the option" and "the user can use the soft keys marked by arrows to scroll between the items," for example, to switch the reversed bar from "Off" to "On". (Ex. 1087, at 3:32-37.) Notably, selecting a row of alphanumeric characters in this manner (with a reversed bar, or a box indicating the row) is nearly identical to the highlighting-based identification mechanism described and illustrated in the '931 patent's specification, as illustrated by Figures 7A and 7B reproduced above next to Figure 4 of Palatsi for comparison. (Ex. 1001, at Figs. 7A, 7B; Ex. 1087, at Fig. 4.) Moreover, a POSITA would have known that the selection of a function (represented by the row of alphanumeric characters and correspondingly highlighted) from the submenu of Palatsi (i.e., identifying either "On" or "Off"), would be achieved by scrolling via stroking the touch strip of Moore. Thus, Palatsi in combination with Moore renders obvious identifying one of the displayed plurality of graphical objects responsive to the output signal of the contact-sensitive transducer. Accordingly, Palatsi in combination with Moore renders obvious Claim 6.

E. Claim 7 is obvious over Palatsi in view of Moore

197. **Claim 7**, which depends from Claim 4, recites that "the controller is operative to determine a position of contact of an object along an axis of the

contact-sensitive transducer responsive to the output signal of the contact-sensitive transducer, and to selectively display a graphical object based on the determined position of contact to thereby identify the graphical object." Palatsi in combination with Moore renders obvious this limitation. Specifically, the proposed modification to Palatsi by Moore discloses this limitation.

198. First, the proposed modification to Palatsi by Moore discloses that "the controller is operative to determine a position of contact of an object along an axis of the contact-sensitive transducer responsive to the output signal of the contact-sensitive transducer." Specifically, the scrolling functionality of Moore, as implemented on the proposed modification to Palatsi by Moore as discussed *supra* with respect to Claims 1d and 1f, is premised upon determining a position of contact and movement of that contact point. Specifically, Moore describes that the touch strip outputs a voltage "representing a position touched on the touch strip," and that scrolling is effectuated by "strok[ing] the touch strips along their length in the direction in which the displayed field is to move." (Ex. 1012, at 2:57-59, 4:25-28.) Accordingly, a POSITA would have understood that the controller determines a starting position and an ending position of contact along the touch strip (i.e., the controller determines, at least, a position of contact of an object along an axis of the touch strip). Thus, using a touch strip of Moore to selectively display a graphical object on the display of Palatsi, as discussed *supra* with respect to Claim

4, would require the controller to determine a position (i.e., actually, both a starting position and a stopping position) of contact along the axis of the touch strip, responsive to the output signal produced in response to moving contact with the touch strip.

199. Second the proposed modification to Palatsi by Moore discloses that the controller "selectively display[s] a graphical object based on the determined position of contact to thereby identify the graphical object. Specifically, and by virtue of, e.g., scrolling based on starting position and an ending position on the touch strip to selectively display the "Last Calls Redial," the "Messages," or the "Lights" menu items as illustrated in Figs. 3 and 4 of Palatsi (above), and thereby identify one of the menu items (i.e., a graphical object), the selective display is based on the last position of the contact along the touch strip. (Ex. 1087, at 2:60-66, Fig. 3.) Thus, Palatsi combined with Moore renders obvious Claim 7.

F. Claim 8 is obvious over Palatsi in view of Moore

200. **Claim 8**, which depends from Claim 7, recites that "the controller is operative to highlight one of a plurality of displayed graphical objects responsive to the output signal of the contact-sensitive transducer." Palatsi in combination with Moore renders this limitation obvious. Specifically, the proposed modification to Palatsi by Moore discloses this limitation. As discussed *supra* with respect to Claim 6, the proposed modification to Palatsi by Moore discloses that "the

