

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROCHIP TECHNOLOGY INC.,
Petitioner,

v.

APTIV TECHNOLOGIES AG AND APTIV TECHNOLOGIES LIMITED,
Patent Owners.

Case No. IPR2024-00230
U.S. Patent No. 11,176,072

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 11,176,072**

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LISTING OF EXHIBITS

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1001	U.S. Patent No. 9,460,037 (“’037 Patent”)
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1003	U.S. Patent No. 9,619,420 (“’420 Patent”)
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1006	Patent Prosecution History for U.S. Patent No. 9,645,962
1007	U.S. Patent No. 10,545,899 (“’899 Patent”)
1008	Patent Prosecution History for U.S. Patent No. 10,545,899
1009	U.S. Patent No. 11,176,072 (“’072 Patent”)
1010	Patent Prosecution History for U.S. Patent No. 11,176,072
1011	U.S. Patent No. 11,681,643 (“’643 Patent”)
1012	Patent Prosecution History for U.S. Patent No. 11,681,643
1013	Declaration of Eric Welch
1014	U.S. Patent Publication No. 2006/0206650 (“Chang”)
1015	U.S. Patent Publication No. 2009/0268743 (“Chang II”)
1016	U.S. Patent Publication No. 2004/0019732 (“Overtoom”)
1017	U.S. Patent Publication No. 2006/0195625 (“Hesse”)
1018	<i>Universal Serial Bus Specification</i> , Revision 2.0, April 27, 2000 (“USB 2.0 Specification”)
1019	<i>Universal Serial Bus Type-C Cable and Connector Specification</i> , Revision 1.2, March 25, 2016

Exhibit	Description
1020	<i>Universal Serial Bus Power Delivery Specification</i> , Rev. 3.0, V1.0a, March 25, 2016
1021	<i>Universal Serial Bus Implementers Forum Full and Low Speed Electrical and Interoperability Compliance Test Procedure</i> , Revision 1.3, February 2004
1022	<i>On-The-Go and Embedded Host Supplement to the USB Revision 2.0 Specification</i> , Revision 2.0 version 1.1a, July 27, 2012 (the “OTG Supplement”)
1023	<i>Universal Serial Bus 3.0 Specification</i> , Revision 1.0, November 12, 2008 (“USB 3.0 Specification”)
1024	Declaration of Jeffrey L. Ravenscraft re USB Specifications.
1025	U.S. Patent No. 8,683,085 (“Castleberry”)
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1027	INTENTIONALLY OMITTED
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1029	U.S. Patent No. 8,447,598 (“Chutorash”)
1030	U.S. Patent No. 8,694,803 (“Rafiee”)
1031	GL620USB-A: GeneLink USB PC-to-PC Networking Controller, Specification 1.6, November 17, 2000
1032	U.S. Patent Publication No. 2008/0005262 (“Wurzburg”)
1033	U.S. Patent Publication No. 2007/0255885 (“Bohm ’885”)
1034	U.S. Patent No. 7,162,566 (“Lin”)
1035	<i>PL-2501 Product Brochure</i> , Prolific Technology Inc., September 11, 2002
1036	<i>NET1080 USB TurboCONNECT Preliminary Specification</i> ,

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	Revision 0.6, NetChip Technology, Inc., January 31, 2000
1037	<i>M5632 Preliminary Product Brief</i> , ALi Corporation, September 15, 2002
1038	U.S. Patent No. 7,085,876 (“Lai”)
1039	U.S. Patent Publication No. 2009/0185559 (“Chen”)
1040	U.S. Patent No. 3,916,380 (“Fletcher”)
1041	U.S. Patent No. 7,057,413 (“Young”)
1042	U.S. Patent Publication No. 2006/0227759 (“Bohm ’759”)
1043	Oral Order, dated December 19, 2017 in <i>Microchip Technology Incorporated v. Delphi Automotive Systems, LLC et al.</i> , Case No. 1:17-cv-01194-JDW (D. Del.)
1044	INTENTIONALLY OMITTED
1045	Aptiv Technologies Limited’s Responses and Objections to Microchip Technology Inc.’s First Set of Interrogatories (Nos. 1-11), dated June 12, 2023 in <i>Aptiv Technologies AG, v Microchip Technology Inc.</i> , Case No. 1:23-cv-00307-JDW (D. Del.)
1046	U.S. Patent Publication No. 2007/0156293 (“Kellzi”)
1047	U.S. Patent No. 7,502,878 (“Wright”)
1048	INTENTIONALLY OMITTED
1049	<i>USB in Automotive: Not Just for PCs Anymore</i> , Brian Ellis, Cypress Semiconductor Corp., Electronic Product News, September 1, 2006
1050	<i>The Car Entertainment System</i> , Niels Koch (published as Chapter 23 in Part 5 (“Infotainment and Navigation Systems” of <i>New Trends and Developments in Automotive System Engineering</i> , Marcello Chiaberge (Editor), InTech, 2011 (2014 Reprint))

Exhibit	Description
1051	<i>The Car Entertainment System</i> , Niels Koch (published as Chapter 23 in Part 5 (“Infotainment and Navigation Systems” of New Trends and Developments in Automotive System Engineering, Marcello Chiaberge (Editor), IntechOpen, 2011)
1052	U.S. Patent No. 9,864,711 (“Wang”)
1053	U.S. Patent Publication No. 2004/0088449 (“Sakaki”)
1054	Anchor Chips Single-Chip EZ-Link (AN2720SC), product brochure dated November 1998
1055	<i>CMOS Circuit Design, Layout, and Simulation</i> , R. Jacob Baker, IEEE Press, 1st Edition (1998) (“Baker”)
1056	Library of Congress Catalog Record for <i>CMOS Circuit Design, Layout, and Simulation</i> , R. Jacob Baker, IEEE Press, 1st Edition (1998)
1057	U.S. Copyright WebVoyage Record for <i>CMOS Circuit Design, Layout, and Simulation</i> , R. Jacob Baker, IEEE Press, 1st Edition (1998)
1058	Declaration of Mariellen F. Calter re <i>CMOS Circuit Design, Layout, and Simulation</i> , R. Jacob Baker, IEEE Press, 1st Edition (1998)
1059	Fairchild Semiconductor USB Switch listing from October 16, 2011 printed from Internet Archive Wayback Machine
1060	Fairchild Semiconductor FSUSB63 3:1 High-Speed USB 2.0 Switch / Multiplexer, dated November, 2010
1061	Internet Archive Affidavit of Nathaniel E Frank-White re Exhibits 1031, 1035, 1037 and 1054
1062	Internet Archive Affidavit of Nathaniel E Frank-White re Exhibits 1036, 1049, 1050/1051, and 1058

Exhibit	Description
1063	Maxim 4989 Datasheet (USB 2.0 Hi-Speed 2-of-4 Crosspoint Switch), dated August 2008
1064	Cypress Semiconductor AN96527 - Designing USB Type-C Products Using Cypress's CCG1 Controllers, dated June 3, 2015
1065	Internet Archive Affidavit of Nathaniel E Frank-White re Exhibits 1059, 1063, 1064, 1068, and 1071
1066	U.S. Patent No. 9,104,821 ("Dunstan")
1067	U.S. Patent Publication No. 2010/0265179 ("Ram")
1068	Fairchild Semiconductor FSUSB30 Low-power, Two-Port, High-Speed USB2.0 Switch, dated January 2007
1069	<i>The ART of Electronics</i> , P Horowitz and W. Hill, Cambridge University Press, 2 nd Edition (1989)
1070	<i>Universal Serial Bus: Micro-USB Cables and Connectors Specification</i> , Revision 1.01, April 4, 2007
1071	Fairchild Semiconductor FSA880 / FSA881 – USB Port 2:1 Switch with Accessory and Charger Detection, dated November 2011
1072	Aptiv's Supplemental Infringement Contentions (Redline), dated November 8, 2023 in <i>Aptiv Technologies AG, v Microchip Technology Inc.</i> , Case No. 1:23-cv-00307-JDW (D. Del.) [PROTECTIVE ORDER MATERIAL - FILED UNDER SEAL]
1073	Microsoft Computer Dictionary, 4 th ed., Microsoft Press, 1999 ("Microsoft Dictionary")
1074	STMicrosystems, RM0033 Reference Manual, STM32F205xx, STM32F207xx, STM32F215xx and STM32F217xx advanced ARM-based 32-bit MCUs, Doc ID 15403 Rev 2, December 2010
1075	Joint Claim Construction Statement (Dkt. No. 115), dated December 6, 2023 in <i>Aptiv Technologies AG, v Microchip Technology Inc.</i> , Case No. 1:23-cv-00307-JDW (D. Del.)

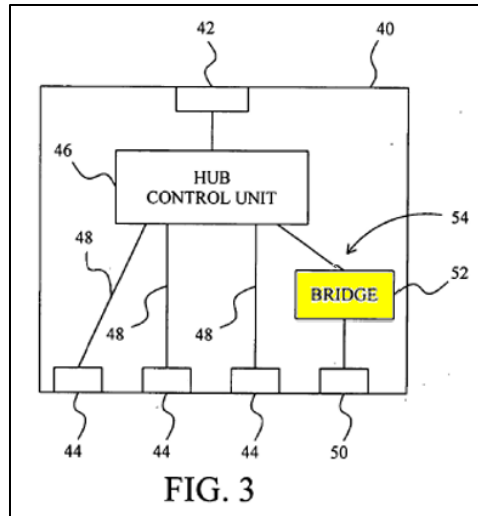
I. INTRODUCTION

Petitioner requests *inter partes* review (“IPR”) of claim 1 (the “Challenged Claim”) of U.S. Pat. 11,176,072 (the “’072 patent,” EX1009). There is more than a reasonable likelihood that Petitioner will prevail with respect to the Challenged Claim.

The ’072 patent purports to solve the “problem” of connecting an upstream USB host via a USB hub to a downstream USB product that may operate either as a USB host¹ or a USB device. *See* EX1009, 3:21-48, 4:7-15. The Challenged Claim allegedly solves this problem by adding two well-known components (*viz.*, a “routing switch” and “bridge”) to a standard USB hub. *See id.*, claim 1. The purported novelty is routing USB communications (1) through the bridge (via a host-to-host connection) or (2) around the bridge (via a host-to-device connection), depending on whether the downstream USB product is operating in host or device mode. *Id.*, 4:16-33. Combining Chang (EX1014) and Chang II (EX1015) renders the Challenged Claim obvious.

In particular, Chang already connected an upstream host to a downstream host through a USB hub by adding a bridge to the hub. EX1014, Fig. 3.

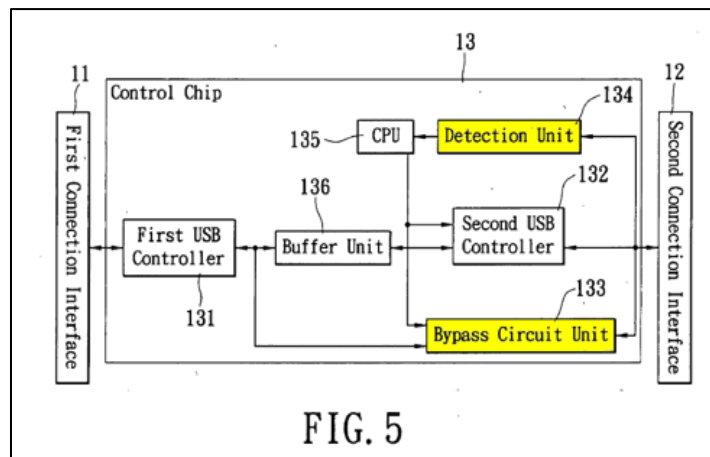
¹ The ’072 patent is written in the context of “dual-role” USB products, *e.g.*, a smartphone, that can operate as either host or device. *See* EX1009, 3:7-20.



CHANG

Chang did not use a bypass path (or a switch to access a bypass path), because Chang used a dedicated host port instead of a dual-role port (*i.e.*, a port that supported a product that could operate in either host or device mode). *Id.*

Chang II, however, supported dual-role products and selected a bypass route based on the host/device determination of the “detection unit.” EX1015, Fig. 5.



CHANG II

Indeed, dual-role products were well-known to POSITAs well before the '072

patent priority date. In fact, the '072 patent observes that “leading mobile device manufacturers and system designers [began] designing their mobile device products (i.e., smartphones, tablets, etc.) to support both USB Host and USB Device roles” before 2013. EX1009, 2:55-62. Castleberry expressly teaches that dedicated ports (like Chang) “add[ed] overhead and increase[d] the cost associated with devices that are implemented with both Host and Device functionality.” EX1025, 1:41-43. Accordingly, it would have been obvious to a POSITA to apply Chang II’s teachings and the knowledge of a POSITA (viz., dual-role port with bypass path) to Chang. The Challenged Claim—which represents nothing more than the expected result of combining known techniques (viz., Chang’s system in view of dual-role port detection and routing)—is obvious. Petitioner respectfully requests that the Board find the Challenged Claim unpatentable.

II. REQUIREMENTS FOR *INTER PARTES* REVIEW

This Petition complies with all statutory requirements, as well as 37 C.F.R. §§42.101 et seq. and should be accorded a filing date pursuant to 37 C.F.R. §42.106.

A. Certification

Petitioner certifies that the '072 patent “is available for *inter partes* review and that the petitioner is not barred or estopped from requesting an *inter partes*

review challenging the patent claims on the grounds identified in the petition.” 37 C.F.R. §42.104(a).

B. Identification of Challenges and Requested Relief

Under 37 C.F.R. §§42.104(b) and 42.22, Petitioner requests that the Board institute IPR on the Challenged Claim and cancel it as unpatentable. The prior art² references combined to form the Grounds are:

Exhibit	Reference	Prior Art
1014	U.S. Pub. 2006/0206650 (“Chang”) ³	Post-AIA §102(a)(2)
1015	U.S. Pub. 2009/0268743 (“Chang II”) ⁴	Post-AIA §102(a)(2)

² The ’072 patent claims priority to a provisional application filed on September 26, 2013. EX1009.

³ Chang was filed August 16, 2005 and was published September 14, 2006. EX1014.

⁴ Chang II was filed May 22, 2008 and published October 29, 2009. EX1015.

Note that the first named inventor on Chang II (Chi-Tung Chang) is different than Chang (Ming-Te Chang).

Exhibit	Reference	Prior Art
1029	U.S. Pat. 8,447,598 (“Chutorash”) ⁵	Post-AIA §102(a)(2)

The Grounds asserted are:

Ground	Claim(s)	Basis for Unpatentability
1	1	Obviousness under 35 U.S.C. §103 over Chang in view of Chang II and the Knowledge of a POSITA
2	1	Obviousness under 35 U.S.C. §103 over Chang in view of Chang II, Chutorash, and the Knowledge of a POSITA

This Petition is supported by the accompanying Expert Declaration of Eric Welch (“Welch,” EX1013).

III. TECHNOLOGY BACKGROUND

A. USB Basics

The ’072 patent provides its disclosures against the backdrop of the Universal Serial Bus (“USB”) standards and products that follow those standards. *See* EX1009, 1:21-3:48. USB products were ubiquitous more than a decade before the ’072 patent priority date, and a POSITA would have been intimately familiar

⁵ Chutorash was filed January 14, 2011 and claims priority through various continuation applications and a provisional application to December 5, 2007. EX1029.

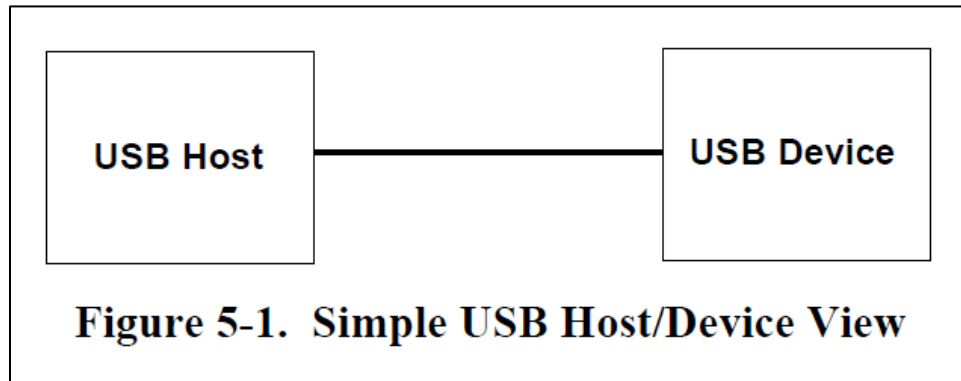
with the USB standards (*infra* §IV.C) promulgated by the USB Implementers Forum, Inc. (“USB-IF”). Among others, these standards include *Universal Serial Bus Specification*, Revision 2.0 (“[USB 2.0 Specification](#),” EX1018) published in April, 2000 and *Universal Serial Bus 3.0 Specification*, Revision 1.0 published in November, 2008 (“USB 3.0 Specification,” EX1023). The USB 3.0 Specification adds higher speeds, but “has similar architectural components as USB 2.0.” EX1023, §3.1; *see also id.*, §3 (“USB 3.0 ... provides backward compatibility with USB 2.0.”). The USB industry standards contain several background concepts relevant here. Welch, ¶¶50-54.

1. Hosts and Devices

The USB specifications set forth two USB product⁶ roles: “host” and “device.” Welch, ¶55; *see also* EX1018, §4.9 (USB Host) and §5.2.2 (USB Devices). The USB architecture “connects USB devices with the USB host.” *Id.*, §4.1.1. The USB specifications employ a master/slave architecture, where the “host” (master) commands a “device” (which acts as slave). Welch, ¶¶55-58, 62-63; *see also* EX1025, 1:17-20. “The USB interconnect supports data traffic

⁶ Some literature uses the term “device” generically, referring to products that may operate as device or host. For clarity, this Petition only uses “device” to refer to USB products operating in device mode.

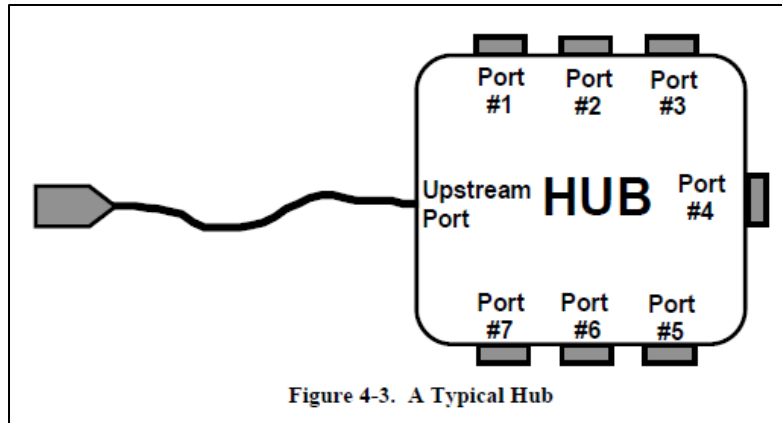
between a host and a USB device.” EX1018, 303. When first published, the USB 2.0 Specification contemplated “only one host in any USB system.” *Id.*, §4.1.1.1. In the simplest configuration, one USB host (*e.g.*, personal computer) connected to one USB device (*e.g.*, keyboard), as shown below. *Id.*, Fig. 5-1.



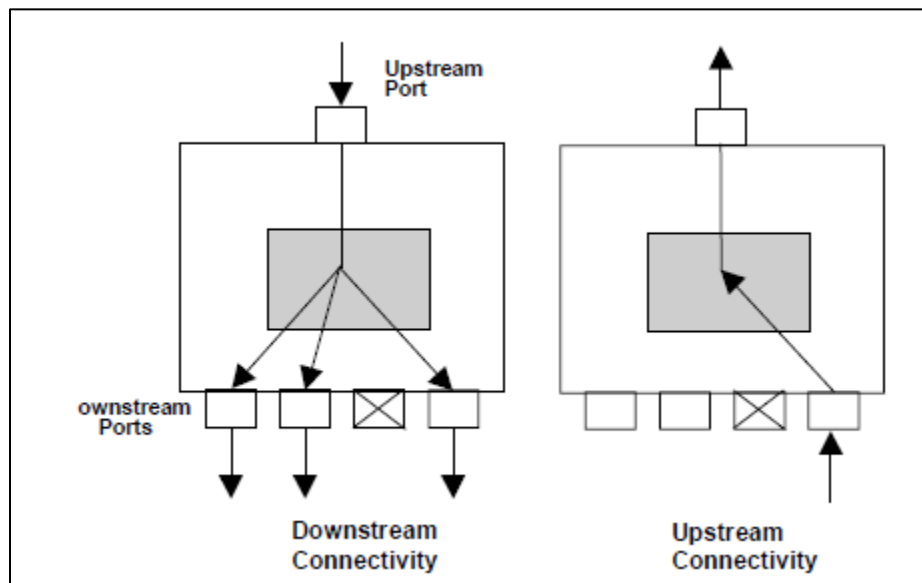
Well before 2013, other USB configurations (with additional devices and/or hosts) were both possible and well-known. *See infra* §III.A.2 (hubs) and §III.C (bridges).

