

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QSC AUDIO PRODUCTS, LLC,
Petitioner,

v.

CREST AUDIO, INC.,
Patent Owner.

Case IPR2014-00131
Patent 5,652,544

Before MIRIAM L. QUINN, GLENN J. PERRY, and BRYAN F. MOORE,
Administrative Patent Judges.

MOORE, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
Inter partes review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Petitioner, QSC Audio Products, LLC (“QSC” or “Petitioner”), filed a Corrected Petition (Paper 6, “Pet.”) to institute an *inter partes* review of claims 1–15, 18–21, and 23–26 of U.S. Patent No. 5,652,544 (Ex. 1001, “the ’544patent”) pursuant to 35 U.S.C. §§ 311–319. Petitioner indicates that the ’544 patent is being asserted in *Crest Audio, Inc. v. QSC Audio Products, LLC*, No. 3:13-CV610 DPJ-FKB, filed in the United States District Court for the Southern District of Mississippi, Jackson Division, on September 7, 2013. Pet. 1; Paper 12, 2.

On May 6, 2014 we instituted review as to claims 1–15, 18–21, and 23–26 of the ’544 patent and instituted trial on the grounds of unpatentability as set forth below. Paper 16, “Dec. on Inst.”

Claims	Grounds	Reference
Claims 1–6, 9–13, 15, and 19	§ 103	Sudo ¹ and Porambo ²
Claims 1–6, 9–13, 15, 19, 21, and 25	§ 103	Sudo and Krokstad ³
Claims 7, 20, 21, 23, 24, 25, and 26	§ 103	Sudo, Porambo, and APA ⁴
Claims 7, 24, and 26	§ 103	Sudo, Krokstad, and APA
Claim 8	§ 103	Sudo, Porambo, and TMS320 ⁵
Claim 8	§ 103	Sudo, Krokstad, and TMS320
Claims 14 and 18	§ 103	Sudo, Krokstad, and Porambo

Patent Owner, Crest Audio, Inc. (“Crest” or “Patent Owner”) responded to the Petition (Paper 23, “PO Resp.”), Petitioner replied (Paper 29, “Reply”) to Patent Owner’s response. Oral Argument was held on January 27, 2015. Paper 40, “Tr.”

The Board has jurisdiction under 35 U.S.C. § 6(c). In this Final Written Decision, issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73, we determine Petitioner has demonstrated by a preponderance of the evidence that the following claims for which trial was instituted, claims

¹ US 5,822,775, issued Oct. 13, 1998 (Ex. 1005, “Sudo”).

² US 5,450,624, issued Sept. 12, 1995 (Ex. 1006, “Porambo”).

³ WO 91/08654, published June 13, 1991 (Ex. 1007, “Krokstad”).

⁴ The Admitted Prior Art (“APA”) includes ’544 patent description at column 5, lines 46–55.

⁵ TEXAS INSTRUMENTS TMS320 SECOND GENERATION DIGITAL SIGNAL PROCESSORS, 1–67 (1991) (Ex. 1008, “TMS320”)

1–15, 18, 19, 21, and 24–26, are unpatentable. We determine that claims 20 and 23 have not been shown to be unpatentable.

II. THE '544 PATENT (Ex. 1001)

The '544 patent is directed to an audio amplifier with a digital signal processor (DSP) in the amplifier. An amplifier programmer is connected removably to the amplifier to allow the signal processing functions and/or parameters to be changed or modified without changing the signal processing circuit elements themselves. Ex. 1001, 2:48–58. Programming information can be input from portable programmer 200 through connector 300 and programming port 120 to control circuit 158. *Id.* at 6:41–47. “This programming information may comprise signal processing function programs and program data for defining function parameters, parameter modification requests, new parameters, and other suitable control information.” *Id.* Control circuit 158 may comprise a programmable microprocessor that serves as an interface between the portable programmer and signal processing circuit 154. *Id.* at 6:48–51. The control circuit and signal processing circuit of the amplifier may be formed by a digital signal processor. *Id.* at 6:51–55. If a digital signal processor is provided in amplifier 100, both signal processing functions and function parameters may be changed by inputting control information from portable programmer 200 to amplifier 100. *Id.* at 6:48–54. Independent claim 1 is reproduced below and is illustrative of the claimed subject matter.

1. An amplifier comprising:

an input port for receiving an input signal;

a signal processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal processing function parameter, wherein the signal processing circuit receives the input signal from the input port and modifies the input signal;

a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting an amplified signal to an output device;

an external programmer; and

a programming signal input port for receiving at least one programming signal from the external programmer, the external programmer being removably connectable to the programming signal input port for modifying at least one of a signal processing function and a signal processing function parameter defined in said signal processing circuit.