controller is operative to display a plurality of graphical objects on the display and to identify one of the displayed plurality of graphical objects responsive to the output signal of the contact-sensitive transducer." Moreover, as further described with respect to Claim 6, Palatsi discloses that the mechanism for identifying the selected one of the plurality of graphical objects is by highlighting with a reversed bar displayed over the selected row, similar to a box used to highlight, and thereby identify the select row as disclosed by the '931 patent, as illustrated by comparing Fig. 4 of Palatsi (above) with Figs. 7A and 7B from the '931 patent (above). Indeed, Palatsi teaches that "the telephone could indicate items for selection by…highlighting successive items…." (Ex. 1087, at 4:24-27.) Furthermore, as described above with respect to Claims 1d and 1f, it would have been obvious to replace the soft keys and scroll-and-select menu functionality of Palatsi with a touch strip (contact-sensitive transducer) and gesture based scrolling of Moore. Thus, Palatsi in combination with Moore renders obvious Claim 8.

G. Claim 9 is obvious over Palatsi in view of Moore

201. **Claim 9**, which depends from Claim 7, recites that "the controller is operative to display a cursor that indicates one of a plurality of displayed graphical objects responsive to the output signal of the contact-sensitive transducer Palatsi in combination with Moore renders this limitation obvious. Specifically, the proposed modification to Palatsi by Moore discloses this limitation. As discussed *supra* with

respect to Claims 6, the proposed modification to Palatsi by Moore discloses selectively displaying a graphical object to identify the graphical object. Moreover, Palatsi teaches that "the telephone could indicate items for selection by…moving a cursor from one item to the next…or scrolling menu items relative to the cursor." (Ex. 1087, at 4:24-27.) And, Moore further teaches that "[w]hen a cursor generation program is selected by pushing the appropriate functional key, a cursor is generated at a reference position in the terminal display the cursor being usable for many functions." (Ex. 1012, at 3:54-58.) Thus, it would have been obvious to a POSITA to combine Palatsi with Moore to render obvious that "the controller is operative to display a cursor that indicates one of a plurality of displayed graphical objects." Accordingly, Palatsi in combination with Moore renders obvious Claim 9.

H. Claim 10 is obvious over Palatsi in view of Moore

202. **Claim 10**, which depends from Claim 7, recites that "the controller is operative to cause at least one of the display or the radiotelephone communications transceiver to perform a plurality of actions, wherein an action of the plurality of actions is associated with the identified graphical object and wherein the controller is further operative, responsive to the contact-sensitive transducer, to initiate the action associated with the identified graphical object." Palatsi in combination with Moore renders obvious these limitations. Specifically, the proposed modification to

Palatsi by Moore discloses this limitation.

203. First, the proposed modification to Palatsi by Moore discloses that "the controller is operative to cause either the display or radiotelephone communications transceiver to perform a plurality of actions." Specifically, as described above with respect to the limitation Claim 6, the proposed modification to Palatsi by Moore teaches a controller that is "operative to display a plurality of graphical objects on the display" and to "identify one of the displayed plurality of graphical objects responsive to the output signal of the contact-sensitive transducer," e.g., "Messages" or "Lights" menu items (i.e., perform a first action). Moreover, Palatsi further describes that a user may scroll through options within a menu, then pause for a predetermined time frame to change the state of the scroll-and-select menu such that pressing the soft key again "will then select the currently-displayed menu item and cause the processor to take the appropriate action corresponding to that item—for instance to move to the next menu level…" (i.e., perform a second action). (Ex. 1087, at 3:7-10.) Thus, the processor (i.e., the controller) is operative to cause the display to perform a plurality of actions (i.e., either scroll through menu options or display the next menu level).