2. USB Hubs

Systems with multiple USB devices have long been known. *See* EX1018, Chapter 11 (“Hub Specification”). The USB 2.0 Specification explains that a “hub” “provides additional connections to the USB.” *Id.*, 34. The hub’s attachment points are called “ports.” *Id.*, 36. “The upstream port of a hub connects the hub towards the host,” as shown in the “typical hub” below. *Id.*, 50-51. The remaining hub ports are “downstream” ports for connecting USB products. *Id.*



“In the downstream direction, hubs operate in a broadcast mode,” with upstream host communications sent to all enabled downstream devices. EX1018, 327; *see also id.*, 33, 38. USB 2.0 Specification Fig. 11-2 (below) shows both “downstream” (left) and “upstream” (right) communications.



A hub enables an upstream host (*e.g.*, PC) to simultaneously connect to multiple downstream devices (*e.g.*, keyboard, mouse, etc.). Welch, ¶¶65-68.

B. Dual-Role Products

“When the USB standard was developed, it was assumed that the Host and

Device functions were separate and permanent, meaning that a Host unit could never function as a Device unit and vice versa.” EX1025, 1:21-24. However, it was quickly recognized that certain products may sometimes act as host and other times as device. Welch, ¶¶69-73; EX1016, Abstract (discussing “dual-role devices (OTG devices)”); EX1032, [0007] (discussing “dual-role peripheral devices” such as “dual-role USB printer”), [0052] (“dual-role USB Digital Versatile Disc (DVD) read/write drive, among others.”), and [0102]; EX1033, [0040]. Thus, “the USB standard [added] the possibility of a unit that can function in either Host or Device mode.” EX1025, 1:25-27. The USB-IF standardized this functionality in *On-The-Go and Embedded Host Supplement to the USB Revision 2.0 Specification* (“OTG Supplement,” EX1022) in December, 2001. See EX1022, §1.1.

Initially called “Dual Role Device[s],” such products were later renamed “On-The-Go [OTG] Device[s].” EX1022, Revision History, 2 (replacing “Dual Role Device” with “On-The-Go Device.”). By 2009, the OTG Supplement provided for “[d]ynamic role swaps during active connections.” *Id.*; see also *id.*, §1.1. However, neither the OTG Supplement nor the USB 3.0 Specification changed the single-host architecture of USB. See EX1023, §3.1 (“The baseline structural topology ... consists of ... a single host.”). In simple terms, with OTG, one product operates as host and another as device (while the products could “swap” modes, there was always just a host-to-device connection). Welch, ¶¶59,

69-73. In contrast, the '072 patent upstream host always operates as host regardless of whether the downstream product operates as host or device. See §IV.A.

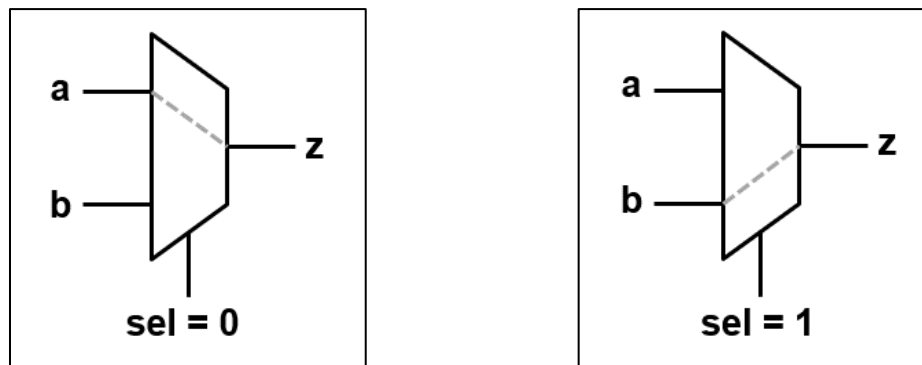
1. Host/Device Detection

Naturally, the proliferation of dual-role products was accompanied by a proliferation of dual-role ports, because dedicated ports “add[ed] overhead and increase[d] the cost associated with devices that are implemented with both Host and Device functionality.” EX1025, 1:41-43. Various prior art approaches have been used to detect host/device status. Welch, ¶¶74-87. For example, POSITAs were well aware prior to 2013 of measuring the data line pull-up/pull-down resistance values specified in the USB Specifications (*e.g.*, using a voltage divider) to determine the host/device status of connected products. *Id.*, ¶¶75-78 (discussing termination resistance requirements in USB 2.0 Specification, Chapter 7); *see also*, *e.g.*, EX1032, [0005] (explaining use of data line for host/device detection); EX1025, 7:30-52 (describing various “suitable way[s]” to detect downstream USB products).

It was also well-known to POSITAs by 2013 that, in OTG implementations, the physical connector and “ID Pin” could be used to ascertain host/device status. See EX1022, §3.1.1, §4.2.4; Welch, ¶81.

2. Routing Switches

Various switches, multiplexers, and the like have existed for many decades. *See, e.g.*, EX1040 (describing “switch controller”). Such components connect particular input and output ports, typically for signal routing purposes. Welch, ¶88. For example, the well-known 2:1 multiplexing switch, shown below, enables connecting either signal “a” or “b” to signal “z” via the “sel” (select) control signal. *Id.*, ¶89.



Commercial USB multiplexer switches were likewise well-known. *See* EX1059; EX1060; EX1068; Welch, ¶¶90-91. Where multiple input **and** multiple output ports exist, the well-known crossbar switch can route any input to any output. *See, e.g.*, EX1040, 4:39-5:29; Welch, ¶¶91-92. Multiplexers, crossbars, and related signal routing circuits were basic, easy to use electronic building blocks well-known to POSITAs before 2013. EX1041, 1:20-36 (crossbar switch); EX1055, 284-288; Welch, ¶¶93-96.

It was further well-known to use these switches for the specific purpose of routing USB communications emanating from a product to the appropriate path

upon detection of whether the product is operating in host or device mode. For example, Hesse discloses a “port router” (crossbar switch) that routes ports to the appropriate “port handler” depending on whether the USB product is operating in host or device mode. EX1017, Fig. 6, [0056]-[0057] (port routing depending on unit’s configuration). Similarly, Wang discloses a “switching structure” to route USB ports to the appropriate path depending on host or device detection. EX1052, Fig. 1, 3:7-20; *see also* EX1053, Fig. 1, [0031]-[0034] (switching data line connections based on host/device mode detection); Welch, ¶95.

C. Host-to-Host Bridges

It was sometimes desirable to connect two USB hosts, *e.g.*, connecting two PCs (each a USB host) to share/transfer files. *See, e.g.*, EX1034, 5:56-59; EX1035; Welch, ¶97. While the USB 2.0 Specification did not expressly describe host-to-host connections, such connections could still comply with the USB 2.0 Specification. *See, e.g.*, EX1034, 7:7-11 (“USB specification revision 2.0 compliant,”); EX1035 (“Full compliance with the USB Specification v2.0”); EX1037 (“USB Specification revision 2.0 Compliant”). The mechanism creating a host-to-host connection was often called a “bridge,”⁷ and prior to 2013 USB host-

⁷ The term “bridge” is descriptive—similar to a bridge connecting two riverbanks, a USB “bridge” connects two hosts.

to-host bridges were very well-known to POSITAs. *See, e.g.*, EX1034 (filed in 2004), Abstract (“transferring information between two hosts”); EX1035 (2002 product brochure) (“USB Host-to-Host Bridge Controller”); EX1038, 1:38-40 (discussing “USB bridge” circa 2003); EX1031 (commercial prior art bridge); EX1036 (same); EX1037 (same); EX1039, [0004] (connecting hosts through “USB bridge”); EX1015, [0002] (same). Indeed, in 2005, USB bridges were so well-known that Chang called them “prior art” which need “not [be] described in detail.” EX1014, [0020]; Welch, ¶¶98-99.

D. Automotive USB Applications

The '072 patent describes prior art USB deployments in automobiles. EX1009, 1:49-2:40. Indeed, while USB technology originated with the proliferation of personal computers in the 1990s, USB technology is not limited to any particular device type or environment. Welch, ¶100. As the USB 3.0 Specification stated in 2008, “USB is the most successful PC peripheral interconnect ever defined and it has migrated heavily into the [consumer electronics] and Mobile segments.” EX1023, §1.1. And “USB has gone beyond just being a way to connect peripherals to PCs,” with devices like PDAs and smartphones acting as hosts. *Id.* More generally, by 2008, the USB protocol was

even “being picked up and used in many nontraditional applications.”⁸ *Id.*

USB automotive applications were well-known⁹ and a natural fit for USB technology for at least two reasons. Welch, ¶101. First, by 2013, many vehicles included USB-compatible embedded host computers (similar to PCs in many respects) in the form of computerized control and infotainment systems. *See, e.g.*, EX1029, Figs. 1, 3, and 27-30; 1:20-5, 14:40-53, and 27:4-55. Second, numerous portable consumer products (like GPS/navigation, smartphones, and media players) with USB ports had entered the market. *Id.*

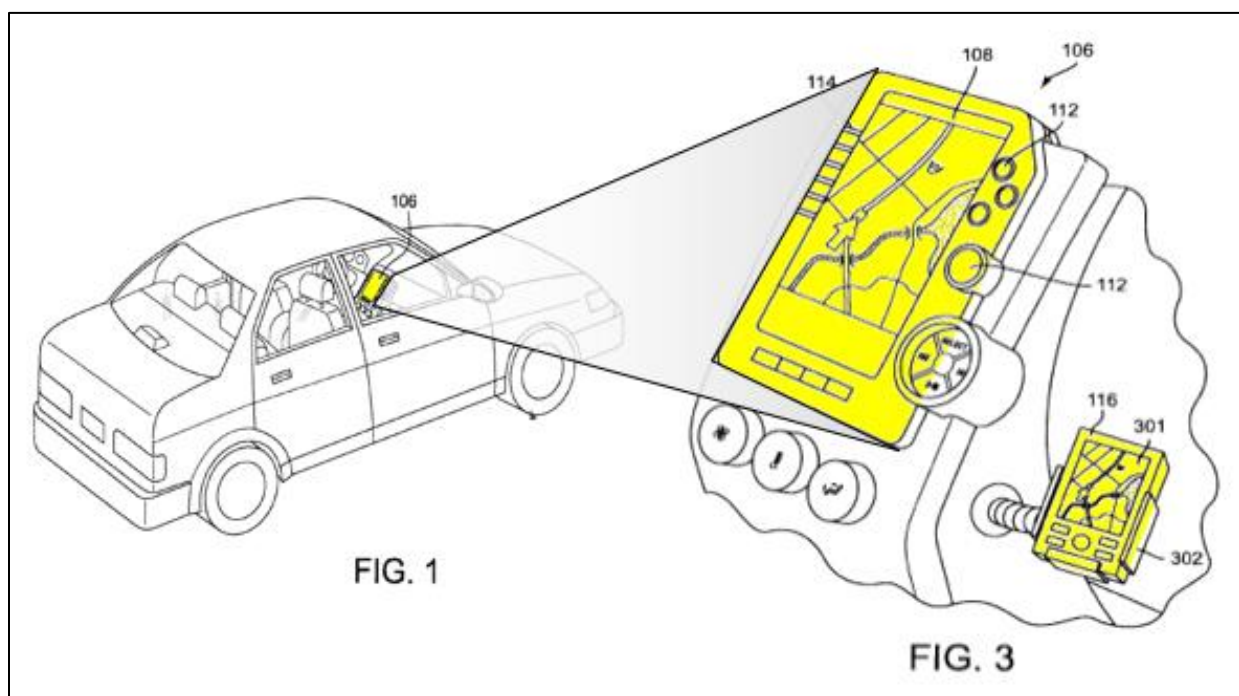
Indeed, by 2002, USB hubs were already used in automobile entertainment systems. *See* EX1016, Abstract and Fig. 1 (describing a “Dual-Role Compatible USB Hub” for “vehicle entertainment systems”). A 2006 article titled “USB In Automotive: Not Just For PCs Anymore!” explained that because “the car has become a PC on wheels” and “consumer electronics are PC depend[en]t,” employing USB in the automobile will avoid “reinvent[ing] the wheel.” EX1049, 1. The article states that USB hosts can be located in “either the portable consumer

⁸ By 2013, USB products included mice, keyboards, printers, scanners, PDAs, mobile phones, headsets, speakers, thumb drives, hard drives, fans, GPS, CD/DVD drives, camcorders, and many others. Welch, ¶100.

⁹ The ’072 patent essentially admits this. EX1009, 1:49-50.

device or the infotainment system.” *Id.*

U.S. Pat. 8,447,598 (“Chutorash,” EX1029) (discussed *infra* §VI.C) provides another automotive USB example. Chutorash discloses a “vehicle control system 106 (e.g., media system ...)” shown in Figs. 1 and 3 below, *viz.*, an infotainment system. EX1029, 5:31-33. Chutorash’s vehicle control system includes “a USB connector or interface 2728, 2744” that is “within vehicle 100” for connecting “mobile phone 2734,” “PDA 2746,” “media player 2752,” etc. to an “embedded host.” *Id.*, 27:4-28; *see also* Fig. 27.



Such vehicle deployments were “scalab[e]” and “straight forward and easy to implement.” EX1050, 19; Welch, ¶¶102-104.

IV. THE '072 PATENT

The '072 patent is titled “Flexible Mobile Device Connectivity to

Automotive Systems with USB Hubs” and claims priority through a provisional application to September 26, 2013, making it a post-AIA patent. The ’072 patent contains a single claim.

A. Summary of the Patent

The ’072 patent “BACKGROUND” (including Figs. 1-3) reprises the roles of USB hosts, devices, and hubs, largely as described in the USB 2.0 Specification. For example, the ’072 patent explains that USB employs an architecture that connects a “USB Host or master” with “a USB Device or slave.” EX1009, 1:37-42. The ’072 patent further states that additional USB ports are provided “through the use of USB Hubs” which “allow a single USB Host to connect to multiple USB Devices over a single cable.” *Id.*, 2:3-6.

Similarly, the ’072 patent discusses the OTG Supplement, which provides “dual-role” functionality, where a USB product can “act as either USB Host or USB Device.” EX1009, 3:21-27. With respect to smartphones in particular, the ’072 patent specification states it is “not surprising” that “system level design thinking has shifted towards viewing smart phones as the USB Host” because “this is exactly how laptops and PCs work today.” *Id.*, 2:65-3:2.

Against this backdrop, the ’072 patent observes that, in the context of an application using a hub (*e.g.*, an automobile deployment), traditional “USB Hubs do not support OTG” and cannot support a downstream host (*viz.*, a smartphone

cannot be host). EX1009, 3:31-32. The '072 patent further rejects using “custom USB hubs” that support OTG because performing a host/device role swap disconnects “all other downstream ports of the USB Hub[.]” *Id.*, 3:49-4:3.

The '072 patent's purported novel solution is illustrated in Fig. 4, in which two components (a routing switch and host-to-host bridge) are added to a traditional USB hub. *See, e.g.*, EX1009, 5:24-27, 5:49-6:67. The bridge enables host-to-host communications through the hub. *Id.*, 6:8-13. And because consumer products may be dual-role, the switch enables bypassing the bridge based on the operating mode of the downstream product. *Id.*, 6:5-17. This allows dual-role downstream smartphones to connect to the embedded upstream host¹⁰ as device or host. *See, e.g., id.* When the downstream “consumer device is acting as USB Host, the USB Bridge processes the USB packets from the consumer port ... thereby rendering the consumer device compatible with the vehicle's embedded USB Host.” *Id.*, 6:8-13. When the downstream “consumer device is acting as USB Device, ... the switching device provides the USB signaling directly to the USB Hub, bypassing the Bridge.” *Id.*, 6:14-17. These two operational modes are illustrated in annotated versions of Fig. 4 below, with colored lines indicating the

¹⁰ As the '072 patent describes, the “Head Unit” refers to an upstream host in a vehicle. *See, e.g.*, EX1009, 5:57-59.

signal paths taken based on the smartphone mode (*i.e.*, the purple lines show a device-host connection and red lines show host-to-host).

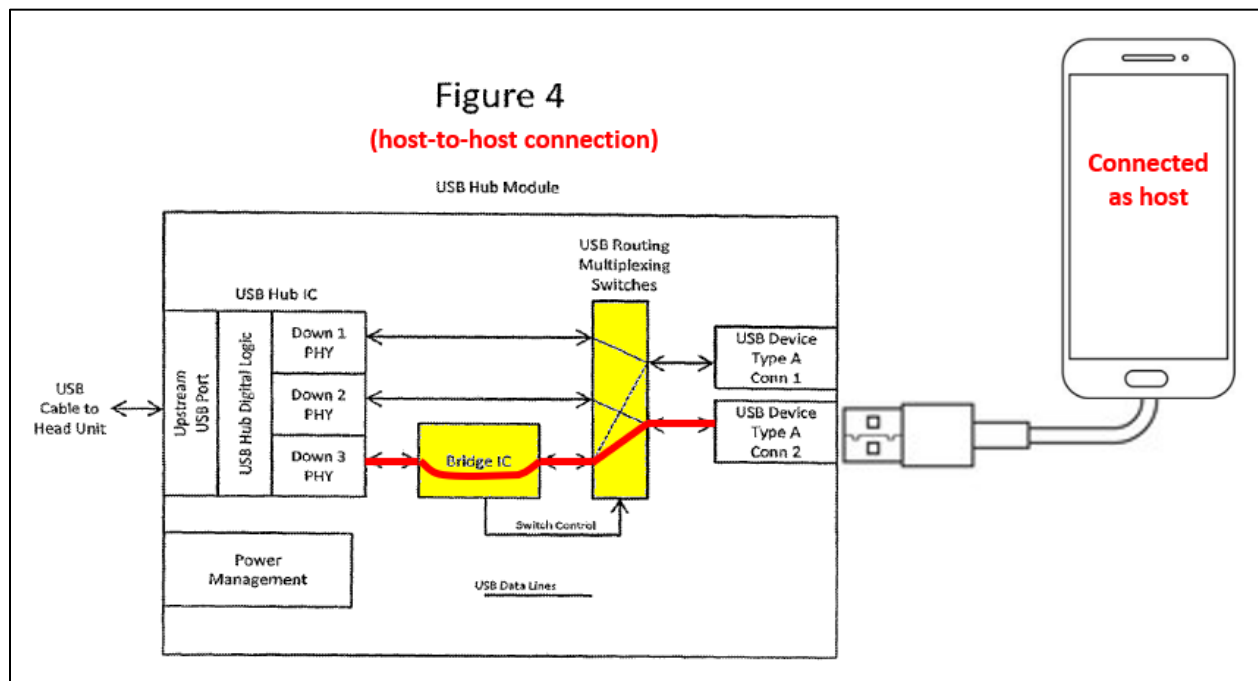
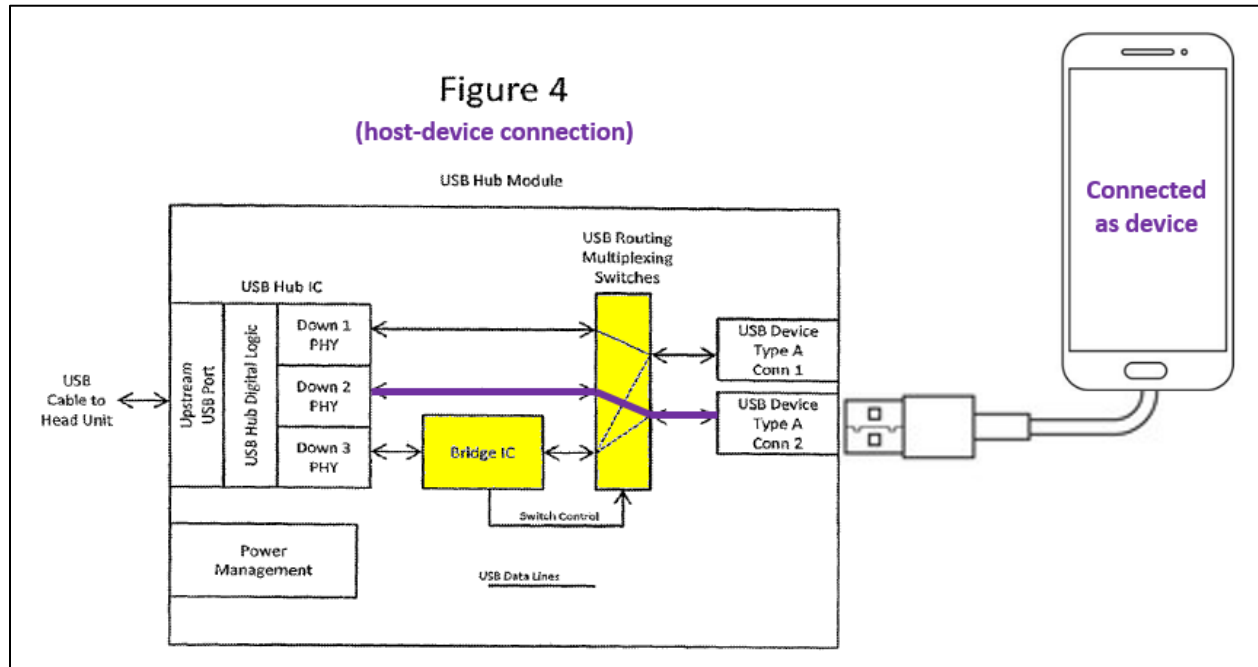


Fig. 5 is an alternate embodiment with a similar architecture, the primary

difference being that the “USB routing/switching logic and a USB Bridge are integrated with a USB Hub in a combination USB Hub/USB Bridge Integrated Circuit (IC).” EX1009, 5:28-32; *see also id.*, 7:15-21. Figs. 6-7 provide additional details regarding Fig. 5. *Id.*, 5:33-36 and 7:22-8:42. Fig. 8 shows “a Head Unit Software Architecture.” *Id.*, 5:37-38 and 8:43-9:13.