IV. ANALYSIS OF CLAIM CHALLENGES

A. Level of Ordinary Skill

Petitioner asserts that a person of ordinary skill in the art would have had the following education and experience: Master of Science degree in Electrical Engineering and at least some practical experience with the design and testing of electronic amplifiers. Ex. 1003 ¶ 8. Patent Owner's declarant generally agrees with the above assertion, but quantifies the practical

experience, asserting that a person of ordinary skill in the art would have the one year of experience with the “actual” design and testing of electronic amplifiers. Ex. 2001 ¶¶ 22–23.

We determine the obviousness issues guided by the evidence of the level of ordinary skill in the art presented by the references themselves. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). From the Porambo reference, which Patent Owner does not contest is in the field of endeavor of the invention in question, we understand that the level of ordinary skill in the art, at a minimum, pertains to audio amplifiers and the incorporation of DSPs in audio amplifiers. *See* Ex. 1006, Abstract (describing the features of the audio amplifiers and DSPs at issue in Porambo).

B. Dr. Ellis’s Qualification to Provide Expert Opinions

Patent Owner argues that Petitioner’s declarant, Dr. Ellis, is not qualified to perform as an expert in this case because of his alleged lack of experience designing audio amplifiers (PO. Resp. 14–16) and the alleged short amount of time he spent reviewing this case (PO. Resp. 17–18). Patent Owner argues that, unlike Dr. Ellis, its declarant Bob Cordell has significant practical experience designing audio power amplifiers at the time of the invention of the ’544 patent. Ex. 2001 ¶¶ 3, 4, 22.

As to his audio amplifier experience, Dr. Ellis completed a Master of Science degree in Electrical Engineering with numerous years of experience as a research assistant researching audio signal processing, sound synthesis and analysis. Ex. 1004, 1. Dr. Ellis stated during his deposition that, although he is an expert in digital signal processing (IPR2014-00129, Ex. 2002, 154:15–16), he has experience in the design of amplifiers from his

undergraduate education. *Id.* at 124:7–20. Dr. Ellis designed and tested microphone amplifiers as a post-doctoral student at the Computer Science Institute at Berkeley, *id.* at 111:13–113:4, and currently is designing amplifiers that can drive speakers with the goal of incorporating these into his professional work. *Id.* at 120:4–121:12. We also note, as discussed above, the field of the '544 Patent invention is related to audio amplifiers generally and the incorporation of DSPs. We find that although Dr. Ellis is less experienced than Mr. Cordell in the area of amplifier design, he is qualified sufficiently to testify about audio amplifiers as they relate to DSPs.

Patent Owner also argues that Dr. Ellis must himself be a person of ordinary skill in the art. PO Resp. 15–16. Patent Owner's arguments are unpersuasive, because, to testify as an expert under FRE 702, a person need not be a person of ordinary skill in the art, but rather "qualified in the pertinent art." *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1363–64 (Fed. Cir. 2008); *see SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1372–73 (Fed. Cir. 2010); *Mytee Prods., Inc. v. Harris Research, Inc.*, 439 Fed. App'x 882, 886–87 (Fed. Cir. 2011) (non-precedential) (upholding admission of the testimony of an expert who "had experience relevant to the field of the invention," despite admission that he was not a person of ordinary skill in the art). As noted above, Dr. Ellis is qualified in the pertinent art.

Finally, Patent Owner argues that Dr. Ellis spent an unreasonably short amount of time reviewing this case before providing his opinion, i.e., only ten hours. PO Resp. 17–18. We find that the amount of time Dr. Ellis chose to spend with the case likely is based on his experience with the subject matter and the difficulty of the subject matter. Thus, we are not

persuaded by Patent Owner's argument that the time spent on the proffered opinion affects the weight we give his opinions.

C. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Any special definition for a claim term must be set forth with reasonable clarity, deliberateness, and precision. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

1. at least one of a signal processing function and a signal processing function parameter

As to the claim term “at least one of a signal processing function and a signal processing function parameter,” Patent Owner argues that the use of the phrase “at least one of” in the independent claims indicates that the DSP has to be capable of receiving a processing function and signal processing function parameters. PO Resp. 19.