204. Second, Palatsi discloses that "an action of the plurality of actions is associated with the identified graphical object." Specifically, as described above, Palatsi discloses switching between desired menu items by scrolling to the desired

menu item (e.g., “Messages” or “Lights”, or “On” or “Off” within the “Lights” menu). (Ex. 1087, at Figs. 3, 4) As illustrated in Fig. 4 (above), Palatsi then teaches that the selection of one of these options by waiting for a predetermined time period and then pressing the soft key again, causes the controller to initiate an associated action (i.e., change to the next menu level, or revert to the previous menu level 29 in Fig. 4 of Palatsi), resulting in the display of associated text on the display (e.g., changing from the “On” and “Off” menu options to display just the “Lights” menu label). (Ex. 1087, at 3:20-43, Fig. 4.)

205. Third, the proposed modification to Palatsi by Moore discloses that the “controller is further operative, responsive to the contact-sensitive transducer, to initiate the action associated with the identified graphical object.” Specifically, as described above, Palatsi teaches that selecting a menu option, pausing for a predetermined time frame, and then pressing the soft key again “will then select the currently-displayed menu item and cause the processor to take the appropriate action corresponding to that item—for instance to move to the next menu level….” (Ex. 1087, at 3:7-10.) By virtue of implementing scrolling on the mobile telephone of Palatsi using the moving contact-based touch strips of Moore, as discussed supra with respect to Claim 1f, a POSITA would have known that a user would identify the graphical object associated with the desired action by scrolling using the touch strip (i.e., stroking the surface of the touch strip in the desired direction).

Accordingly, Palatsi in combination with Moore renders obvious this feature.

206. Thus, Palatsi in combination with Moore discloses or renders obvious each and every feature of Claim 10, and renders the claim obvious.

I. Claim 11 is obvious over Palatsi in view of Moore

207. **Claim 11**, which depends from Claim 10, recites that "the controller is operative, responsive to the contact-sensitive transducer to detect a momentary contact with the contact-sensitive transducer and to initiate the action associated with the identified graphical object responsive to detection of the momentary contact." Palatsi in combination with Moore discloses this feature. Specifically, the proposed modification to Palatsi by Moore discloses this limitation.

208. A POSITA would have known that, where Palatsi discloses pressing a soft key to "select the currently-displayed menu item and cause the processor to take the appropriate action corresponding to that item," the equivalent operation would be performed using the touch strip of Moore. (Ex. 1087, at 3:7-9, Figs. 3-4.) Indeed, Moore discloses that "pressing the menu selection function key" designated on the touch strip to cause the microprocessor to initiate a desired program. (Ex. 1012, at 3:45-52.) Thus, it would have been apparent to a POSITA to initiate the scroll-and-select menu selection functions described with respect to Figs. 3 and 4 of Palatsi (e.g., enter the "Lights" menu or the "Messages" menu) associated with the graphical object (the row of text indicating "Lights" or

"Messages"), by pressing the touch strip location corresponding to a programmed menu selection function key, as described in Moore. (Ex. 1087, at Figs. 3, 4.) Moreover, a POSITA would have further understood the "pressing of the menu selection function key" to be a momentary contact with the touch strip (i.e., the contact-sensitive transducer), such that the controller would be operative to detect that momentary contact and initiate the menu selection action (i.e., display the "Lights" menu or the "Messages" menu) as illustrated in Fig. 3 of Palatsi. (Ex. 1012, at 3:45-52; Ex. 1087, Fig. 3.) For example, as discussed *supra* with respect to Claim 10, Palatsi teaches that the selection of one of these options can be made by waiting for a predetermined time period and then pressing the soft key again (i.e., pressing the touch strip of Moore as implemented on the mobile telephone of Palatsi) to cause the controller to initiate an associated action (i.e., change to the next menu level, or revert to the previous menu level 29 in Fig. 4 of Palatsi), resulting in the display of associated text on the display (e.g., changing from the "On" and "Off" menu options to display just the "Lights" menu label). (Ex. 1205, ¶208.) A POSITA would have also known that pressing the touch strip again when the "On" menu option is displayed in the "Lights" menu would cause the controller to initiate an action of turning on lights (e.g., LED light or backlighting on the mobile telephone display or keypad). A POSITA would have understood that touching to initiate an action would strongly suggest a single momentary contact

with the contact-sensitive transducer (i.e., the touch strip) because "land-on-lift-off" strategies (i.e., a momentary contact), as opposed to just a land-on strategy, were used in touch sensors as of the Alleged Priority Date to provide confirmation that a selection is intended prior to initiating an action (Ex. 1075, at 13-15, 22, 24). Accordingly, Palatsi in combination with Moore renders obvious each and every feature of Claim 11, and renders the claim obvious.