Lastly, the ’072 patent does not disclaim use of downstream dual-role OTG products. Rather, the ’072 patent only states that the upstream “embedded USB host” lacks “On the Go (‘OTG’) capability.” EX1009, 1:21-28.

B. File History¹¹

The application resulting in the ’072 patent was filed with 11 claims, but only claim 1 ultimately issued. EX1010, 372-373, 274. Thus, this summary focuses on prosecution of claim 1.

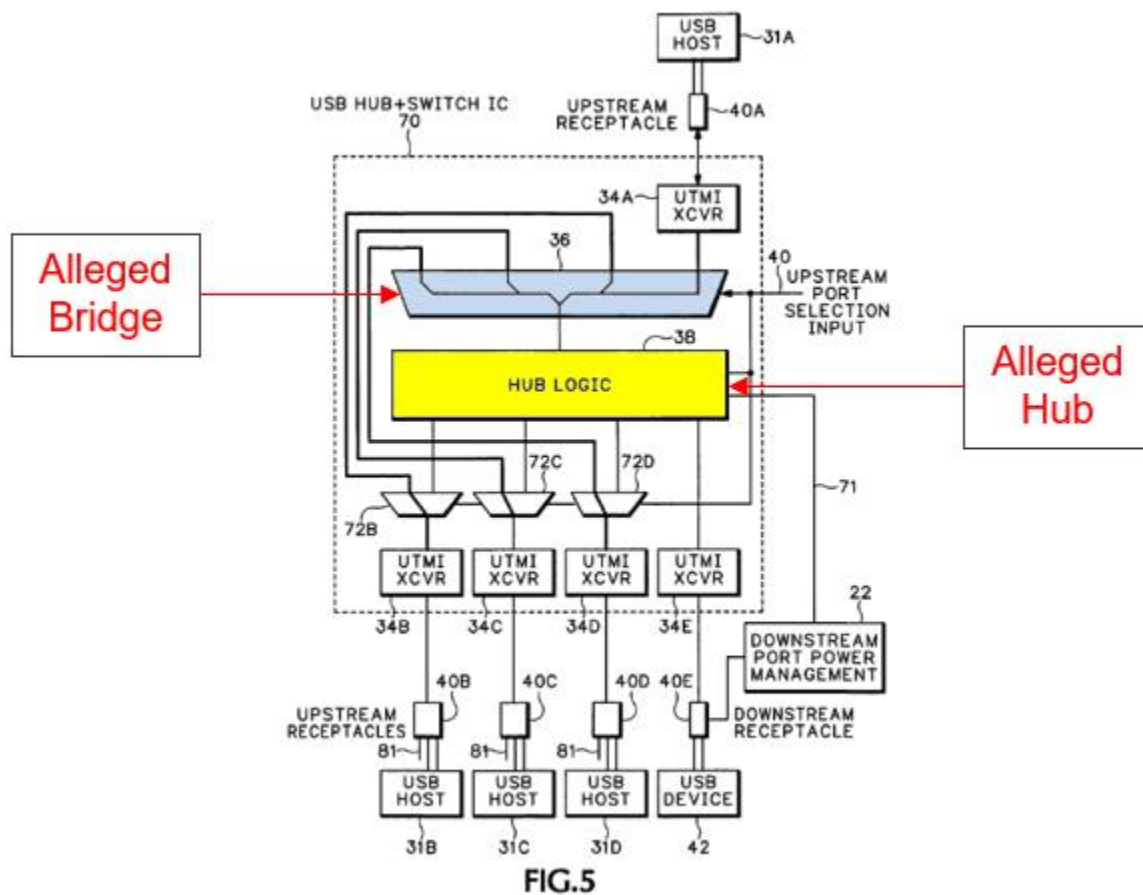
On February 18, 2021, claim 1 was objected to and rejected as anticipated. EX1010 (Office Action), 274-281. Claim 1 was objected to as indefinite because the Examiner found the claim’s “mode change” language unclear. *Id.*, 278. And claim 1 was rejected as anticipated by U.S. Pat. 7,502,878 (“Wright”). *Id.*, 280-

¹¹ This Section highlights the differences between (1) the prior art and arguments at issue in the file history and (2) the prior art and arguments in this Petition. *See* § VIII.B.

281.

On May 25, 2021, Applicant filed a Supplemental Amendment and Response which substantially amended claim 1 (similar to its current form), to expressly recite “host” and “device” modes (where device mode signals “bypass[ed] the USB Bridge”). EX1010, 352.

Applicant argued that the amendments obviated the objection. EX1010, 355. Applicant traversed the Examiner’s anticipation rejection that mapped Wright’s “multiplexer 36” to the claimed bridge and “hub logic 38” to the claimed USB hub. *Id.*, 356. These elements are shown below in Wright Fig. 5:



EX1047, Fig. 5 (annotated).

Applicant argued two distinctions over Wright: (1) that Wright's alleged host-to-host communications (between hosts 31A and 31B) bypassed the hub entirely; and (2) that Wright's host-to-device communications passed through the alleged bridge instead of bypassing it. EX1010, 356. The Examiner issued a Notice of Allowance following an Examiner-initiated Interview and minor clarifying amendments. *Id.*, 371-376.

The Reasons for Allowance are generic. EX1010, 372-373. Unlike the Grounds in this Petition, however, Wright's alleged host-to-host communication bypassed the hub and the host-to-device communication passed through the alleged bridge. Note that Wright **does not** disclose a host-to-host connection at all. This is evident, for example, from the fact that the alleged bridge is not at a bridge at all, but a multiplexer. Welch, ¶143. For at least these reasons, this Petition's Grounds do not present similar art to Wright, nor do they raise similar prosecution arguments.

The '072 patent claims priority to U.S. Pat. 9,460,037 (the "'037 patent," EX1001) through several continuation patents and also has a child patent. Petitioner summarizes the related file histories to show that this Petition's Grounds and arguments are not cumulative to those relied on by the Examiner. Welch, ¶¶124-147. Section VIII.B addresses §325(d) in more detail.

U.S. Pat. 9,460,037

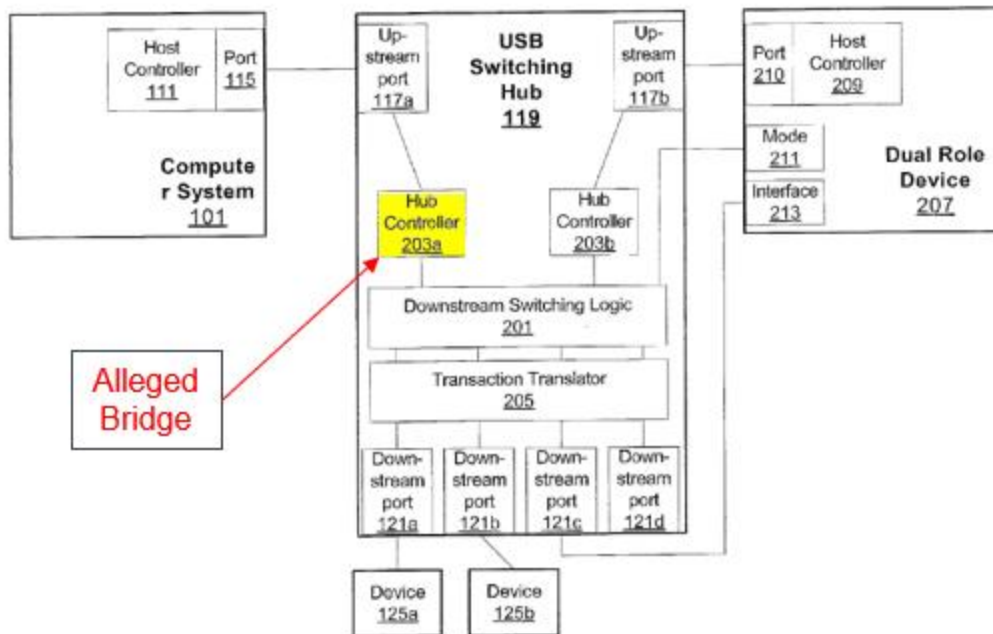
The '037 patent application was rejected over two primary references: Kellzi (U.S. Pub. 2007/0156293, EX1046) and Bohm '759 (U.S. Pub. 2006/0227759, EX1042). *See generally* EX1002.

The Examiner issued an anticipation rejection over Kellzi. EX1002, 76. In response, Applicant amended the claims to require a bridge (located between the hub and downstream port) for establishing host-to-host communications with the hub's upstream host. *Id.*, 98. Applicant also argued various distinctions related to Kellzi's OTG implementation which:

- lacked an "embedded host";
- lacked a host-to-host connection; and
- had limited connection and port swapping capabilities when "an intervening hub" is present.

See id., 104-108.

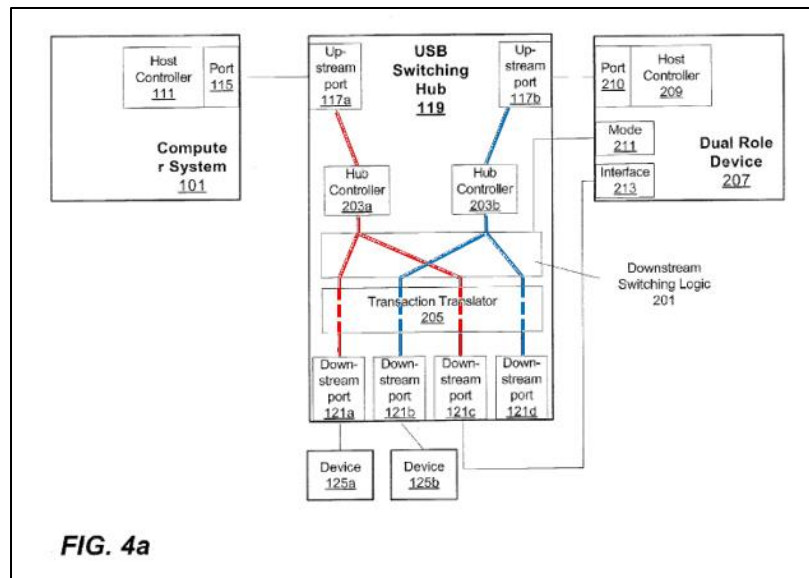
Next, the Examiner issued anticipation and obviousness rejections based on Bohm '759. EX1002, 115. Applicant argued that the Examiner's reading of Bohm '759 was "not logical," because components such as Hub Controller 203 (the alleged bridge shown in yellow below) could not be inside the hub and "at the very same time be[] separate elements that are interconnected to the [hub]." *Id.*, 163.



EX1042, Figure 3 (annotated).

An Examiner Interview, Examiner Amendment, and Notice of Allowance followed. EX1002, 185-197. Two amendments are notable here. Welch, ¶¶130-131. First, with Applicant’s consent, Examiner amended claim 1 to require the hub to “connect the embedded USB Host system to a second USB Host” (i.e., create a host-to-host connection instead of a host-to-device connection like Bohm ’759). EX1002, 190-191; *see also* EX1042, [0038].

Second, the Examiner amended claim 1 to require “broadcast[ing] data from the embedded USB Host system to each USB Port in the plurality of USB Ports.” EX1002, 190-191. This distinguished Bohm ’759 Figs. 4a and 4b because each upstream host only broadcasted to different downstream ports assigned to that host, as shown in annotated Fig. 4a below. *See* EX1042, Fig. 4a-b and [0040]-[0042].



U.S. Pat. 9,619,420

There were no prior art rejections, and the claims issued with an Examiner amendment following an Examiner Interview. *See* EX1004, 148.

U.S. Pat. 9,645,962

There were no prior art rejections. *See* EX1006.

U.S. Pat. 10,545,899

The '899 patent application was rejected over Wright. EX1008, 401. Applicant amended claim 1 to require (among other things) “a USB bridge interconnected to the USB hub, and a USB routing switch interconnected to the USB bridge, the USB hub, and the second USB port.” *Id.*, 454. Applicant argued that Wright lacked a bridge, and traversed Examiner’s assertion that “hub logic 38” is a bridge, because “hub logic 38” is a conventional hub. *Id.*, 460.

The Examiner again rejected the claims based on Wright, asserting that

Wright discloses a bridge “because hub logic 38 of Wright performs the same claimed bypass function as claimed ‘USB bridge’ If claimed ‘USB bridge’ is a specific ‘bridge’, the specifics have to be recited.” EX1008, 466 (emphasis in original).

Applicant then made significant claim amendments, including reciting that the bridge connects two hosts (EX1008, 488), and argued Wright does not disclose “a USB bridge interconnected to the USB hub and configured to connect the USB host to a second USB host” (*id.*, 493).

In an Examiner Interview, Applicant “described the invention as a hub to dynamically switch a device connection between USB Device mode and USB host mode when desired.” EX1008, 498. The Examiner then issued a Notice of Allowance, noting that the prior art does not disclose the claim language. *Id.*, 523.

U.S. Pat. 11,681,643

The Examiner again issued a rejection over Wright, contending that Wright’s “mux 36” was the claimed hub and that “connection 74” (*i.e.*, the wire between mux 36 and mux 72B) was the claimed USB bridge. EX1012, 67. Applicant traversed this rejection. *See id.*, 89 (“[T]he multiplexer 36 of Wright cannot be fairly characterized as a USB hub.”). Following an Examiner Interview and an Examiner Amendment, a Notice of Allowance was issued. *Id.*, 102.

The Applicant then filed an RCE and submitted an IDS that included, among

other references, Chang II. EX1012, 175, 180. Another Examiner Interview was conducted, followed shortly by an Examiner Amendment and another Notice of Allowance, after which the '643 patent issued. *Id.*, 197, 208.

C. Level of Ordinary Skill in the Art

The '072 patent pertains generally to the field of USB connectivity (*e.g.*, USB systems/architectures/communications), though other technical fields may be relevant. See EX1009, 1:21-23. A POSITA at the time of the alleged invention would have been well-versed in USB standards (including the USB 2.0 and 3.0 Specifications and the OTG Supplement) and the design/deployment of USB hosts, USB devices, and USB hubs, including suitable environments for USB systems. A POSITA would also have had a working understanding of network/communication architectures (*e.g.*, master/slave) and components (*e.g.*, host-to-host bridges), computer hardware and peripherals, computer programming, and the design/implementation of communication software/firmware/drivers in standard operating systems (*e.g.*, Windows and Linux) and embedded systems. Welch, ¶¶45-49.

A POSITA would have had at least a four-year degree in electrical engineering, computer engineering, computer science, or a related field and substantial experience (*e.g.*, several years) designing USB systems, including USB hosts, USB hubs, and USB devices. A relevant advanced degree may substitute for

some work experience. Welch, ¶¶45-49. Similarly, relevant work experience may substitute for formal education. *Id.*

V. CLAIM INTERPRETATION

In IPR, claim terms are construed under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*) and its progeny. 37 C.F.R. §42.100(b). Petitioner submits one term for construction for this proceeding.¹²

A. “Embedded USB Host”

The parties stipulated in the underlying district court action that “embedded USB host” means “USB host physically embedded in a vehicle.” EX1075, 2. This is supported by the ’072 patent specification which states that “[t]he USB Host function is often embedded into a component *of the vehicle infotainment system*, such as into the radio or other control module.” EX1009, 1:51-53 (emphasis added). All other references to “embedded USB host” refer to this host being built into a vehicle component. *See id.*, 1:21-23 (“vehicle electronic systems”), 1:57-61 (“vehicle infotainment system can access content”), 4:7-11 (“vehicle’s embedded USB Host system”), 4:27-30 (“vehicle’s embedded USB Host”), 5:50-53, 5:58-60 (“vehicle’s embedded USB Host (such as a USB Host in a Head Unit)”), 6:11-13;

¹² Petitioner reserves all rights to raise additional and alternative claim constructions in district court.

Welch, ¶217. Given that the patent’s only example of “embedded host” refers to the host built into a vehicle component, the “embedded USB host” in the context of the ’072 patent claims must at least encompass a “USB host physically embedded in a vehicle.” *VirnetX, Inc. v. Cisco Sys., Inc.*, 767 F.3d 1308, 1318 (Fed. Cir. 2014).¹³

The Board only needs to construe claim terms to the extent necessary to resolve the controversy. *See, e.g., Toyota Motor Corp. v. Cellport Sys., Inc.*, No. IPR2015-00633, Paper No. 11 at 16 (PTAB. Aug. 14, 2015); *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

VI. THE PRIOR ART¹⁴

A. Chang Summary

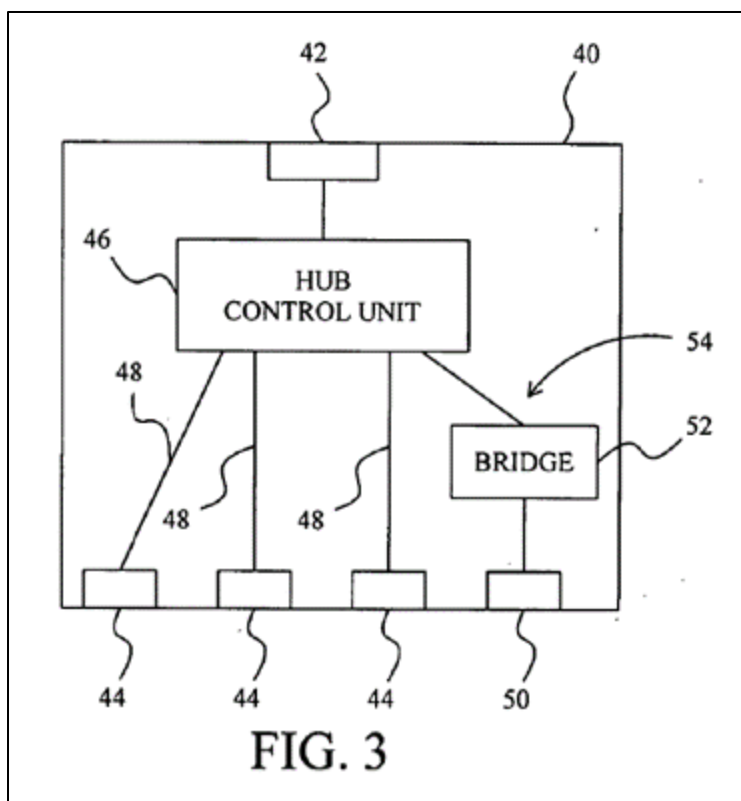
Chang is titled “Hub with a Host-to-Host Transmission Function.” The “SUMMARY OF THE INVENTION” explains that “host-to-host transmission” is accomplished via “***a bridge connected between the host port and hub control unit*** for the first and second hosts to communicate with each other.” EX1014, [0005]

¹³ Should the Board disagree with the “vehicle” requirement, Petitioner also addresses how the prior art satisfies “embedded USB host” under a broader construction that does not require that the host be located “in a vehicle.”

¹⁴ Section II.B establishes that each reference is prior art.

(emphasis added); Welch, ¶¶148-152. Chang expressly recognizes that, even in 2005, the “host-to-host transmission mechanism [viz., USB bridge] is a prior art,” and thus “is not described in detail.” EX1014, [0020]; *see also id.*, [0022] (referring to “conventional bridge”); [0020] (exemplary OTi2108 commercial chip).