J. Claim 12 is obvious over Palatsi in view of Moore and Tiilikainen

209. **Claim 12**, which depends from Claim 11, recites that the "controller is operative to initiate the action in response to detection of a plurality of momentary contacts occurring within a predetermined time interval." Palatsi in combination with Moore renders obvious this limitation. As described above with respect to Claim 11, Palatsi in combination with Moore discloses that "the controller is operative, responsive to the contact-sensitive transducer to detect a momentary contact with the contact-sensitive transducer and to initiate the action associated with the identified graphical object responsive to detection of the momentary contact." Neither Palatsi nor Moore explicitly disclose a "plurality of momentary contacts occurring within a predetermined time interval" (i.e., double tapping). However, Tiilikainen renders this limitation obvious. (*Id*.) In particular, as discussed above in Section X.C, it would have been obvious to incorporate the grid-based menu selection GUI system described in Tiilikainen with the portable

telephone of Palatsi to further enhance user-friendliness.

210. Similar to both Palatsi and Moore, Tiilikainen describes selecting menu items using a single momentary contact (i.e., tapping). Specifically, Tiilikainen describes that "selection can be made by pressing with a finger or e.g. with a pen whereby the phone immediately makes a call to the chosen number." (Ex. 1088, 3:19-22.) This "pressing with a finger or [pen]" is a momentary contact. Moreover, Tiilikainen also discloses double tapping. (*Id*.) Specifically, Tiilikainen explains that "the selection can be thought to be activated by double-pressing, i.e. pressing the required column quickly two subsequent times." (Ex. 1088, 3:22-24.) By virtue of pressing twice (i.e., a plurality of momentary contacts) "quickly," the double-pressing of Tiilikainen would occur within a predetermined (i.e., quick) time interval. A POSITA would have understood that the pressing twice to initiate an action would strongly suggest a two momentary contacts with the contact-sensitive transducer (i.e., the touch strip) within a predetermined timeframe because "land-on-lift-off" strategies (i.e., a momentary contact), as opposed to just a land-on strategy, were used in touch sensors as of the Alleged Priority Date to provide confirmation that a selection is intended prior to initiating an action (Ex. 1075, at 13-15, 22, 24). Moreover, touch sensors as of the Alleged Priority Date implemented a time interval in which a lift-off must be detected (whether in the context of a single touch or double touch) to minimize the impact of detecting

"false land-ons" or "false lift-offs." (*Id.*) Combining Tiilikainen with Palatsi and Moore, therefore, renders obvious double tapping as a selection mechanism. Accordingly, it would have been just as apparent to a POSITA to use a double tapping contact with the touch strips of Moore to initiate an action, such as initiating a call or function (i.e., turning Lights "On" or "Off" as illustrated in Demonstrative Fig. 4 of Palatsi as modified by Tiilikainen (above) to increase the user-friendliness of the mobile telephone interface. Thus, Palatsi in combination with Moore and Tiilikainen renders Claim 12 obvious.

K. Claim 15 is obvious over Palatsi in view of Moore

211. **Claim 15**, which depends from Claim 1, recites that "the contact-sensitive transducer comprises one of a resistive transducer, a capacitive transducer, or a semiconductive transducer." Palatsi in combination with Moore renders obvious this limitation. Specifically, the proposed modification to Palatsi by Moore discloses this limitation. Moore describes that the touch strip (i.e., the contact-sensitive transducer of the proposed modification to Palatsi by Moore) comprises resistive material spaced from conductive material, and are controlled by applying a voltage gradient along the resistive strips and reading an output voltage that correlates to position. (Ex. 1012, at 1:60-2:5, 2:38-67, 4:37-41.) Accordingly, Moore discloses a resistive contact-sensitive transducer. Thus, Palatsi in combination with Moore renders obvious this limitation, and renders the claim

obvious.

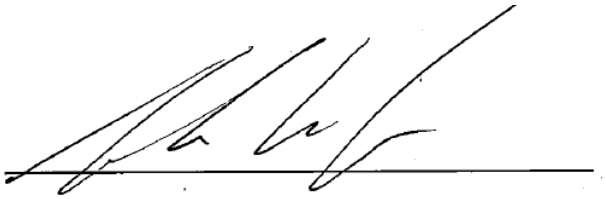
XII. CONCLUSION

212. In view of my opinions and analysis, as declared above, it is my opinion that:

a. Claims 1-11 and 15 are invalid under 35 U.S.C. § 103(a) as being obvious over Palatsi in view of Moore;

b. Claim 12 is invalid under 35 U.S.C. § 103(a) as being obvious over Palatsi in view of Moore and Tiilikainen; and

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed this 12th day of August, 2015 at Los Gatos, California.



Andrew Wolfe, Ph.D.

Wolfe Declaration Appendix A

Andrew Wolfe Ph.D.

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(408) 402-5872 (office) (408) 394-1096 (mobile)
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Education:

Ph.D. in Computer Engineering, Carnegie Mellon University, 1992
Visiting Graduate Student, Center for Reliable Computing, Stanford University, 1988-1989
M.S. in Electrical and Computer Engineering, Carnegie Mellon University, 1987
B.S.E.E. in Electrical Engineering and Computer Science, The Johns Hopkins University, 1985

Recent Employment:

Consultant, [October 2002-present]
Wolfe Consulting

Consultant on processor technology, computer systems, consumer electronics, software, design tools, and intellectual property issues. Testifying and consulting expert for IP and other technology-related litigation matters.

Sample clients include:

AMD	Nvidia	Samsung
IBM	Motorola	HTC
SMIC	AMKOR	ACER/Gateway
Dell	Honeywell	Western Digital
Intergraph	Kingston	Sonos
Moneygram	Arraycomm	Insilica
Synaptics	Activision	TPK
Mysticom	P.A.R.C.	Quester Ventures

Lecturer, [September 2013-present]
Santa Clara University

Teaching graduate courses on Computer Organization and Architecture and undergraduate courses on electronics and embedded computing..

Chief Technical Officer, [1999-2002]; Sr. VP of Business Development, [2001-2002]; VP, Systems Integration, S3 Fellow , [1998 – 1999]; Director of Technology, S3 Fellow , [1997 - 1998]
SONIC|blue, Inc, Santa Clara, CA (formerly S3 Inc.)

Strategic Business Development:
Developed and implemented strategy to reposition S3 from PC graphics into the leading networked consumer electronics company.

- Acquired Diamond Multimedia and coordinated integration of communications, Rio digital music, and workstation graphics divisions into S3.
- Identified and negotiated acquisitions to grow digital media businesses including Empeg, ReplayTV, and Sensory Science.
- Identified and negotiated strategic investments including Comsilica, Intellon, KBGear Interactive, Entridia, DataPlay and others.
- Developed strategy for integrated graphics/core-logic products and established a joint venture with Via Technologies to design and market these products.
- Negotiated divestiture of graphics chip business to Via and the workstation graphics division to ATI.

Product Planning and Development:

- Drove roadmap development within SONICblue product divisions.
- Managed Business Development for all product lines.
- Led New Product Development and Corporate Vision processes.
- Acting co-General Manager of Rio digital music business in 2nd half of 2001. Responsible for all areas of product development, business development, and cost management.
- Managed development of the Savage/MX and Savage/IX mobile 3D graphics accelerators and Savage/NB system logic products.