Describing Fig. 3 (shown below), Chang explains that it “shows a hub 40 [], which has, as a conventional hub, an uplink port 42 for being linked to a host, several downlink ports 44 for being linked to devices, and a hub control unit 46 for establishing several transmission paths 48 between the uplink port 42 and downlink ports 44.” EX1014, [0019]. Chang further explains, however, that hub 40 includes “host port 50 for being linked to a host, and a bridge 52 connected between the hub control unit 46 and host port 50” where “[t]he bridge 52 provides a function for host-to-host communications.” *Id.*, [0020].



Like any traditional hub, the uplink port “link[s] to a host” and “several transmission paths may be established” to “communicate with each downlink port.” EX1014, [0018].

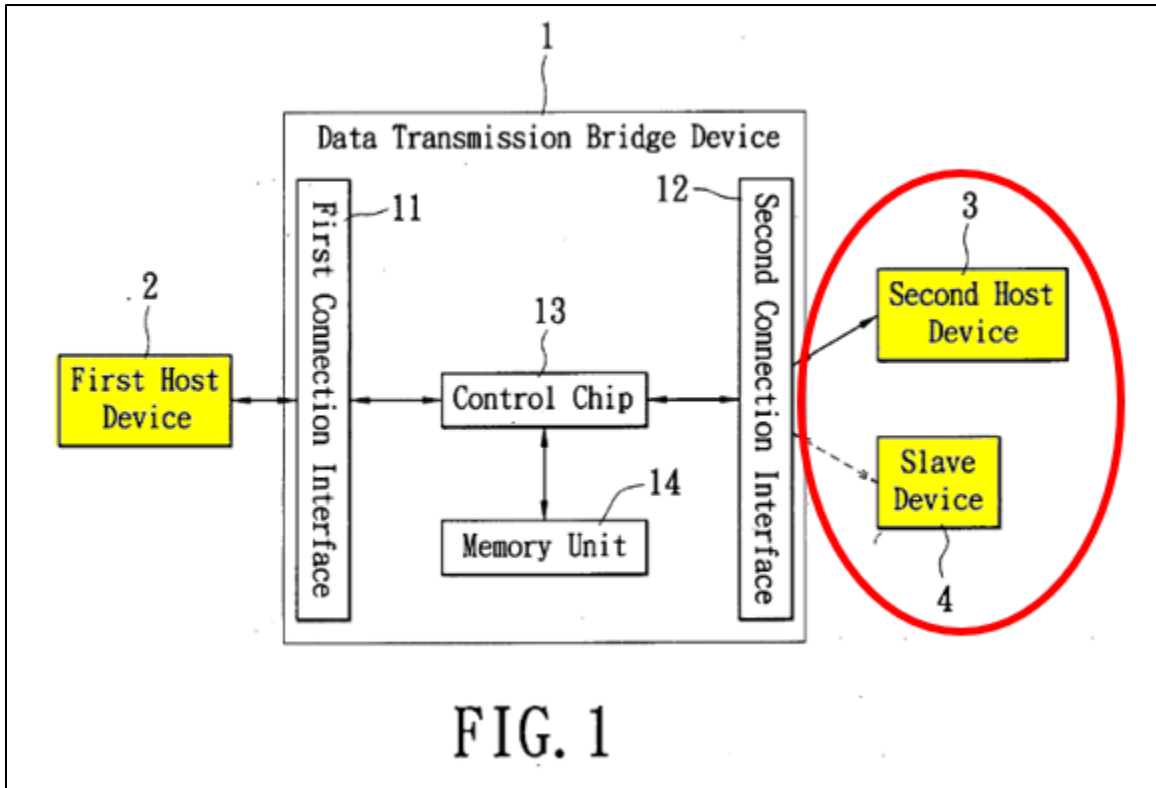
Chang further teaches that its “invention can be implemented merely by integrating or adding a bridge to a USB hub, and thus does not require too many modifications on the current hub control unit. Therefore, the derived cost is relatively low, while a multi-functional USB hub with a host-to-host transmission function is obtained.” EX1014, [0024]. Additionally, Chang teaches that the bridge may be a discrete component (*see* Fig. 3) or integrated with other circuitry comprising the hub (*see id.*, [0022]).

B. Chang II Summary

Chang II is titled “Data Transmission Bridge Device and Control Chip Therefor for Transmitting Data.” Chang II relates to “a bridge device for transmitting data; and more particular[ly] to a data transmission bridge device and control chip thereof for transmitting data that adopts USB specification, and can utilize switching to bridge between two host devices.” EX1015, [0002]; *see generally* Welch, ¶¶153-168.

Unlike Chang (which has dedicated host and device ports), Chang II discloses a single port that allows a connected USB product to act either as a “Second Host Device” or a “Slave Device” when communicating with a “First Host Device,” as shown in annotated Fig. 1 below. *See* EX1015, [0030] (“In practical design, the second connection interface 12 can also directly adopt an A-Type male connector and a B-Type male connector of USB specification to achieve dual connector type design”); *see also id.* [0012] (“the second connection interface is for connecting to a second host device or a slave device.”).¹⁵

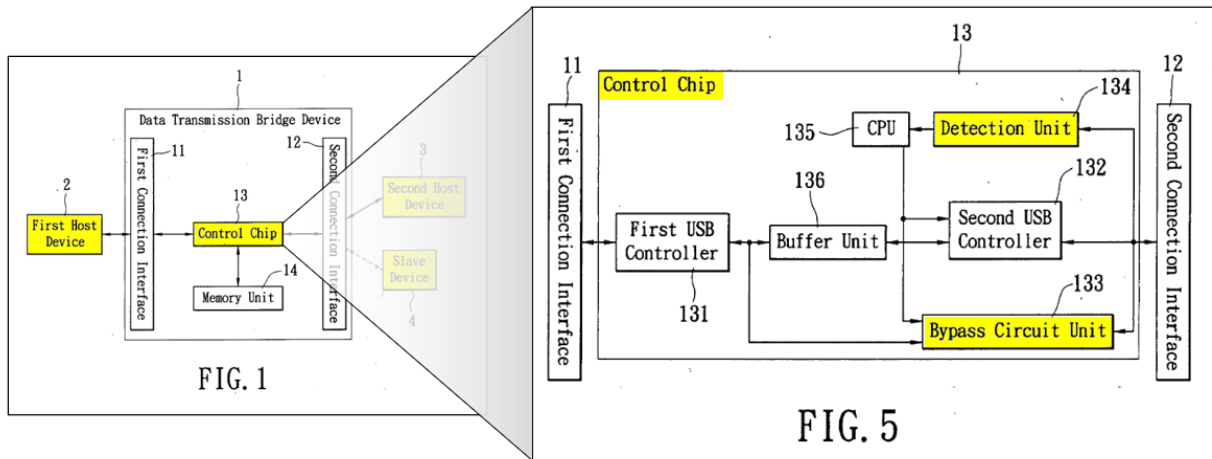
¹⁵ As discussed further *infra* §VII.A.2.e, a POSITA would have understood (and certainly found it obvious) that connecting dual-role products to the second interface was within Chang II’s disclosure.



The “data transmission bridge device ... automatically detect[s] the connecting device type and accordingly switch[es] between different transmission paths, which would not only allow for support of data transfer between a host device and a slave device, but also can directly support data transfer between two host devices, ... [and] is suitable for simple ‘plug and play.’” *Id.*, [0011].

The bridge is primarily implemented in control chip 13, as detailed in Fig. 5, reproduced with highlights below. Fig. 5 is “a schematic diagram for a control chip of a data transmission bridge device As the figure shows, the present embodiment provides a control chip 13 for a data transmission bridge device 1, which includes: a first USB controller 131, a second USB controller 132, *a bypass*

circuit unit 133, a detection unit 134, a central processing unit (CPU) 135, and a buffer unit 136.” EX1015, [0034] (emphasis added).



The fundamental concepts of (1) detecting the host/device type and (2) selecting between two transmission paths (one for host-to-host communication and another for host-to-device communication) are repeated throughout the specification. See, e.g., EX1015, [0024].

Host/Device Detection. As highlighted in Fig. 5 above, Chang II discloses a “Detection Unit 134.” Operational details of detection unit 134 are at [0038]-[0040], and an exemplary host/device detection algorithm is shown in Fig. 6. More generally, Chang II explains that “[f]or those skilled in the art of USB devices it is common knowledge” to use an “inquire signal” to determine whether a connected USB product is a host or device. EX1015, [0025]-[0027]. In view of the discussion at [0025]-[0027] and [0038]-[0040], a POSITA would have understood that this involves detecting the presence/values of resistors discussed

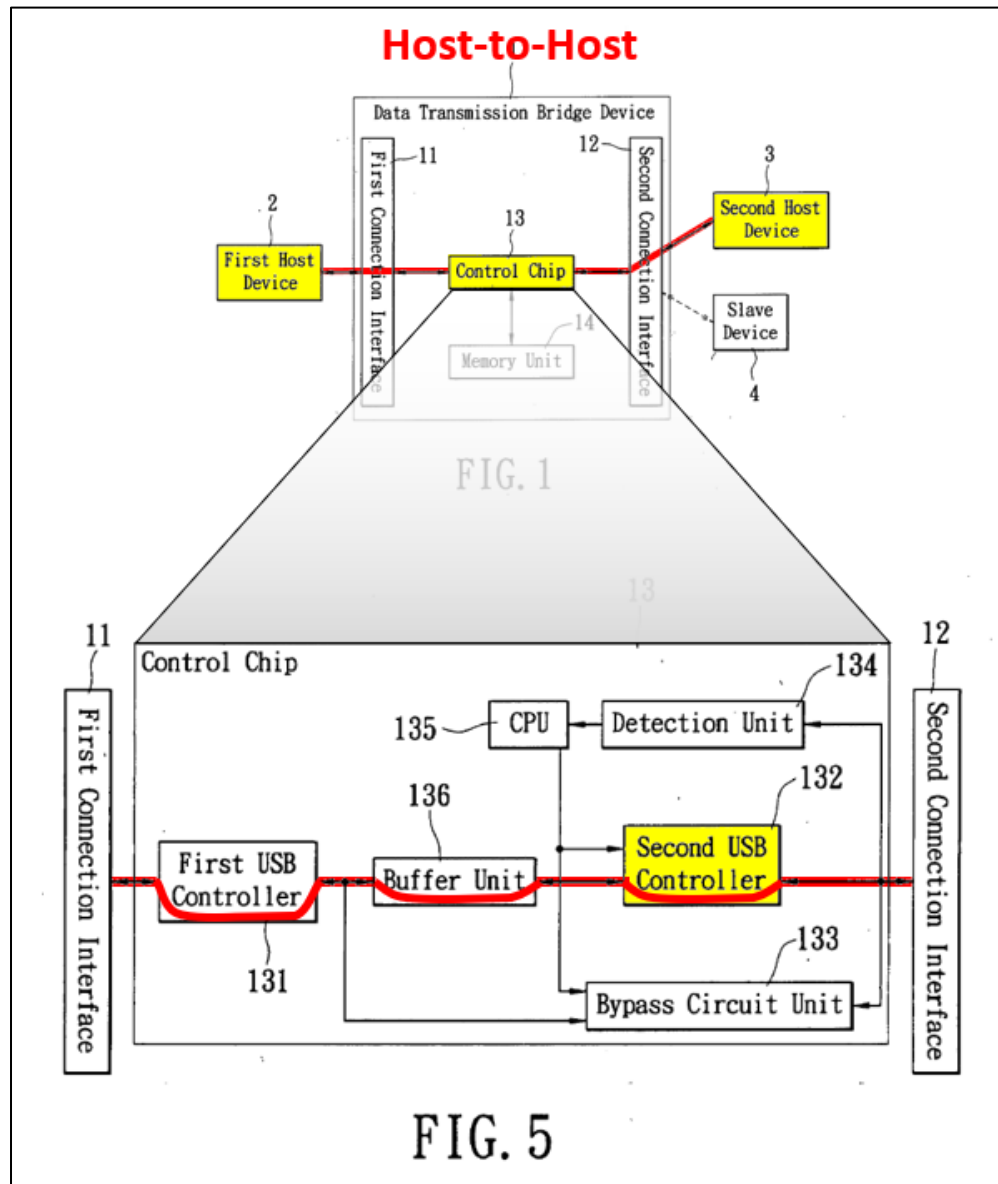
supra §III.B.1. Welch, ¶159. In summary, Chang II explains that “[t]he detection unit 134 ... will automatically operate to switch between [states] ... to determine the type of device currently connected.” EX1015, [0038]; *see also id.*, [0028].

The purpose of host/device detection is so that “the control chip 13 can respectively switch to the bridge transmission path or the bypass path.” *Id.*, [0024].

Switching Between Two Transmission Paths. Chang II discloses “a data transmission bridge” that includes “***two different transmission paths, so that by automatically detecting the type of device connected (host or slave) the present invention can switch to the proper transmission path***, thus not only can host-slave operation between the host device and the slave device be supported, but direct bridging between two host device[s] for data transfer is also possible.” EX1015, [0021] (emphasis added).

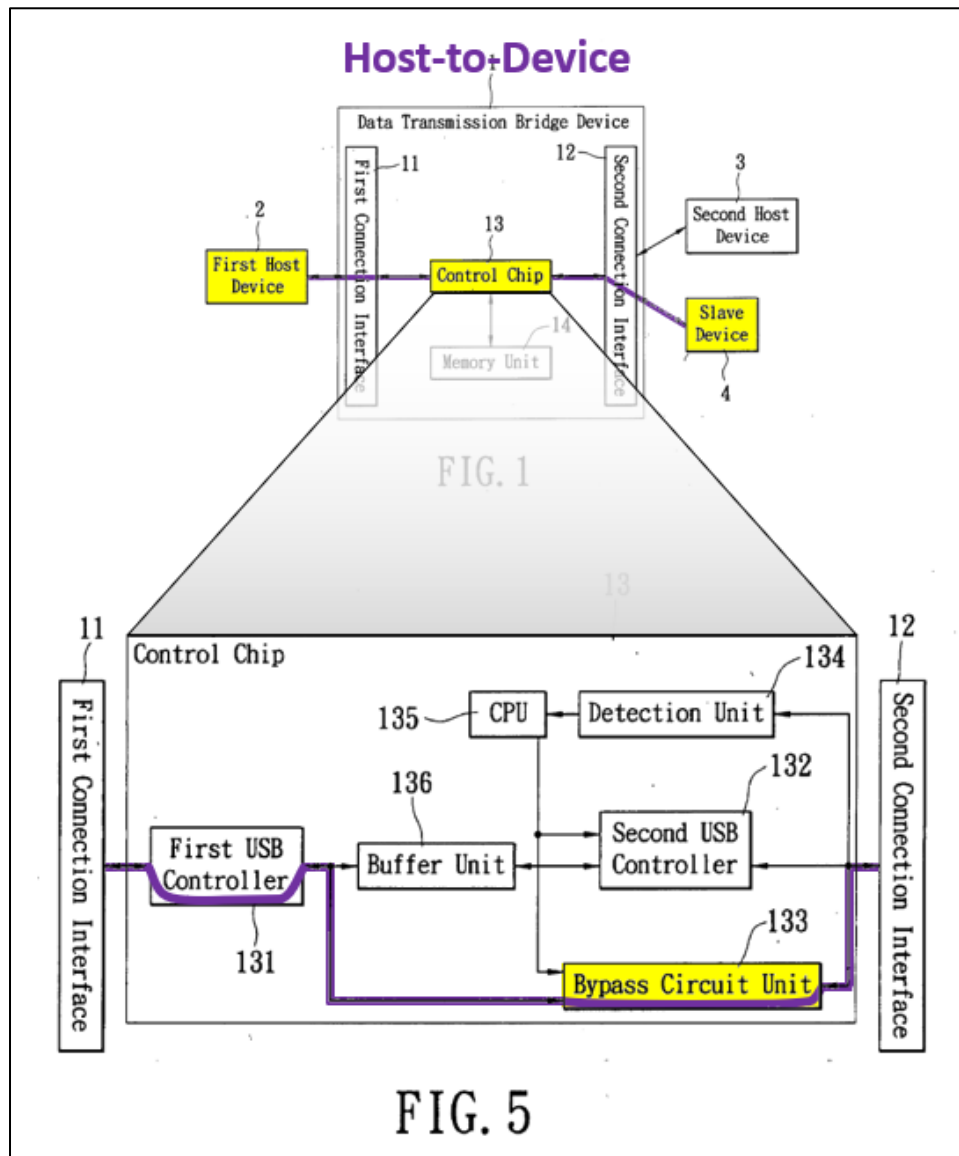
The “two transmission paths” are described as (1) “a bridge transmission path” and (2) “a bypass path.” EX1015, [0024]. As shown by the red annotation below, the “first path is the bridge transmission path which spans first connection interface 11, first USB controller 131, buffer unit 136, second USB controller 132, and second connection interface 12.” *Id.*, [0023]. As shown immediately below, “when the second connection interface is connected to a second host device, the second USB controller would also connect with the second host device through the

second connection interface” which “form[s] a bridge for data transfer between the second host device and the first USB controller.” *Id.*, [0013]. In other words, the second USB controller 132 is central to creating the host-to-host bridge. *Id.*



As shown by the purple annotation below, “[t]he second path is the bypass path which spans first connection interface 11, first USB controller 131, bypass circuit unit 133, and second connection interface 12.” EX1015, [0023]. Chang II

explains that “the bypass circuit unit will directly connect the first USB controller and the second connection interface, in order to provide host-slave operation between the first host device and the slave device.” *Id.*, [0013]; *see also id.*, [0037] (describing “a direct connection between the first USB controller 131 and the second connection interface 12”).



Notably, Chang II discloses that, when in host-to-device mode, the data

transmission bridge device acts “similar[ly] to the commonly known USB HUB function.” EX1015, [0027]; *see also id.*, [0040] (“the control chip 13 at this time **functions like a USB Hub chip**, merely acting with intermediate transmission function”) (emphasis added).

To choose between transmission paths, CPU 135 controls a switching function: “the detection signal will be received by the CPU, and the CPU will accordingly control the second USB controller (host-to-host data transfer) or the bypass circuit unit (host-to-slave data transfer) for the appropriate operation.” EX1015, [0013]; *see also id.*, [0023] (“switching to one of the two transmission”); [0038] (CPU setting transmission path); and [0039]-[0040]. A POSITA would have understood this functionality to be implemented by some type of switch, mux, or crossbar. Welch, ¶165.

To recap, Chang II’s “main feature is the provision of two different transmission paths, so that by automatically detecting the type of device connected (host or slave) the present invention can switch to the proper transmission path.” EX1015, [0021]. The fundamental concepts of (1) detecting the host/device type and (2) selecting/switching between two transmission paths are repeated extensively throughout the specification:

- There are “**two transmission paths**; the control chip is for **detecting the device** connected with the second connection interface, and accordingly **decide on one of the two transmission paths to use** for the data transmission.” *Id.*, [0012] (emphasis

added).

- “[A] detection of whether the type of external device is the second host device 3 or slave device 4 can be made [so] the proper transmission path can be switched to accordingly.” *Id.*, [0045].
- When “connected to a second host device, the second USB controller ... ***form[s] a bridge for data transfer between the second host device***” and when “connect[ed] with a slave device, ***the bypass circuit unit will directly connect the first USB controller ... to provide host-slave operation.***” *Id.*, [0013] (emphasis added). “[T]he detection unit will automatically operate to [detect host/device and provide a] detection signal ... [to access] the second USB controller (host-to-host data transfer) or the bypass circuit unit (host-to-slave data transfer).” *Id.*

Chang II discloses that its bridge device may be built into a data transmission cable (*see id.*, Fig. 3) or “directly within a first host device” such as a notebook computer. EX1015, [0031]. In view of this disclosure, a POSITA would have understood (or at least found it obvious) that the bridge may form part of a USB hub module or work in conjunction with a hub. *Id.* [0027], [0040]; Welch, ¶167.