Public Relations, Public Policy and Investor Relations:

- Present company products and strategy at industry events such as CES, Comdex, and Microprocessor Forum.
- Discuss new products and initiatives with the press.
- Promote issues of interest to SONICblue to industry groups and in Washington.
- Brief analysts, and investors on company progress. Participate in quarterly conference calls.

IP Management and Licensing:

- Negotiated and managed partnership agreements including a critical cross-licensing agreement with Intel.
- Renegotiated technology-licensing agreements with IBM for workstation graphics products.
- Evaluated outside technology opportunities, managed video research and development, and managed corporate IP strategy with legal staff including patent filings, cross licensing, and litigation.

Consulting Professor , [1999-2002]
Stanford University, Stanford, CA

Teaching computer architecture and microprocessor design.

Assistant Professor [1991 - 1997]
Princeton University, Princeton, NJ

Teaching and research in the Electrical Engineering department. Research in embedded computing systems, multimedia, video signal processors, compiler optimization, and high performance computer architecture. Principal investigator or project manager for ~$6M in funded research.

Visiting Assistant Professor , [1992]
Carnegie Mellon University, Pittsburgh, PA

Research and preparation of teaching materials on advanced microprocessor designs including new superscalar and superpipelined processor architectures.

Founder and Vice President and Consultant, [1989 - 1995]
The Graphics Technology Company, Inc., Austin, TX

Founded company to develop touch-sensitive components and systems for the first generation of PDA devices and interactive public systems. Obtained financing from Gunze Corp., Osaka, Japan. Company is now part of 3M.

Senior Electrical Engineer, [1989]
ESL - TRW, Advanced Technology Division, Sunnyvale, CA

Designed the architecture for an Intel i860-based multiple-processor digital signal processing system for advanced military applications. Designed several FPGA interface chips for VME-bus systems.

Design Consultant, [1986 -1987]
Carroll Touch Division, AMP Inc., Round Rock, TX

Developed several new technologies for touch-screen systems. Designed the first ASIC produced for AMP, a mixed-signal interface chip for controlling touch-screen sensors. Developed the system electronics, system firmware, and customer utility software for numerous products including those based on the new ASIC.

Senior Design Engineer, [1983 -1985]
Touch Technology Inc., Annapolis, MD

Advisory Boards:

Director, Turtle Beach Corporation (NASDAQ:HEAR) (formerly Parametric Sound Corporation), KBGear Interactive, Inc., Comsilica, Inc., Rioport.com, various S3 subsidiaries.

Technical Advisory Boards, Ageia, Inc., Intellon, Inc., Comsilica, Inc., Entridia, Inc., Siroyan, Ltd., BOPS, Inc, Quester Venture Funds

Carnegie Mellon University Silicon Valley Advisory Board; Johns Hopkins University Tech Transfer Advisory Board

Awards:

Micro Test-of-Time Award (in recognition of one of the ten most influential papers of the first 25 years of the symposium), 2014
Business 2.0 "20 Young Executives You Need to Know", 2002
Walter C. Johnson Prize for Teaching Excellence, 1997.
Princeton University Engineering Council Excellence in Teaching Award, Spring 1996
AT&T/Lucent Foundation Research Award, 1996.
Walter C. Johnson Prize for Teaching Excellence, 1995
IEEE Certificate of Appreciation, 1995, 2001.
AT&T Foundation Research Award, 1993.
Semiconductor Research Corporation Fellow, 1986 - 1991.
Burroughs Corporation Fellowship in Engineering, 1985 - 1986.

Professional Activities:

Program Chair: Micro-24, 1991, Hot Chips 13, 2001.

General Chair: Micro-26, 1993, Micro-33, 2000.