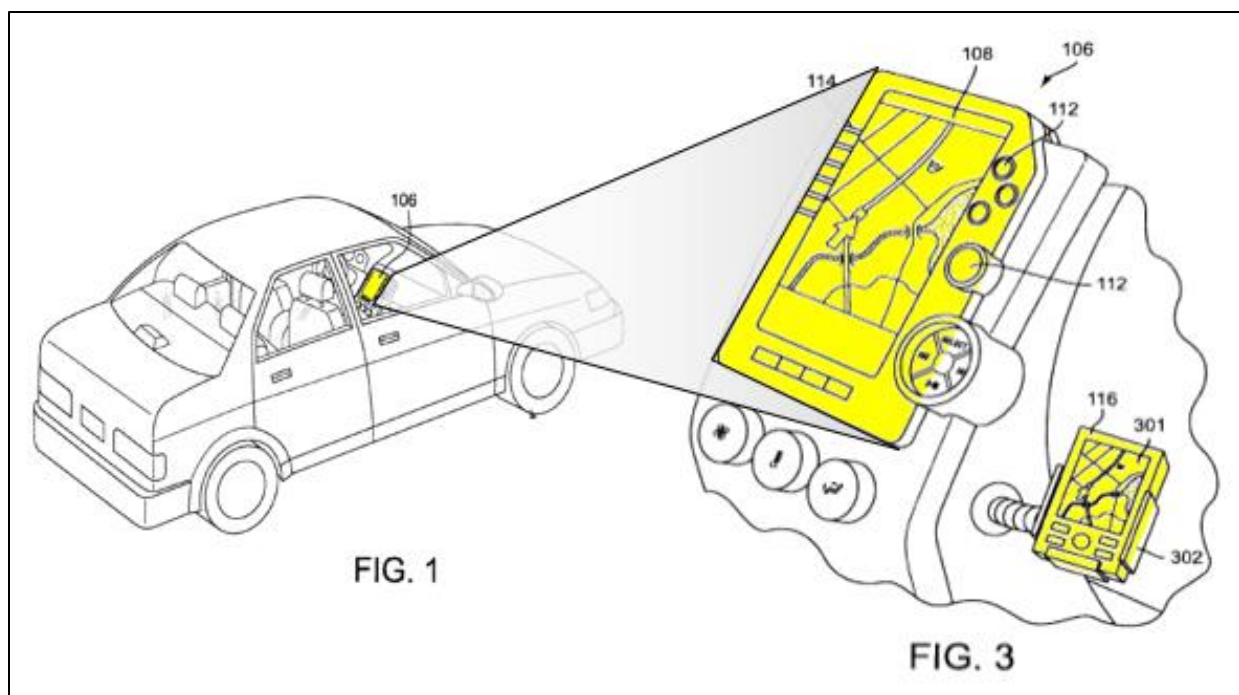
In summary, Chang II discloses “a data transmission bridge device, which by automatically detecting the type of connected device to switch between the proper transmission path, can not only support data transmission between a host device and a slave device, but can also directly support data transmission between two host devices.” EX1015, [0046].

C. Chutorash Summary

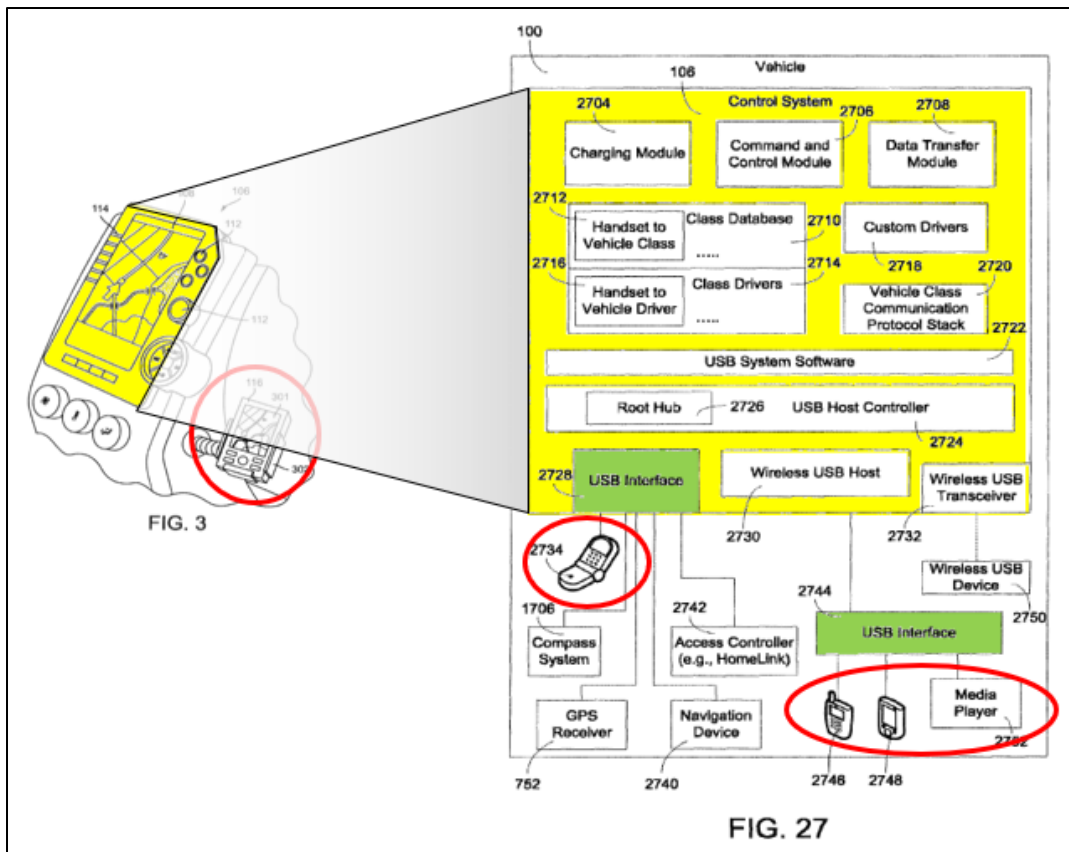
Chutorash is titled “Vehicle User Interface Systems and Methods.”

Chutorash recognizes that “[v]ehicles typically include a number of electronics systems and subsystems” such as “an in-vehicle entertainment system,” but such systems “typically do not interface well with remote sources and portable devices such as cellular phones.” EX1029, 1:20-28. As such, there exists “a need for improved user interface features and/or connectivity features relating to vehicle control systems, remote sources, and/or portable devices.” *Id.*, 1:34-36.

Against this backdrop, Chutorash discloses a “vehicle control system 106 (e.g., media system, navigational system, entertainment system, display system, communications systems, etc.)” connected to “a portable electronic device 116” as shown in Figs. 1 and 3 below. EX1029, 5:31-33 and 6:51-7:10. The “portable electronic device 116 can provide information to vehicle control system 106 for processing.” *Id.*, 7:8-10.



Relevant here, Chutorash discloses “various embodiments for a vehicle control system connecting via a USB interface to various remote sources” in Figs. 27-30. EX1029, 27:1-3. In particular, Chutorash’s vehicle control system 106 includes “a USB connector or interface 2728, 2744” that “is provided within vehicle 100.” *Id.*, 27:4-10; *see also id.* (“The USB interface may be embedded in vehicle control system 106 (interface 2728) or ... coupled to vehicle control system 106 (interface 2744).”). These USB interfaces (with “mobile phone 2734,” “PDA 2746,” and “media player 2752” connected to them) are illustrated in Fig. 27 below. The availability of USB ports in vehicle 100 is unsurprising, given that vehicle control and entertainment system 106 is essentially a built-in computer that “could be classified as an embedded host.” *Id.*, 27:26-28.



The “USB interface 2728, 2744 may facilitate operative connection of a mobile phone 2734.” EX1029, 27:12-25. The “[v]ehicle control system 106 may use the USB interface 2728 and/or features for charging, **command and control**, and/or data transfer.” *Id.* (emphasis added); *see also id.*, 13:22-24. For example, “[v]ideo services 724 of the portable device 116 may be utilized by vehicle control system 106 to provide video decoding and/or playback features to the vehicle.” *Id.*, 14:40-53; *see also id.*, 14:62-67. A POSITA would have recognized (or at least found it obvious) that “USB Interface[s]” 2728 and/or 2744 would be USB hubs given that each has multiple products connected to it. Welch, ¶173.

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1 (Claim 1): Chang in view of Chang II and POSITA Knowledge

1. Motivation to Combine

As §VI.A demonstrates, Chang discloses a hub with dedicated downstream device ports (for host-device connections) and a dedicated downstream host port (for a host-host connection through a bridge). It would have been obvious to modify Chang in view of Chang II and a POSITA's knowledge to include one or more dual-role ports and a switch to route the ports to the appropriate transmission path. Welch, ¶¶175-202.

To start, Chang was filed in 2005. As the '072 patent admits, consumer products (*e.g.*, smartphones and other mobile device) with dual-role USB capabilities were gaining popularity before the 2013 priority date. EX1009, 2:41-3:6; *see also* Welch, ¶176; §III.B. The '072 patent further admits automobile manufacturers were “motivated to adapt to this changing technology,” *i.e.*, use of dual-role ports to support products dynamically switching between host/device modes. EX1009, 3:11-4:3. Indeed, the USB-IF promulgated a standard beginning in 2001 (the OTG Supplement) for this very purpose. *See supra* §III.B. This is common sense: it would be impractical, and inconvenient at best, to require consumers to understand when to switch connections between dedicated host- and device-ports when using a dual-role product—especially when driving. Welch,

¶177. It goes without saying that dedicated ports have “a disadvantage in that it requires multiple connectors, multiple ASIC pins and the like,” which add “overhead” and “increase[s] the costs.” EX1025, 1:36-43. Accordingly, a POSITA would have been motivated to combine Chang’s dedicated device- and host-ports to create one or more dual-role mode ports. Welch, ¶177.

In addition, modifying Chang to include dual-role ports would further its express goal of “easily establishing a connection between a computer and another computer.” EX1014, [0003]. Chang illustrates an upstream host PC 20 connected to downstream host PC 70—but uses a dedicated downstream host port. *Id.*, [0002], [0020], [0023], Figs. 3-4. As the ’072 patent admits, however, prior art smartphones dynamically operated as either device or host, with host operation resulting from the fact that smartphones had effectively become personal computers. EX1009, 2:46-49; *see also id.*, 2:62-3:2. Accordingly, a POSITA would have been motivated to include a dual-role port to further Chang’s goal of connecting the upstream computer to the downstream phone acting as a computer. Welch, ¶178. Specifically, a dual-role port would allow consumer products, such as smartphones, that operate as computers (in host mode) to “easily establish[] a connection” (EX1014, [0005]) to the upstream host; the smartphone would plug into the dual-role port and automatically connect to the upstream host (through the bridge) when the smart phone switches to host mode (*see below regarding routing*

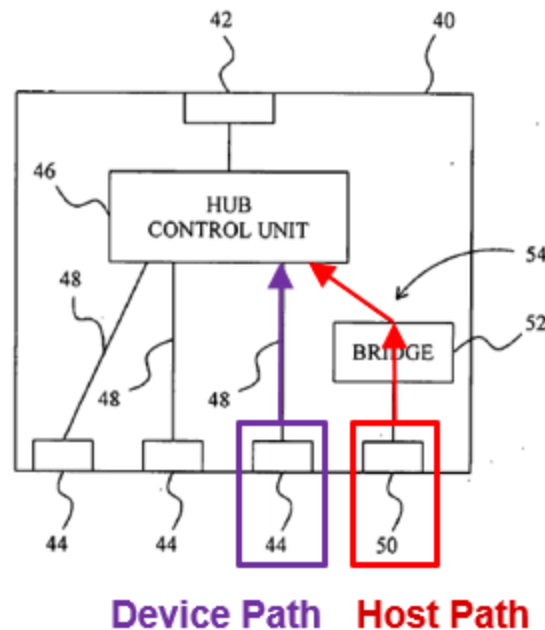
to bridge) without requiring the user to switch between dedicated host- and device-ports. Welch, ¶¶178-179. This avoids the inconvenience, hassle, and confusion of consumers having to keep track of (1) what mode their phone is operating in and (2) what mode(s) are supported by individual hub ports. *Id.*, ¶179.

Indeed, in the vehicle deployment context, this convenient host-to-host connection became further optimal because the vehicle's upstream host was often embedded (see EX1029, at 27:26-28, "embedded host" and EX1049, car had "become a PC on wheels"), requiring a host-to-host connection when the downstream consumer product, *e.g.*, smartphone, operates as host. See §III.D, Welch, ¶180.

A POSITA would have had a high expectation of success in modifying Chang to include dual-role ports. To start, and as §§III.B, III.B.1, and III.B.2 demonstrate, dual-role ports (*viz.*, interfaces for connecting dual-role products) and host/device detection were already well-known, and merely involved using commercially available components and well-understood signaling. See also EX1025, 3:10-32, 3:40-4:8, 7:34-40; EX1052, 3:21-50. Again, the '072 patent admits several solutions for supporting dual-role ports in a USB system were readily available. EX1009, 3:21-59; see also Welch, ¶183.

Next, a POSITA would have recognized that Chang effectively provides a roadmap to implement the necessary switching to support dual-role ports. Chang

discloses separate transmission paths for a host-to-host connection (“**host-to-host transmission path 54**”) and host-to-device connections (“**transmission paths 48**”):



EX1014, Fig. 3 (annotated), [0019]-[0020]. As §§III.B.2 and VI.B demonstrate, it was already well-known to include switching functionality to select the appropriate transmission path depending on the consumer product operating mode, *e.g.*, “**host-to-host transmission path 54**” or “**transmission paths 48**.” See also EX1053, Fig. 1, [0031]-[0034] (switching data line connections based on host/device mode detection); EX1052, Fig. 1, 3:7-20 (“switching structure 170” controls data paths depending on operating mode); EX1017, Fig. 6, [0057] (port routing depending on unit’s configuration). Accordingly, in the context of Chang, a POSITA would have been motivated to implement one or more dual-role ports by including a switch (*e.g.*, multiplexer or crossbar) that connects the dual-role port(s) directly to

the hub's upstream port (when the consumer product is configured as a device, *i.e.*, path 48) or to the hub through the bridge (when the consumer product is configured as host, *i.e.*, path 54). Welch, ¶¶182-187.

A POSITA would have been further motivated to improve Chang in view of Chang II, because Chang II expressly states its relevance to USB hubs. See EX1015, [0027] (invention performs “similar[ly] to the commonly known USB HUB function” for host-to-device communication); [0040] (“the control chip 13 at this time ***functions like a USB Hub chip***, merely acting with intermediate transmission function”) (emphasis added); Welch, ¶181.

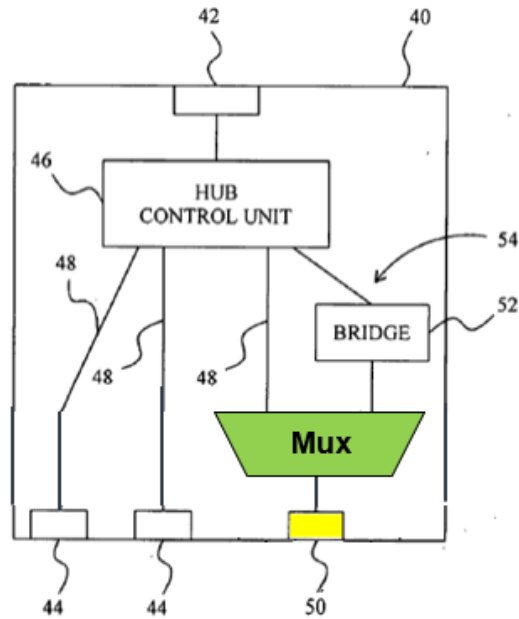
Further, while Chang does not disclose significant detail regarding its bridge (EX1014, [0020]), Chang II details various aspects of its bridge (EX1015, Title, Figs. 1-2 and 5). Importantly, Chang II further details exemplary switching for either a host- or device-product: “the main feature is the provision of two different transmission paths, so that by automatically detecting the type of device connected (host or slave) the present invention can switch to the proper transmission path.”¹⁶ EX1015, [0021]. In other words, Chang II describes using “switch[ing]” to either connect the port (and corresponding product) to a “bridge” transmission path (when the product is a host) or a “bypass” path (when the product is a device). *Id.*,

¹⁶ Chang II uses “slave” to refer to device mode. See §III.A.1; Welch, ¶62.

Figs. 1, 5, [0013]. And Chang II further discloses “detection unit 134” for detecting whether the consumer product is host or device. *Id.*, [0038].

Accordingly, a POSITA would have been motivated, with a high expectation of success, to route the dual-role ports (and products attached thereto) to the appropriate path using a switch.¹⁷ Welch, ¶186; §III.B.2. An obvious implementation for modifying Chang Fig. 3 is shown below which includes a 2:1 multiplexer (green) and one dual-role port (yellow). *Id.*, ¶191.

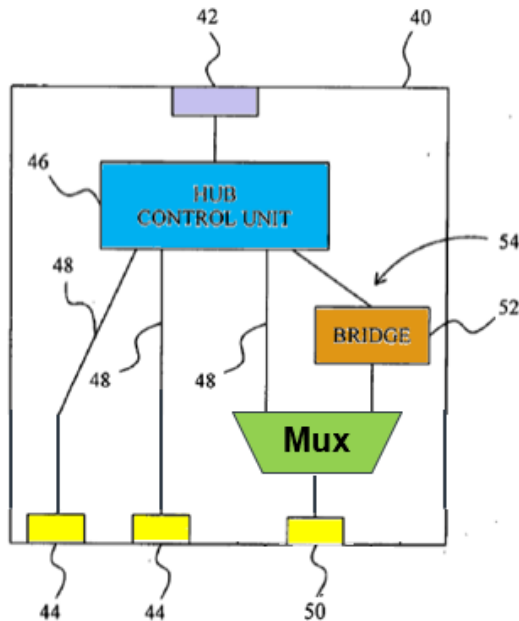
¹⁷ It would have been routine and obvious for the detection unit and/or bridge to control the switching functionality. Welch, ¶193. Chang II’s bridge chip controls routing, viz., “Bridge Device 1” in Fig. 1 includes “control chip 13” (shown in Fig. 5) with “detection unit” (134) and CPU (135). EX1015, [0022]-[0023], [0034]. Accordingly, in view of Chang II and the knowledge of a POSITA, it would have been obvious for Chang’s bridge and/or detection unit to control, *e.g.*, the select lines of the switch. Welch, ¶193; *see also* §III.B1, §III.B.2.



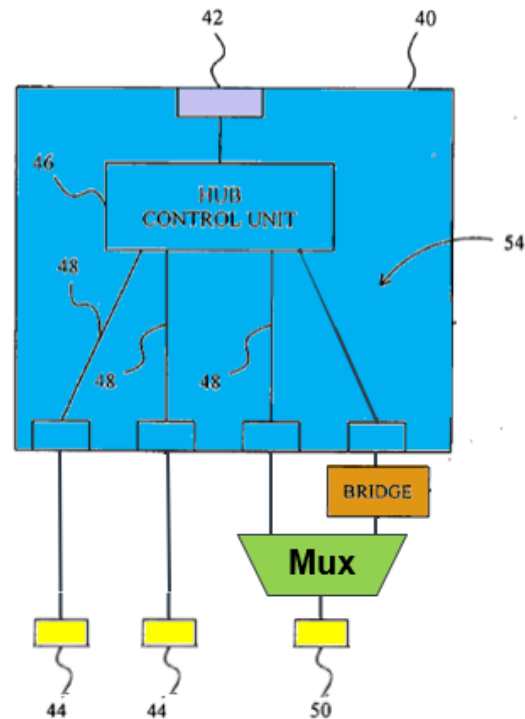
EX1014, Fig. 3 (modified and annotated); Welch, ¶191.

This Mux Implementation of Chang Fig. 3 comes in two variations (shown below) relevant to Ground 1. The lefthand version has the bridge and mux inside hub 40. In the righthand version, the bridge and mux are located outside hub 40. For reasons explained *infra* §VII.A.2.c, these are called “Chang (Hub 46)” and “Chang (Hub 40),” respectively.

Chang (Hub 46)



Chang (Hub 40)



The placement of the bridge and mux inside/outside of hub 40¹⁸ is merely a design choice, and motivations exist for each choice. Welch, ¶200. Indeed, given the limited locations relative to hub 40 where the components can be placed, a POSITA would have had motivations for each. *Id.* One benefit of placing the

¹⁸ For example, a separate “hub module” may encase the components (*see, e.g.*, EX1067 (U.S. Pat. Pub. 2010/0265179), [0210], Fig. 16 (“hub/bridge module 232”)) or they could be located in cabling (*e.g.*, EX1015, [0029] (“USB bridge transmission line 5”)).

components outside hub 40 is the ability to use a conventional off-the-shelf hub, resulting in faster development and quicker time to market. Welch, ¶201. This allows for minimal modifications to legacy designs and easy sourcing of components (*e.g.*, the conventional hub). *Id.* Alternatively, integrating the components inside hub 40 results in a more compact design and lower manufacturing/assembly costs. *Id.*, ¶202. Chang discloses adding host-to-host functionality to the hub “merely by integrating or adding a bridge to a USB hub,” which “does not require too many modifications on the current hub control unit.” EX1014, [0024]. Thus, “the derived cost is relatively low, while a multi-functional USB hub with a host-to-host transmission function is obtained.” *Id.*; *see also id.*, [0022] (noting it is “possible” to integrate the bridge into the hub control unit; and one could “integrate” the bridge with a “conventional hub.”).

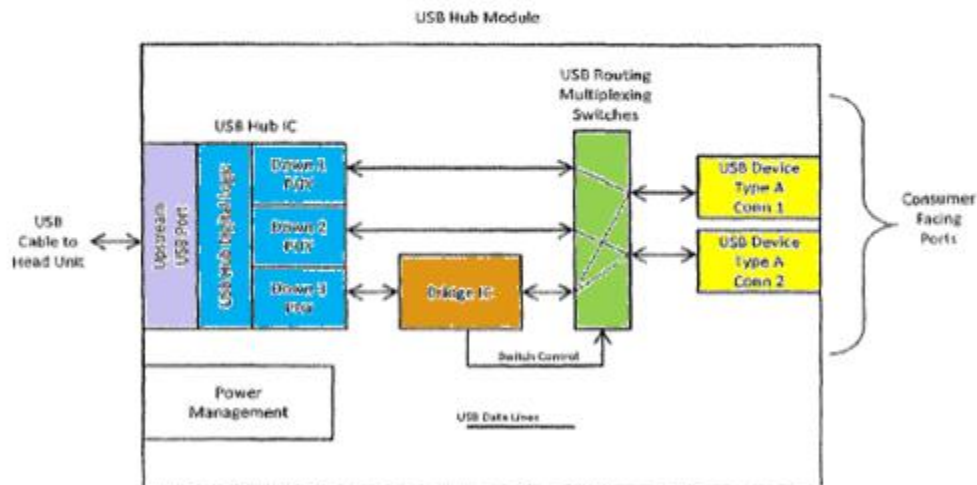
In the “Hub 40” version of the Mux Implementation, the figure above shows extended vertical lines connecting the ports 44 to the hub 40. This simply reflects that the ports 44 can be connected via wires to allow physical placement of the ports in different locations (*e.g.*, in the backseat of a vehicle). Note, however, that the ports can just as easily be located on the hub itself with no additional wiring required. The location of the ports 44 (and 50) and the length of any associated wiring is simply a function of the deployment context. Welch, ¶199.

For comparison, the claimed embodiment of ’072 patent Fig. 4 is shown

below, with corresponding components identified using the same colors.

'072 Patent

Figure 4



2. Claim 1

For reference, annotated figures mapping claim 1 to each modified Mux Implementation of Chang Fig. 3 are below.

Hub 46 Mapping

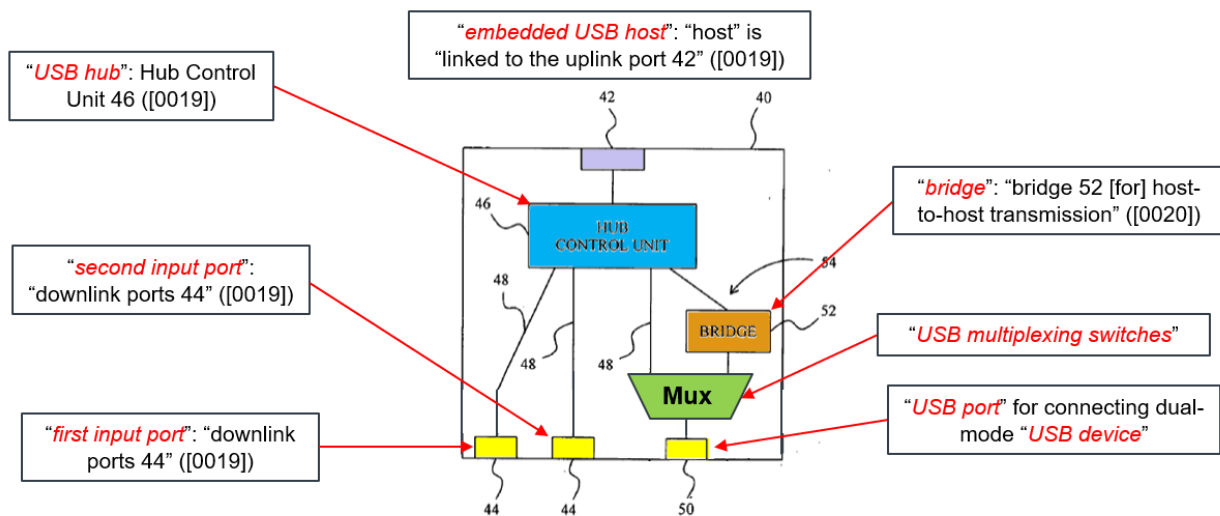


FIG. 3

Hub 40 Mapping

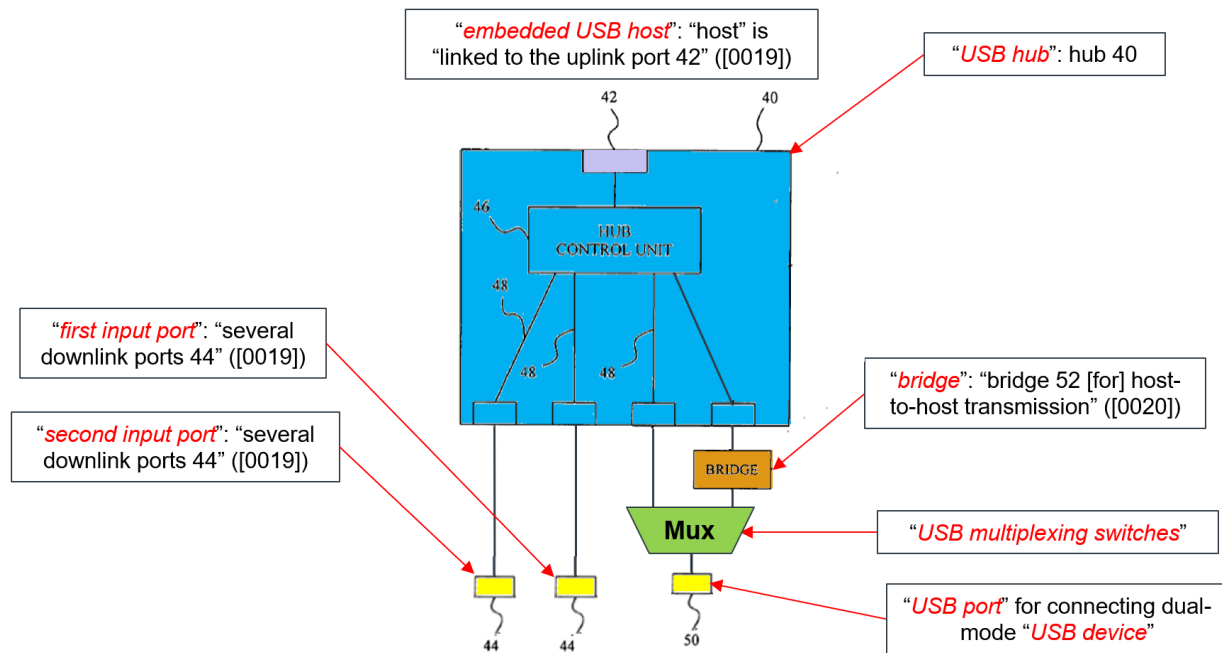


FIG. 3

EX1014, Fig. 3 (modified and annotated).

a. [Preamble]: "A method, comprising:"

To the extent Aptiv argues that the preamble is limiting, Ground 1 renders it obvious. As the below demonstrates, Ground 1 renders obvious each method step of the claim.

b. 1[a] "providing efficient communications among USB components of a data communication system that includes"

The '072 patent does not adequately describe what qualifies as "*efficient communication*" versus, *e.g.*, "inefficient communication." Nevertheless, both Chang and Chang II disclose providing "efficient communication." Chang

discloses making “a communication channel between two computers ... simpler and more efficient.” EX1014, [0002]. Chang II discloses enabling users to “conveniently and efficiently proceed to transfer data between two computer host[s].” EX1015, [0010]. Chang II further discloses that its “design will attend high transfer efficiency.” *Id.*, [0046]. Regardless of how “efficient communication” might be construed, both Chang and Chang II disclose “efficient communication” more expressly and extensively than any disclosure in the ’072 patent. Welch, ¶222. So, too (as the claim 1 analysis demonstrates), do both Mux Implementations of Ground 1 render obvious “efficient communication” among the components of claim 1. *Id.*, ¶223.

Note that the ’072 patent does not use the term “*efficient communication*” in the specification (only in claim 1). However, because all embodiments of the ’072 patent are in the context of USB communication systems that include “USB components” such as hosts, dual-role products, bridges, hubs, and a bypass path, one example of “efficient communication” must be USB communication among these components as arranged in claim 1 (despite the outer bounds of the claim being uncertain). *See generally* EX1009.

Finally, the below claim mapping demonstrates that Ground 1 renders obvious “*a data communication system that includes*” each component of claim 1. In particular, Chang discloses its system communicates “data.” EX1014, [0002],

[0017], [0046]; Welch, ¶224.

Accordingly, Ground 1 renders obvious “*providing efficient communications among USB components* [Chang and Chang II disclose ‘efficient’ USB communication, and Ground 1 renders obvious the same USB configuration of the ’072 embodiments] *of a data communication system that includes* [Chang discloses communication ‘data,’ and Ground 1 renders obvious the components of claim 1].”

c. 1[a][i] “a first input port, second input port, a USB hub, a USB bridge connected to the USB hub,”

Chang discloses a “*first input port*” and “*a second input port*,” e.g., downstream ports 44. EX1014, [0019]-[0020] (discussing ports for connecting to downlink ports 44, 50 as well as for connecting to uplink port 42). Note that port 50 is also an “input port.” Welch, ¶226.

Petitioner provides two mappings (one for each Mux Implementation) depending on whether the claimed “*USB hub*” is Chang’s “hub control unit 46” or “hub 40.” Each meets element 1[a][i].

Hub Control Unit 46

While Chang also discloses a “hub 40” (discussed *infra*), hub control unit 46 itself satisfies the claimed “*USB hub*.” EX1014, [0019] (“hub control unit 46” establishes “several transmission paths” between “uplink port 42 and downlink ports”). A “*USB hub*” does not require a physical enclosure around the

component(s) and ports that comprise the hub. This is consistent with the '072 specification, file history, and USB 2.0 Specification. Welch, ¶228.

'072 Patent Specification. '072 patent Fig. 5 illustrates a hub, bridge, and switch on one IC. See EX1009, 5:28-32. Fig. 5's "hub" is simply the logic that performs the hub functionality of broadcasting upstream communications downstream (and vice versa). *Id.*, 7:15-21, Fig. 5 (defining "hub" by drawing box around "USB hub digital logic"); Welch, ¶230.

File History. During prosecution of the related '037 patent, the Examiner also defined "hub" functionally. See EX1002, 141 ("the USB switching hub 119 of Bohm discloses *the function of claimed hub*") (emphasis added). Welch, ¶231.

USB Specification. The USB 2.0 Specification describes "hub" as "[a] USB device that provides additional connections to the USB." EX1018, 34. That is precisely what hub control unit 46 does. Welch, ¶229.

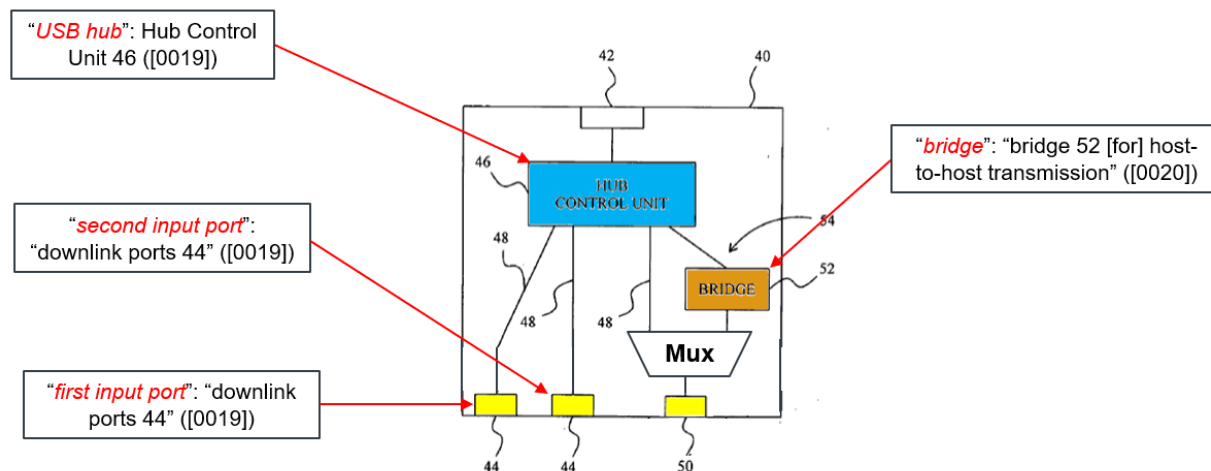


FIG. 3

EX1014, Fig. 3 (modified and annotated).

Thus, as shown above, Chang’s hub control unit 46 is the claimed “**USB hub**.” Welch, ¶233.

Chang further discloses bridge 52: “The bridge 52 provides a function for host-to-host communications, and may be implemented with a bridge chip for example OTi2108 of Ours Technology Inc. or other host-to-host transmission chip.” EX1014, [0020]. As such, Chang discloses each component of 1[a][i].

Hub 40

Ground 1 also satisfies element 1[a] if Chang’s USB hub 40 in its entirety is considered the “**USB hub**.” Welch, ¶234. Specifically, it would have been obvious to modify Chang such that its bridge is a separate physical component outside of Chang’s hub unit 40. *Id.* Chang discloses it is “possible to integrate” the bridge into the hub control unit (EX1014, [0022]), suggesting to a POSITA that the bridge

could also be located outside of it. Welch, ¶235.

Hub 40 Mapping

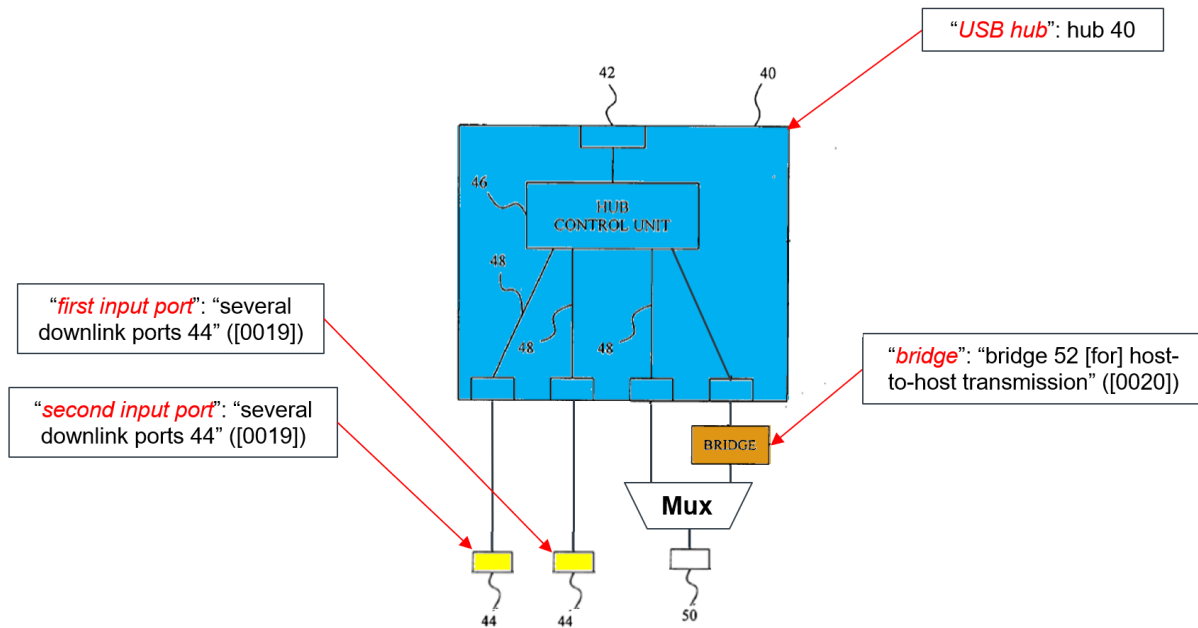


FIG. 3

EX1014, Fig. 3 (modified and annotated).

Adding the bridge and switch using an external connection to a hub downstream port would advantageously allow using a conventional hub without modification (EX1014, [0024]), allowing for minimal modifications to legacy designs and allowing easy sourcing of components (*e.g.*, the conventional hub). Welch, ¶¶236-237. And the implementation would be simple, because it would merely involve connecting, for example, the bridge transmission cable to the conventional hub. *Id.*

Under this mapping, the bridge is external to physical hub structure 40 and the first and second inputs are ports 44. See EX1014, [0019] (describing

“downlink ports 44 such that the host linked to the uplink port 42 can communicate with the devices linked to the downlink ports 44”), [0020] (“[T]he host linked to the uplink port 42 can communicate with the host linked to the host port 50.”); Welch, ¶238.

d. 1[a][ii] “an embedded USB host connected to the USB hub,”

Ground 1 renders this limitation obvious, and specifically, that an embedded host would connect to Ground 1’s upstream port. A POSITA would have understood “embedded USB host” to at least encompass a “USB host physically embedded in a vehicle.” See §V.A.

To start, the ’072 patent admits that using USB hubs in a vehicle infotainment system was already known, and “[t]he USB Host function is often embedded into a component of the vehicle infotainment system, such as into the radio or other control module.” EX1009, 1:51-53. Indeed, using USB hubs to support vehicle infotainment systems connecting to downstream consumer devices was ubiquitous. See *supra* §III.D. What’s more, the ’072 patent also admits that there was a need for the vehicle infotainment system to connect to downstream hosts. EX1009, 2:41-3:20. Chang’s host-to-host bridge addresses this specific need. Welch, ¶¶240-241. Accordingly, it would have been obvious to connect Chang’s system (and this Ground’s modified Chang/Chang II hub) to an embedded

host.

Chang discloses that a “host” is “linked to the uplink port 42.” EX1014, [0019]. Indeed, this link is merely a standardized USB cable connection. While Chang’s disclosure is more general than the ’072 patent, Chang does not limit its disclosure to any particular type of host. Instead, Chang broadly discloses its invention in the context of a USB hub that allows for a host-to-host connection, without restriction as to the type of host which will connect to uplink port 42. *Id.*, [0001], [0003], [0020]. Accordingly, a POSITA would have recognized that Chang is applicable to any system that employs a USB hub, and in particular, where a host-to-host connection would be advantageous. Welch, ¶242.

Moreover, vehicle infotainment systems are effectively host computer systems connected to smartphones (which had also effectively become computer systems) via downstream ports. EX1009, 1:62-3:5; EX1029, 5:27-7:34 (describing “vehicle control system 106,” *e.g.*, a vehicle infotainment system); EX1049, 1 (“the car has become a PC on wheels”). And Chang provides an example of an upstream host PC (analogous to a vehicle infotainment system) connecting to a downstream host (*e.g.*, a smartphone), expressly suggesting application to the vehicle environment. EX1014, Fig. 4, [0023] (downstream host 70 connected on port 50); Welch, ¶243. Such an implementation was highly predictable: simply arranging the hub, *e.g.*, in the front of the vehicle, with wiring to downstream ports

throughout the vehicle. *Id.*, ¶244. The express disclosure in Chang of an upstream host PC provides additional motivation to consider a vehicle deployment of Ground 1's system.

To the extent that the Board determines that “embedded USB host” does not require being built into a vehicle, Chang and Chang II each expressly disclose this limitation. Chang discloses a PC, which was well-known to have a built-in USB host function, as being connected to the hub's upstream host. EX1014, Figs. 3-4, [0023]; Welch, ¶¶245-246. Chang II also discloses “build[ing] the data transmission bridge device 1 directly within a first host device 2 (such as a notebook computer), and the first connection interface 11 is internally and directly connected with the host processor unit 21 of the first host device 2. In other words, the first connection interface 11 is permanently attached to the first host device 2.” EX1015, [0031].

Accordingly, Ground 1 renders obvious “*an embedded USB host connected to the USB hub.*” The “embedded USB host” mapping does not change regardless of whether Chang's “hub 40” or “hub control unit 46” is mapped to the claimed hub.