Associate Editor: IEEE Computer Architecture Letters; ACM Transactions in Embedded Computing Systems

Speaker at CES, WinHec, Comdex, Intel Dev. Forum, Digital Media Summit, Microprocessor Forum, etc.

Keynote speaker at Micro-34, ICME 2002

IEEE B. Ramakrishna Rau Award committee – 2012-2014

IEEE Computer Society Awards Committee - 2015

Over 50 refereed publications.

Patents:

U.S. Pat. 5,041,701 – *Edge Linearization Device for a Contact Input System*, Aug. 20, 1991.
U.S. Pat. 5,438,168 – *Touch Panel*, Aug. 1, 1995.
U.S. Pat. 5,736,688 – *Curvilinear Linearization Device for Touch Systems*, Apr. 7, 1998.
U.S. Pat. 6,037,930 – *Multimodal touch sensitive peripheral device*, March 14, 2000.
U.S. Pat. 6,408,421 – *High-speed asynchronous decoder circuit for variable-length coded data*, June 18, 2002.
U.S. Pat. 6,865,668 – *Variable-length, high-speed, asynchronous decoder circuit*, March 8, 2005
U.S. Pat. 7,079,133 – *Superscalar 3D Graphics Engine*, July 18, 2006
EP 1 661 131 B1 – *PORTABLE ENTERTAINMENT APPARATUS*, Jan. 21, 2009
U.S. Pat. 7,555,006 – *Method and system for adaptive transcoding and transrating in a video network*, June 30, 2009
U.S. Pat. 7,996,595 – *Interrupt Arbitration for Multiprocessors*, Aug. 9, 2011
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U.S. Pat. 8,243,045 – *Touch-sensitive display device and method*, August 14, 2012
U.S. Pat. 8,244,982 – *Allocating processor cores with cache memory associativity*, August 14, 2012
U.S. Pat. 8,260,996 – *Interrupt Optimization for Multiprocessors*, Sept. 4, 2012
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101200740 (KR) – *OLED display and sensor*, November 7, 2012
101200741 (KR) – T*ouch-sensitive display device and method*, November 7, 2012
U.S. Pat. 8,321,614 – *Dynamic scheduling interrupt controller for multiprocessors*, Nov. 27, 2012
U.S. Pat. 8,352,679 – *Selectively securing data and/or erasing secure data caches responsive to security compromising conditions*, Jan. 8, 2013
U.S. Pat. 8,355,541 – *Texture Sensing*, Jan. 15, 2013
U.S. Pat. 8,370,307 – *Cloud Data Backup Storage Manager*, Feb. 5, 2013
U.S. Pat. 8,398,451 – *Tactile Input Interaction*, March. 19, 2013
JP 5241032 B2 – *Routing Across Multicore Network Using Real World or Modeled Data*, April 13, 2013
ZL201010124820.3 – *Interrupt Optimization for Multiprocessors*, April 17, 2013
U.S. Pat. 8,428,438 – *Apparatus for Viewing Television with Pause Capability*, April 23, 2013
JP 5266197 B2 – *Data Centers Task Mapping*, May 10, 2013
U.S. Pat. 8,508,498 – *Direction and Force Sensing Input Device*, August 13, 2013
U.S. Pat. 8,547,457 – *Camera Flash Mitigation*, October 1, 2013
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U.S. Pat. 8,628,478 – *Microphone for remote health sensing*, January 14, 2014
101362017 (KR) – *Thread Shift: Allocating Threads to Cores*, Feb. 5, 2014
101361928 (KR) – *Cache Prefill on Thread Migration*, Feb. 5, 2014
101361945 (KR) – *Mapping Of Computer Threads onto Heterogeneous Resources*, Feb. 5, 2014
JP 5484580 B2 – *Task Scheduling Based on Financial Impact*, Feb. 28, 2014
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JP 5487307 B2 – *Mapping Of Computer Threads onto Heterogeneous Resources*, Feb. 5, 2014
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101373925 (KR) – *Allocating Processor Cores with Cache Memory Associativity*, March 6, 2014
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101388735 (KR) – *Routing Across Multicore Networks Using Real World or Modeled Data*, April 17, 2014
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U.S. Pat. 8,726,043 – *Securing Backing Storage Data Passed Through a Network*, May 13, 2014
ZL201010124826.0 – *Dynamic scheduling interrupt controller for multiprocessors*, May 14, 2014
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U.S. Pat. 8,738,949 – *Power Management for Processor*, May 27, 2014