- e. ***1[a][iii] “a USB port connected to a USB device capable of operating in a USB Host mode and a USB device mode, and USB multiplexing switches connected to the USB port, the USB hub, and the USB bridge”:***

As §VII.A.1 demonstrates, Ground 1 renders obvious modifying Chang to include a dual-role mode USB port (i.e., “*a USB port*”) that connects “*to a USB device capable of operating in a USB Host mode and a USB device mode.*” For example, Chang II discloses that “the main feature is the provision of two different transmission paths, so that *by automatically detecting the type of device connected (host or slave)* the present invention can switch to the proper transmission path.” EX1015, [0021] (emphasis added). Chang II discloses a single port that allows a connected USB product to act either as a “Second Host Device” or a “Slave Device” when communicating with a “First Host Device.” See *id.* [0030] (“In practical design, the second connection interface 12 can also directly adopt an A-Type male connector and a B-Type male connector of USB specification to achieve dual connector type design”).

Although various embodiments of Chang II contemplate connecting a dedicated host product or dedicated device product to the second interface, Chang II also discloses that “other combinations and other connector types are too numerous to list, but those connector types covered under USB specification is all within the scope of the present invention.” EX1015, [0030]. This would include, for example, the well-known “Micro-AB” connector (and other known connectors) that accepted host, device, and/or dual-mode products. EX1022, 13 (OTG product “provides both host and peripheral capabilities over a single Micro-AB

receptacle”); Welch, ¶250. Thus, a POSITA would have understood (and certainly found it obvious) that connecting a dual-role product to the second interface was within the scope of Chang II’s disclosure. *Id.*, ¶¶249-253; *see also* §VII.A.1 (motivation to include dual-mode USB ports for dual-mode USB products) and §III.B (discussing proliferation of dual-mode products and corresponding ports).¹⁹

Further, in view of a dual-role mode USB port, it would have been obvious to include “*USB²⁰ multiplexing switches connected to the USB port, the USB hub, and the USB bridge*” to route the downstream USB product to the appropriate path. *See* §VII.A.1. For example, Chang II discloses “switch[ing] to select one of the two transmission paths.” EX1015, Abstract. More specifically, Chang II discloses a detection unit 134 and bypass circuit unit 133:

¹⁹ Note that because Chang II discloses “automatically and periodically” checking for a host/device ([0024]), “automatically detect[ing] the connecting device type” ([0011]), and that “checking whether the user has exchanged for other external device *would occur constantly*” ([0043]), Chang II fully supports (or at least renders obvious) a dual-role product that dynamically switches between modes. Welch, ¶¶251-252.

²⁰ That these switches are “*USB* multiplexing switches” stems from the fact that it switches the “USB” lines. Welch, ¶255.

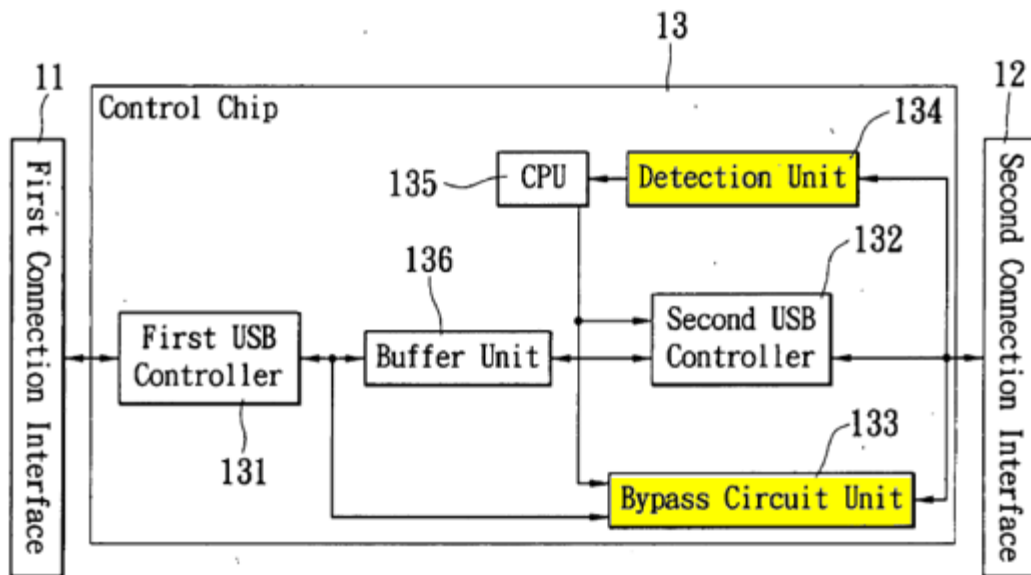


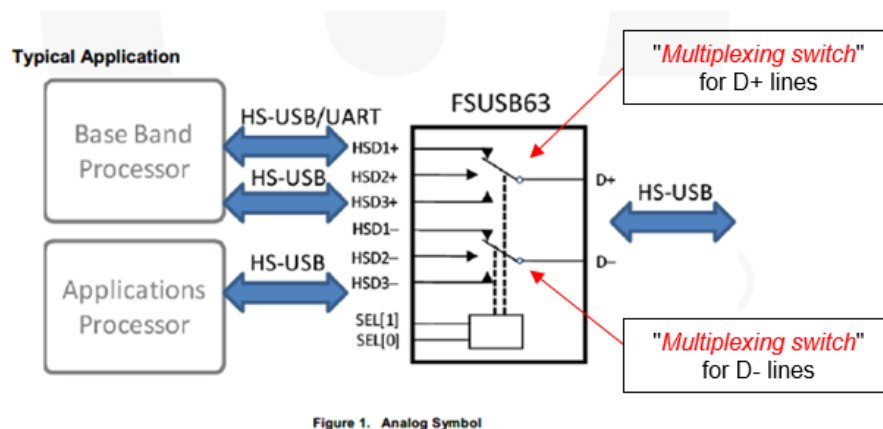
FIG. 5

Id., Fig. 5.

Chang II discloses that “the second USB controller 132 coupled with the first USB controller 131 forms a transmission bridge,” providing host-to-host communication between the first interface (host) and second connection interface (host). EX1015, [0036]. But when a device, not a host, connects to the second interface, “a direct connection between the first USB controller 131 and the second connection interface 12 can be made,” providing host-to-device communication between the first interface (host) and second interface (device). *Id.*, [0037], *see also id.*, [0038]-[0040]; [0044] (describing “bypass path”). In short, the “bypass” provides a path around the bridging function and Chang II teaches switching between the two transmission paths depending on the type of consumer unit (host or device). Sections VII.A.1 and III.B.2 demonstrate that switching between

transmission paths was highly predictable, being both well-known and routine to implement. Welch, ¶¶258-259. Indeed, numerous USB multiplexing switching products were well-known and available by 2013. See EX1059; EX1060; EX1068; Welch, ¶258. In view of these teachings, it would have been obvious to employ, for example, multiplexing switches in Chang to switch between the bridge path (when a host connects) or bypass route around the bridge (when a device connects). Welch, ¶¶255-260.

Note that a USB connection includes two data lines. Thus, typical USB switches will include at least two switches, *e.g.*, to switch (select) among D+ lines and to switch (select) among D- lines:

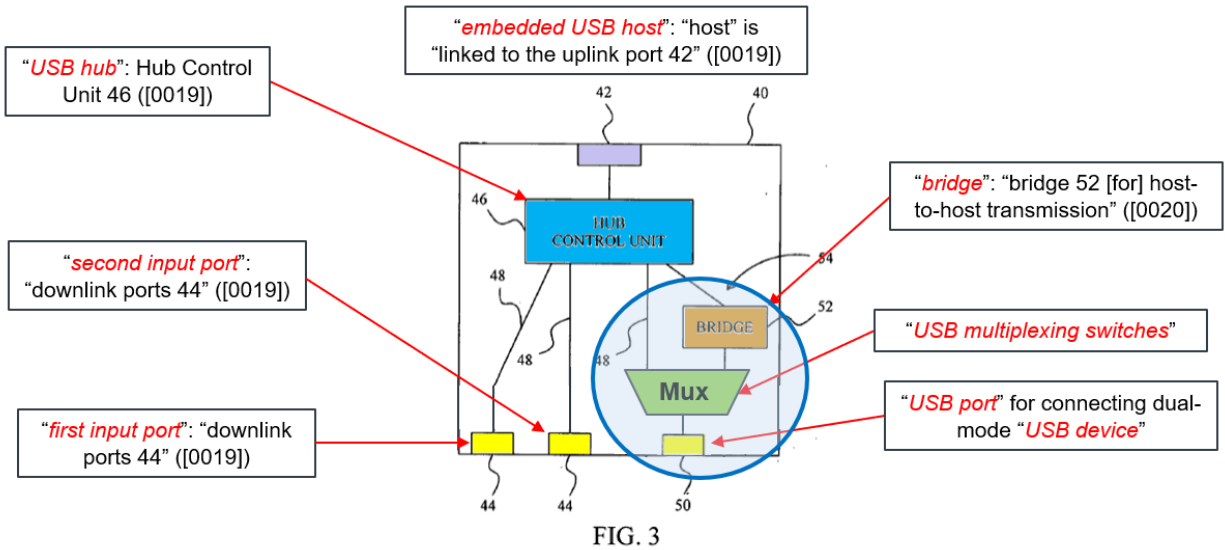


EX1060, 1 (annotated); Welch, ¶259.

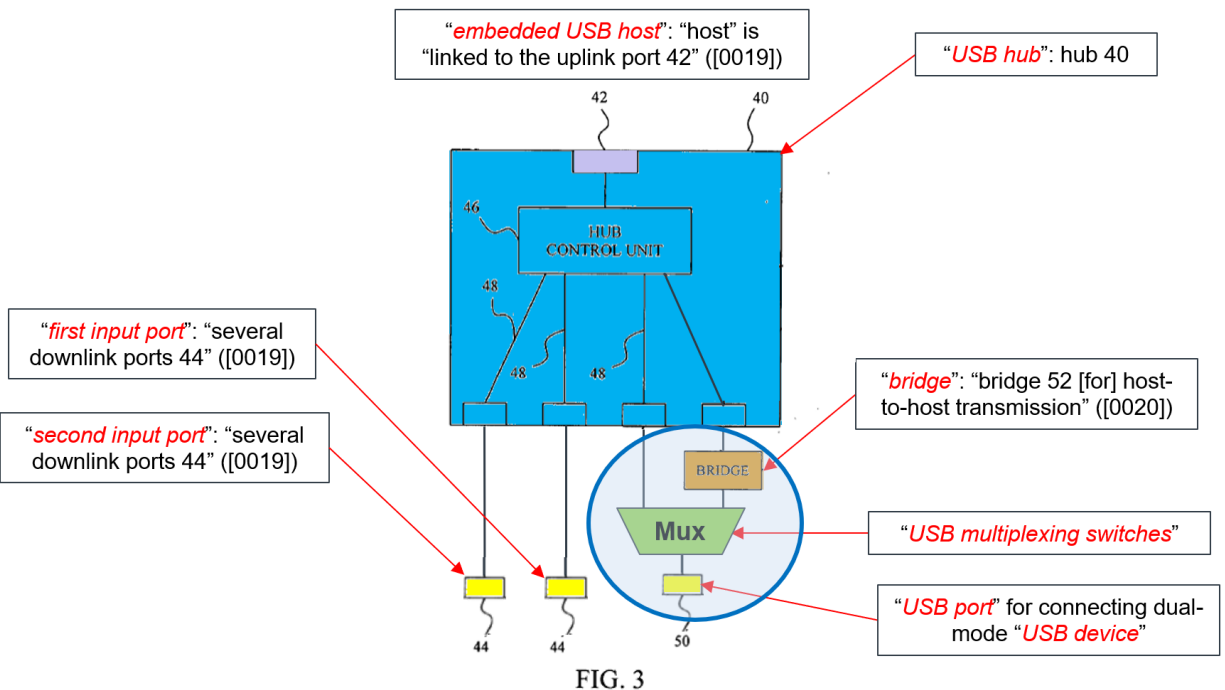
As such, it would have been obvious to modify Chang to include a “USB port” (dual-role port), “USB device” (dual-role product), and “USB multiplexing

switches” (to select the transmission path):

Hub 46 Mapping



Hub 40 Mapping



EX1014, Fig. 3 (modified and annotated).

f. 1[b] “receiving a first USB signal from the USB device via the USB port while the USB device is operating in the USB host mode;”

Ground 1 renders this limitation obvious. Welch, ¶261. Chang discloses allowing host-to-host communication through “a host-to-host transmission path 54 [that] may be established such that the uplink port 42 may communicate with the host port 50.” EX1014, [0020]. In other words, a USB product (“*device*”²¹) sends USB signals to host port 50. *Id.*

As the analysis in §III.A.1 and 1[a][iii] demonstrate, it would have been obvious to modify Chang to include a dual-role port (“*a USB port connected to a USB device capable of operating in a USB Host mode and a USB device mode*”) for dual-mode USB product. Under this obvious modification, the dual-role port would “*receiv[e] a first USB signal from the USB device via the USB port while the USB device is operating in the USB host mode.*” Welch, ¶262.

g. 1[c] “routing the first USB signal via the USB multiplexing switches from the USB device to the embedded USB host through the USB bridge and the USB hub;”

Ground 1 renders this limitation obvious. Welch, ¶263. For example,

²¹ This Ground demonstrates it would have been obvious for the USB product that connects to host port 50 to be a dual-role product (“device”) and host port 50 to be a dual-role port. See analysis under 1[a][iii].

Chang II discloses generating “a detection signal (bridging detection signal or slave detection signal)” and “then according to the detection signal control[ling] the operation of either the second USB controller 132 or the bypass circuit unit 133.” EX1015, [0038]. Applying this teaching (and a POSITA’s knowledge of switching, *see supra* §III.B.2) to Chang, upon detection of the consumer product in host mode, the switch would connect the port to the bridge. The analysis under 1[a][iii] demonstrates that upon detecting a product in host mode, it would be obvious to implement the switch to route USB signals to the embedded host through Chang’s bridge. Welch, ¶263.

Thus, this results in the following obvious configurations, with red arrows showing the host-to-host connection path:

Hub 46 Mapping

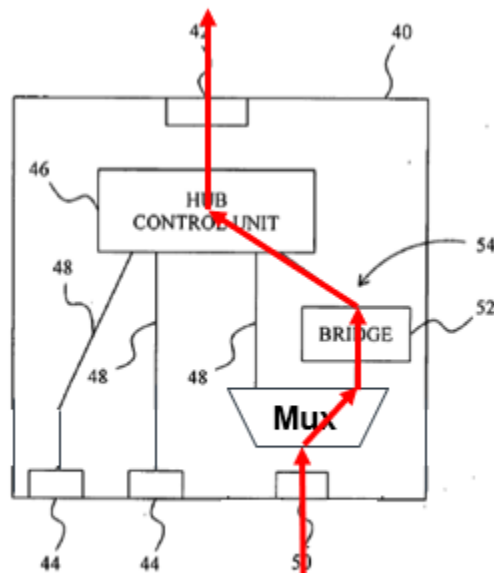


FIG. 3

Hub 40 Mapping

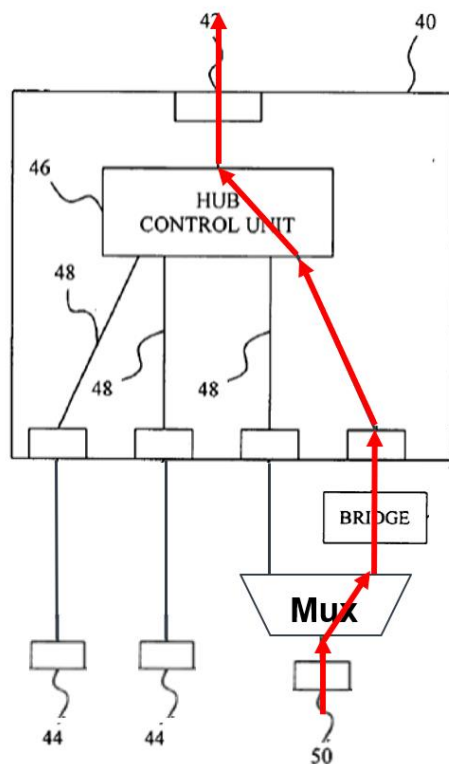


FIG. 3

EX1014, Fig. 3 (modified and annotated).

- h. 1[d] “receiving a second USB signal from the USB device via the USB port while the USB device is operating in the USB device mode; and”***

Ground 1 renders this limitation obvious. Welch, ¶265. Chang discloses “several transmission paths 48 between the uplink port 42 and downlink ports 44.”

EX1014, [0019]. In other words, a USB product (“*device*”)²² sends USB signals to downlink port 44. *Id.*

As the analysis in §VII.A.1 and 1[a][iii] demonstrate, it would have been obvious to modify Chang to include a dual-role port (“*a USB port connected to a USB device capable of operating in a USB Host mode and a USB device mode*”) for dual-mode USB products. As described for element 1[a][iii], Ground 1 discloses (or at least renders obvious) the use of a dual-role products (which were well-known to switch between host/device roles). Welch, ¶266. Under this obvious modification, the dual-role port would “*receiv[e] a second USB signal from the USB device via the USB port while the USB device is operating in the USB device mode.*” *Id.*

- i. ***1[e] “routing the second USB signal via the USB multiplexing switches from the USB device to the embedded USB host through the USB hub, wherein the second USB signal from the USB device to the embedded USB host bypasses the USB bridge.”***

Ground 1 renders this limitation obvious. Welch, ¶267. For example,

²² This Ground demonstrates it would have been obvious for the USB product that connects to host port 50 (or port 44) to be a dual-role product (“device”) and host port 50 (or port 44) to be a dual-role port. See analysis under 1[a][iii].

Chang II discloses generating “a detection signal (bridging detection signal or slave detection signal)” and “then according to the detection signal control[ling] the operation of either the second USB controller 132 or the bypass circuit unit 133.” EX1015, [0038]. Applying this teaching (and a POSITA’s knowledge of switching, *see supra* §III.B.2) to Chang, the analysis under 1[a][iii] demonstrates that upon detecting a product in device mode, it would be obvious to implement the switch to route USB signals to the embedded host by bypassing the bridge. Welch, ¶267.

To the extent Aptiv argues that the claim requires dynamic switching (*e.g.*, “the USB device” switching roles during, for example, an active session)²³ and that Chang II does not disclose such, at a minimum a POSITA would have found it obvious in view of Chang II (and the plethora of dual-role products available at the time) to detect a role switch and route USB signals accordingly. Welch, ¶¶268-270. Specifically, the analysis under 1[a][iii] demonstrates that a POSITA would have understood Chang II to disclose (and at least render obvious) its system

²³ The claim includes no such requirement. Instead, the device need only send a first signal while in a host mode (element 1[b]), and second signal while in device mode (element 1[d]). There is no limitation on what occurs between these signals, *e.g.*, powering on and off the device.

supporting dual-role products, which were known to dynamically switch roles during operation. *See also* §III.B; EX1022, 2 (OTG Supplement revised to address “[d]ynamic role swaps during active connections.”); *see also id.*, §1.1.

Thus, this results in the following obvious configurations, with purple arrows showing the host-to-device connection path:

Hub 46 Mapping

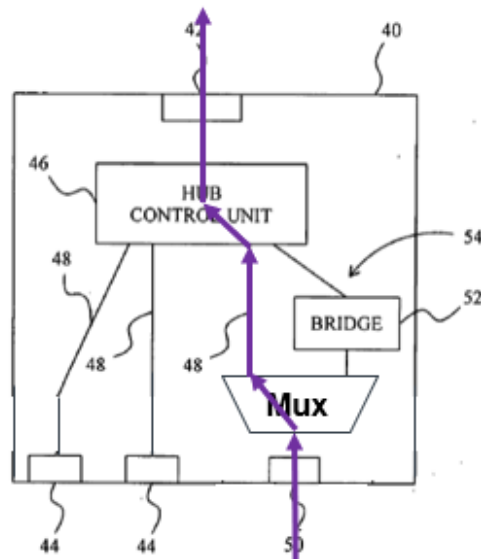


FIG. 3

EX1014, Fig. 3 (modified and annotated).

Hub 40 Mapping

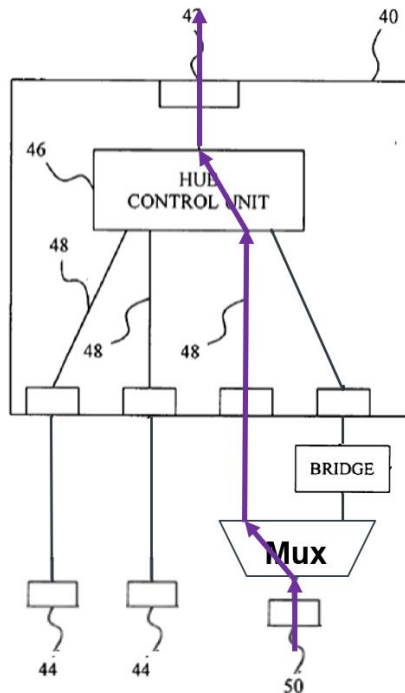


FIG. 3

EX1014, Fig. 3 (modified and annotated).