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101426341 (KR) – *Processor core communication in multi-core processor*, May 23, 2014
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U.S. Pat. 8,824,666 – *Noise Cancellation for Phone Conversation*, Sept. 2, 2014
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U.S. Pat. 8,882,677 – *Microphone for remote health sensing*, Nov. 11, 2014
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Apple Inc. v. Motorola, Inc. and Motorola Mobility, Inc., C.A. 337-TA-750 (U.S. Int'l Trade Commission), C.A. No. 10-661 (W.D. Wisc.), 10-662 (W.D. Wisc.), and Motorola Mobility, Inc. v. Apple Inc., 10-23580 (S.D. Fla.)	ITC	337-TA-750
Auburn University v. IBM	M.D. Alabama	3:09-cv-694-MEF
In the Matter of Certain Universal Serial Bus ("USB") Portable Storage Devices, Including USB Flash Drives (Trek v Kingston, Imation)	ITC	337-TA-788
In the Matter of CERTAIN PORTABLE ELECTRONIC DEVICES AND RELATED SOFTWARE (Apple V HTC)	ITC	337-TA-797
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In the Matter of CERTAIN ELECTRONIC DEVICES WITH GRAPHICS DATA PROCESSING SYSTEMS, COMPONENTS THEREOF AND ASSOCIATED SOFTWARE (S3 v Apple)	ITC	337-TA-813
Walker Digital, LLC v. Ayre Acoustics, Inc. et al	ITC	337 -TA-824
ENOVA TECHNOLOGY CORPORATION v INITIO CORPORATION, INITIO CORPORATION (California), WESTERN DIGITAL CORPORATION, BUFFALO INC., and BUFFALO TECHNOLOGY (USA), INC.	District of Delaware	C.A. 10-040LPS
In the Matter of Certain Consumer Electronics and Display Devices and Products Containing Same (GPH v HTC)	ITC	337-TA-836
In the Matter of Computers and Computer Peripheral Devices and Components Thereof and Products Containing the Same (TPL v Kingston et. al)	ITC	337-TA-841
In the Matter of Certain Electronic Imaging Devices (Flashpoint)	ITC	337-TA-850
Pacing Technologies LLC v. Garmin International and Garmin USA, Inc.	Southern Dist. of California	CV 12-1067 BEN
ProconGPS, Inc. v. Star Sensor, LLC et al.	Northern District of California	3:12-cv-01903-SI
Spireon, Inc. v. CallPass Tech, LLC et al	Northern District of California	3:12-cv-01903-SI
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Florida Atlantic University Research Corporation, et al. v. TPV Technology Limited, et al	S.D. Fla.	09-12-CV-80701 09-12-CV-80694 09-12-CV-80697
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Inter Partes Review of: U.S. Patent No.: 8,176,267 (SMI v Phison)	PTO	IPR2013-00473

Immersion Technologies v HTC CORPORATION et al.	District of Delaware	1:12-cv-00259-UNA
Smartflash v. Samsung et al.	E. D. Texas	6:13-CV-448
Kangaroo Media, Inc. et al. v. YinzCam, Inc.	District of Western Pennsylvania	2:12-cv-00382-JFC
Inter Partes Review of: U.S. Patent No. 8,176,267 (CATR v Kingston)	PTO	IPR2015-00149
Inter Partes Review of: U.S. Patent No. 6,890,188 (Imation v Kingston)	PTO	IPR2015-00066