B. Ground 2 (Claim 1): Chang in view of Chang II, Chutorash, and POSITA Knowledge

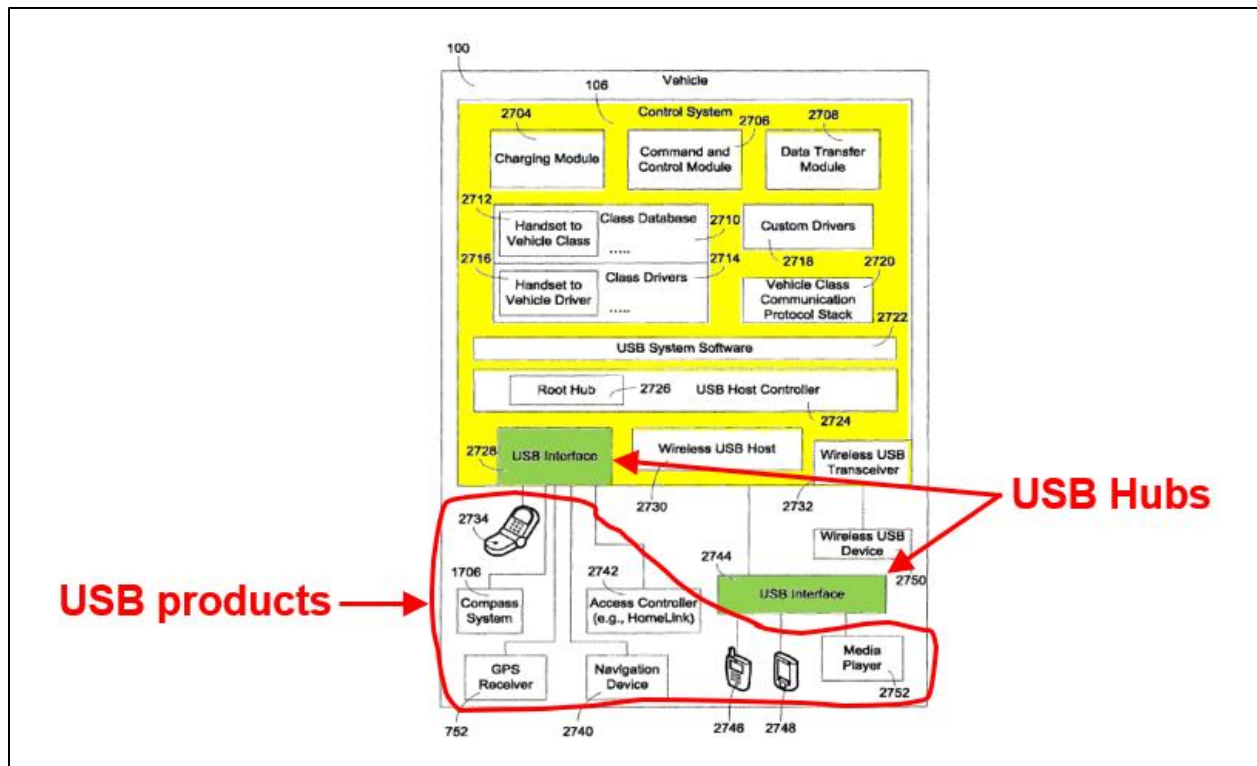
The only difference between Ground 1 and Ground 2 is the express addition of Chutorash, and the analysis from Ground 1 applies equally to Ground 2.

1. Motivation to Combine

The motivation to additionally combine Chutorash with Ground 1 is quite simple. Ground 1 (*i.e.*, Chang, Chang II, and a POSITA's knowledge) discloses a USB hub with a host-to-host bridge and one (or more) dual-role ports. See §VII.A.1. Chutorash expressly discloses using a USB hub in a vehicle

control/infotainment system. *See* §VI.C.

As described in §VI.C, Chutorash discloses a vehicle control/infotainment system with “USB interfaces 2728, 2744” that “facilitate operative connection of a mobile phone 2734, a compass system 1706, a GPS receiver 752, another navigation device 2740, an access controller 2742 (e.g., a HomeLink(R) product sold by Johnson Controls, Inc.), a PDA 2746, a media player 2752, a satellite radio, a USB microphone, a wireless USB device 2750, or another portable device that may be brought into vehicle 100 and configured to communicate via USB connection.” EX1029, 27:1-30; *see also id.*, Figs. 1, 3, and 27-30; 5:29-33 (“vehicle 100 may include ... vehicle control system 106 (e.g., media system, navigational system, entertainment system, display system, communications systems, etc.).”). Indeed, Fig. 27 shows at least 8 separate USB products connected to the control system 106 via the USB interfaces.



Chutorash does not describe the USB interfaces 2728 or 2744 in detail. However, given the number of connected USB products and the implementation in a car, a POSITA would have understood the “USB Interface[s]” to be USB hubs, or at least found it obvious to use USB hubs. Welch, ¶¶173, 204-205. Moreover, a POSITA would have been motivated to use a USB hub with host-to-host capabilities because “[v]ehicle control system 106 could be classified as an embedded host” and various USB products (*e.g.*, mobile phone 2734, media player 2752, etc.) are precisely the types of products that typically act as USB hosts. EX1029, 27:1-30; Welch, ¶206. Further, Chutorash discloses that the “[v]ehicle control system 106 may use the USB interface 2728” for “command and control” purposes. EX1029, 27:12-25; *see also id.*, 13:22-24. For example, “[v]ideo

services 724 of the portable device 116 may be utilized by vehicle control system 106 to provide video decoding and/or playback features to the vehicle.” *Id.*, 14:40-53; *see also id.*, 14:62-67 (discussing gaming applications, including for “a rear set entertainment system”); *id.*, 7:2-10.

Given the ubiquity of USB products in 2013, the similarities of embedded vehicle control/infotainment systems to PCs, and the well-established usage of USB hubs for connecting multiple USB products to an embedded host, a POSITA would have had more than a reasonable expectation of success using the modified Chang USB hub in the vehicle control system of Chutorash. Welch, ¶209.

Moreover, the desirability of being able to plug a smartphone (or other USB product) into any USB port in the car (*e.g.*, including in passenger seat or backset) would also have motivated a POSITA to use a hub with dual-role ports. *Id.*, ¶208.

Indeed, the proposed combination further addresses Chutorash’s stated “need for improved user interface features and/or connectivity features relating to vehicle control systems, remote sources, and/or portable devices.” EX1029, 1:34-36.

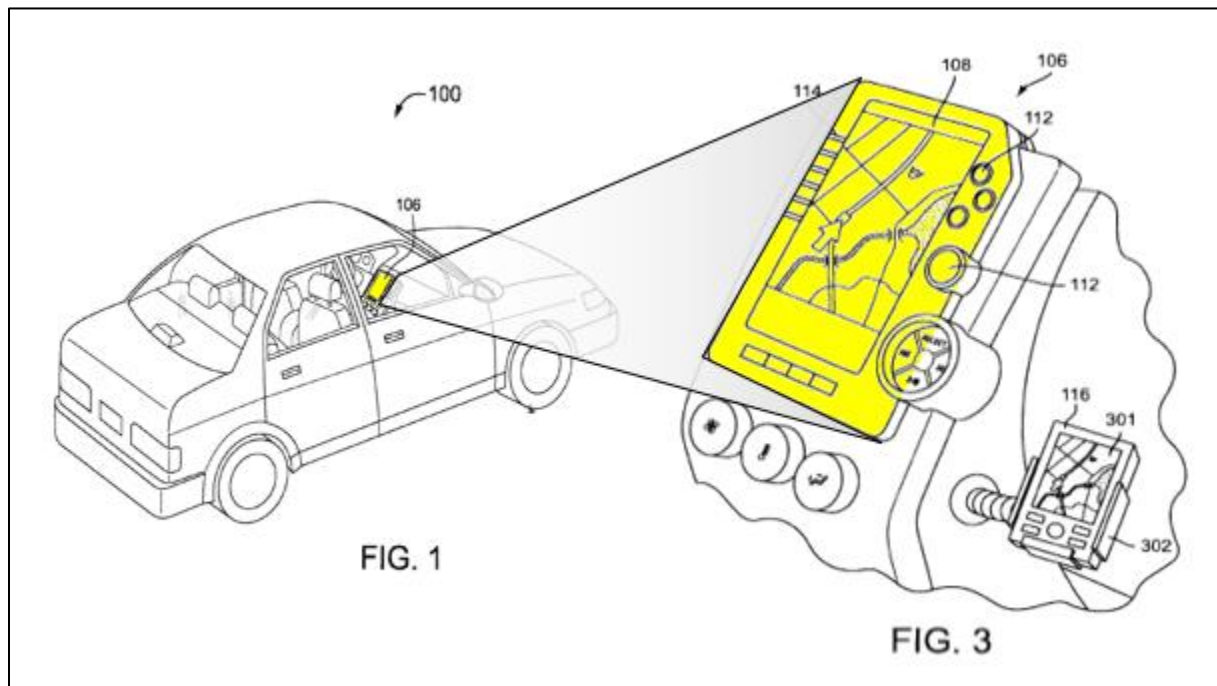
Additional motivations for utilizing the modified Chang hub in a vehicle infotainment system are discussed *supra*, §III.D.

2. Claim 1

To the extent Aptiv argues Ground 1 lacks sufficient support for element 1[a][ii]’s requirement of “an USB embedded host,” *e.g.*, host built into a vehicle

infotainment system, Chutorash discloses a “vehicle control system 106” (which includes a “media system” and “entertainment system”) that is within “vehicle 100.” EX1029, 5:27-33; Figs. 1-3, and 27-30. Welch, ¶273.

All other analysis for claim 1 is the same as Ground 1.



C. Secondary Considerations of Nonobviousness

No secondary considerations of nonobviousness were identified during prosecution. *See generally* EX1010. And Petitioner is unaware of any that apply here. Welch, ¶¶274-291. Aptiv is the plaintiff in related district court litigation against Petitioner asserting six related patents, including the '072 patent. *See infra* §IX.B. In an interrogatory response, Aptiv contends the following secondary considerations support nonobviousness: “commercial success, industry praise for Aptiv’s innovative products, failure by Microchip to develop a solution like

Aptiv’s innovative products, and copying by Microchip of Aptiv’s innovative products.” EX1045, 11.

Commercial Success. Aptiv relies heavily on its so-called “Dual Role Hub” that it contends “embodies the claimed inventions,” but it provides no evidence of commercial success, let alone that any such purported success had the required nexus due to practicing the Challenged Claim. *See, e.g., Bos. Sci. SciMed, Inc. v. Iancu*, 811 F. App’x 618, 623, 627-629 (Fed. Cir. 2020); *Welch*, ¶¶279-283. Should Aptiv proffer any such evidence, Petitioner can rebut it with evidence demonstrating the lack of nexus between the alleged success and the claim.

Aptiv contends that the Dual Role Hub was the first USB hub that “provided all the features sought by the vehicle manufacturers: (1) accommodating the head unit as a first host and the iPhone as a second host while running CarPlay; (2) providing persistent USB; and (3) using a single lane configuration.” EX1045, 11. Aptiv’s assertion fails. Chang’s hub plainly disclosed: (1) a host-to-host connection; (2) persistent USB (*i.e.*, a host-to-host connection does not affect functionality of other downstream devices); and (3) a single lane configuration (*viz.*, a single connection between the hub and upstream host). *See supra* §VI.A. As such, any Aptiv (or Aptiv PLC) product that merely provides these features cannot form the basis for secondary considerations. Moreover, the sole independent claim of the ’072 patent says nothing about “CarPlay,” “persistent

USB,” or “a single USB data connection.” Welch, ¶¶275, 278, 282.

Industry Praise. Aptiv cites a single award, which touts Apple CarPlay compatibility. EX1045, 11. But, as noted, CarPlay is not recited in the Challenged Claim and host-to-host communication in USB hubs was already known. Welch, ¶¶276-278. And the article mentions other reasons (*e.g.*, “lower cost”) contributing to the award. www.autonews.com/awards/2016-winner-delphi-automotive-dual-role-hub.

Failure by Others and Copying. Aptiv’s bare-bones allegations of copying by Microchip and failure by others are unsubstantiated and do not support a finding of nonobviousness. Welch, ¶¶284-285.

Other Secondary Considerations. The secondary considerations of “long-standing problem or need” and “unexpected results / skepticism” do not favor a finding of nonobviousness. Welch, ¶¶288-290. If anything, the ease and speed with which Apple CarPlay requirements in 2013 spurred activity suggests just the opposite. *Id.* Nor has Aptiv showed commercial acquiescence from any entity either seeking or taking a license to the ’072 patent. EX1045, 11; Welch, ¶291.

* * *

Even if Aptiv’s district court allegations had any merit, they would not overcome this Petition’s strong showing of obviousness. Microchip reserves the right to request a preliminary reply to rebut any purported secondary

considerations should Aptiv raise them in a Preliminary Response.

VIII. DISCRETIONARY DENIAL IS NOT WARRANTED

Discretionary denial is unwarranted under 35 U.S.C. §314(a) and §325(d).

A. Section 314(a)

“Consistent with *Sotera Wireless, Inc.*, the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” Interim Procedure for Discretionary Denials in AIA Postgrant Proceedings with Parallel District Court Litigation, June 21, 2022, 3 (citing *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020) (precedential as to §II.A)). Petitioner hereby stipulates that, if the PTAB institutes this *inter partes* review, Petitioner will not pursue invalidity of the Challenged Claim in a parallel district court proceeding on the same grounds or any grounds that could have reasonably been raised before the PTAB in this Petition. Accordingly, the Board should not discretionarily deny Institution of this Petition under §314(a).

B. Section 325(d)

Discretionary denial under 35 U.S.C. §325(d) is not warranted because neither prong from *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (Feb. 13, 2020) is satisfied. *See also Becton, Dickinson and Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at

17-18 (PTAB Dec. 15, 2017) (precedential as to §III.C.5, first paragraph) (the “*Becton, Dickinson* factors”).

With respect to the first prong (corresponding to *Becton, Dickinson* factors (a), (b), and (d)), Chang II was not submitted in an IDS nor cited by the Examiner during the '072 patent prosecution. *See generally* EX1010.²⁴ Notably, Chang II discloses a “bridge device” with a first interface for connecting a first host and separate bridge and bypass paths for connecting another USB product depending on whether it is host or device. EX1015, Abstract; *see also* §VI.B. The first host remains a host, even when connecting to another host (*i.e.*, host-to-host connection). *See* Section VI.B. Petitioner does not believe any prior art before the Patent Office during prosecution is “substantially the same prior art,” “cumulative,” or materially “similar.” *See Becton, Dickinson* factors (a), (b).

²⁴ Nor was Chang II cited in any application to which the '072 patent claims priority. Chang II was submitted in a 2021 IDS during prosecution of a child continuation patent (U.S. Pat. 11,681,643). This is irrelevant to §325(d) because the Examiner was unaware of Chang II when examining the '962 patent claims. Moreover, claim limitations were added the '643 claims after Chang II was submitted by the applicant that are not present in the '072 claim, *e.g.*, “[routing logic connected directly to the] USB hub.” EX1012, 202-03.

Certainly, the Examiner did not consider this Petition’s argument that it would have been obvious to modify Chang (in view of Chang II and a POSITA’s knowledge) to include dual-role ports and a bypass around the bridge. *See Becton, Dickinson* factors (d); §§IV.B, VII.A.1.

Because *Advanced Bionics* prong one is not met, the second prong (corresponding to *Becton, Dickinson* factors (c), (e), and (f)) is inapplicable. Regardless, *Becton, Dickinson* factor (c) strongly weighs against denying institution since none of the art that forms the grounds herein was the basis of rejection during prosecution. *See generally* §IV.B. Moreover, had the Examiner been aware of Chang II (or its teachings) during the ’072 patent prosecution, Petitioner respectfully asserts that the Examiner misapprehended important teachings of both Chang and Chang II.

To start, the Examiner never addressed Chang,²⁵ much less its important

²⁵ Ground 2 relies on Chutorash, which was submitted in an IDS during prosecution of the ’037 patent and is cited on the face of the ’072 patent. Chutorash was never cited or discussed by the Examiner. Moreover, Petitioner relies on Chutorash for the limited purpose of the “embedded USB host” limitation (*viz.*, requiring the USB host to be physically embedded in a vehicle). This

disclosure of connecting a permanent upstream host to a downstream host (through a bridge) and downstream devices (not through the bridge). See §§IV.B, VII.A.1. Nor did the Examiner consider modifying Chang—*e.g.*, in view of Chang II’s bridge path and bypass path disclosure—to include dual-role port(s). *Id.* Thus, even if *Advanced Bionics*’ second prong applied, respectfully, the Patent Office erred or misapprehended Chang and the teachings of Chang II. See *Becton, Dickinson* factor (e).

Moreover, the Petition presents important “additional evidence and facts.” See *Becton, Dickinson* factor (f). For example, this Petition demonstrates that implementing dual-role ports was advantageous and routine. See §§III.B, VII.A.1, IV.B (*e.g.*, Examiner was unaware of Castleberry, which expressly provides motivation to modify Chang with dual-role ports). Thus, even if *Advanced Bionics*’ second prong applied, this Petition warrants reconsideration of Chang and the teachings of Chang II. See *Becton, Dickinson* factor (f).

limitation was not at issue during prosecution. The fact that Chutorash was before the Examiner has no bearing on Petitioner’s §325(d) arguments regarding Chang and Chang II.

Accordingly, both *Advanced Bionics*' prongs favor institution.²⁶

IX. MANDATORY NOTICES

A. Real Party-in-Interest

Petitioner Microchip Technology Inc. and its subsidiaries are the real parties-in-interest.

B. Related Proceedings

No previous IPR or post-grant proceeding has been filed challenging the '072 patent. The '072 patent has been asserted by Aptiv in the following district court action: *Aptiv Technologies AG v. Microchip Technology Inc.*, Case No. 1:23-cv-00307-JDW (D. Del., March 20, 2023). In addition to the '072 patent, the district court action asserts U.S. Patent Nos. 9,460,037; 9,619,420; 9,645,962; 10,545,899; and 11,681,643 from the same patent family. PTAB proceedings on the related patents are listed below:

Patent	PTAB Proceeding
9,619,420	IPR2024-00228

²⁶ Section IV.B details the prior art rejections not only for the '072 patent, but all continuation applications to which the '072 patent claims priority. Section IV.B demonstrates that in each application the Examiner did not apply prior art as the Grounds herein, nor were arguments made that these Grounds present.

Patent	PTAB Proceeding
9,645,962	IPR2024-00229
11,681,643	PGR2024-00011

C. Counsel Information

Petitioners designate the following counsel:

Lead Counsel	Back-Up Counsel
Travis Jensen Registration No. 60,087 tjensen@orrick.com; T61PTABDocket@orrick.com Postal & Hand-Delivery Address: Orrick, Herrington & Sutcliffe LLP 1000 Marsh Road Menlo Park, CA94025-1015 T: 650-614-7400 F: 650-614-7401	Jeremy Jason Lang Registration No. 73,604 jlang@orrick.com; PTABDocketJJL2@orrick.com Postal & Hand-Delivery Address: Orrick, Herrington & Sutcliffe LLP 1000 Marsh Road Menlo Park, CA94025-1015 T: 650-614-7400 F: 650-614-7401

D. Electronic Service

Petitioners consent to email service at the email addresses above.

X. FEES

The required fee is being paid electronically through P-TACTS.

XI. CONCLUSION

Petitioner respectfully requests that the Board institute IPR and enter a final written decision finding the Challenged Claims unpatentable.

Respectfully submitted,

Dated: December 27, 2023

/Travis Jensen/

Travis Jensen, Reg. No. 60,087

CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing Petition with the word count limits set forth in 37 C.F.R. §42.24(a)(1)(i). Excluding the parts of the Petition exempted by 37 C.F.R. §42.24(a)(1), this Petition contains 13,451 words as determined using the word count feature in Microsoft Word, which was used to prepare this Petition.

Dated: December 27, 2023

By: /Travis Jensen/

CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing Petition for *Inter Partes* Review and associated exhibits were caused to be served on December 27, 2023 via overnight courier on the Patent Owner at the correspondence address of record for U.S. Pat. No. 11,176,072:

171991 - Billion & Armitage - Aptiv
7401 Metro Blvd.
Suite 425
Minneapolis, MN 55439

Courtesy copies were also served via email on Patent Owner's counsel of record in a related district court action styled *Aptiv Technologies AG v. Microchip Technology Inc.*, Case No. 1:23-cv-00307-JDW (D. Del., March 20, 2023):

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