The Specification notes that “programming information may comprise signal processing function programs and program data for defining function parameters.” Ex. 1001, 6:43–45. Thus, the Specification suggests that both the functions and parameters are transmitted to the DSP. Additionally, the Federal Circuit, when faced with similar claim language, determined that the phrase “at least one” followed by a list of categories separated by “and” rather than “or” suggests a conjunctive list in which each one of the

members of the list is necessary to satisfy the claim. *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 885–86 (Fed. Cir. 2004) (“A common treatise on grammar teaches that ‘an article of a preposition applying to all the members of the series must either be used only before the first term or else be repeated before each term.’” (quoting William Strunk, Jr. & E.B. White, *The Elements of Style* 27 (4th ed. 2000))). *SuperGuide* points out that each term in the list embraces a different category, each of which must take on a chosen value: “Every disclosed embodiment teaches that the user must choose a value for each designated category.” *Id.* at 887. That is the case here where functions have associated parameters.

For the above reasons, consistent with the plain English meaning and the Specification, we construe “at least one of a signal processing function and a signal processing function parameter” to require that both a signal processing function and a signal processing parameter must be present in the prior art to meet that claim limitation.

2. *programming information from at least one of the input device and a control circuit of the amplifier*

As to the claim term “programming information from at least one of the input device and a control circuit of the amplifier,” Patent Owner argues that the term should be construed similarly to the term “at least one of an algorithm which defines at least one signal processing function and signal processing function parameters,” and require that both an input device and a control circuit be present to meet the claim limitation. PO Resp. 19–20.

Patent Owner does not cite to any support in the Specification for its reading of this claim term. As noted above, under *SuperGuide*, the plain meaning of “at least one of A and B” is “at least one of A and at least one of

B.” However, *SuperGuide* points out that the specification involved there does not enlarge the scope of the plain meaning, and reasons that each term in the list embraces a different category, each of which must take on a chosen value. *Id.* at 887 (“Importantly, the flow chart uses a conjunctive criteria list, i.e., the system’s user must choose at least one value for each designated criteria, or the logic would be inoperable.”).

Accordingly, *SuperGuide* has been distinguished on the basis that the normal conjunctive meaning does not apply when the specification or claims imply a broader meaning. *See Joao v. Sleepy Hollow Bank*, 348 F. Supp. 2d 120, 124 (S.D.N.Y. 2004) (a conjunctive reading of the phrase, “wherein the banking transaction is at least one of a clearing transaction, a check clearing transaction, an account charging transaction, and a charge-back transaction,” would be nonsensical because a single banking transaction cannot be all four).

The ’544 Specification describes two alternative modes of operation for the controller in the programmer. In a first mode, a microprocessor in the controller receives programming information from a keypad. Reply 9 (Ex. 1001, 3:37–60). In a second mode, the user can select a “reading mode” where the microprocessor receives parameters from the signal processor. Reply 9 (citing Ex. 1001, 4:12–34). The Specification does not require—or even suggest—that the microprocessor must receive programming information from both sources to program the DSP. Reply 9. On the record before us, consistent with the Specification, we construe “programming information from at least one of the input device and a control circuit of the amplifier” to require that either an input device OR a

control circuit, but not necessarily both, must be present in the prior art to meet that claim limitation.

3. performance characteristics

As to the claim term “performance characteristics,” Patent Owner argues that the term should be construed to mean ““any variable data relating to the behavior of the signal processing circuit, including signal processing functions and/or signal processing function parameters.”” PO Resp. 21. Patent Owner argues the Specification describes “control signals [sent] to the signal processing circuit *to modify the performance characteristics* of various control elements of the signal processing circuit.” PO Resp. 21 (Ex. 1001 (the ’544 Patent), 7:61-63). According to Patent Owner, because the performance characteristics are modified, the data for the performance characteristics must be variable. PO Resp. 21. Additionally, Patent Owner argues the word “performance” implies a state of a behavior that is dynamic. *Id.* We disagree. The fact that a characteristic can be modified means that its value can be changed at least once, but not that it is dynamically changing, as suggested by Patent Owner. We decline to limit the term performance characteristics as suggested by Patent Owner.

D. Claims 1–6, 9–13, 15, 19, 21, and 25 – Obviousness over Sudo and Krokstad (Ex. 1007)

Petitioner argues that claims 1–6, 9–13, 15, 19, 21, and 25 are unpatentable under 35 U.S.C. § 103(a) over Sudo and Krokstad. Pet. 24–27, 29–36, 42–49, 51, 54, 57–58. Sudo teaches a digital signal processor that receives an input audio signal on an input port and performs a digital signal process on the input audio signal according to a programmed digital signal

processing function (program) and associated parameters (coefficients) in order to modify the input signal to provide a desired sound field. Ex. 1005, 3:35– 4:5. Microcomputer 20 that operates to program DSP 2 is connected to DSP 2 through interface 19. *Id.* If a user selects a key representing a different sound field on the keyboard, microcomputer 20 reads out the processing program corresponding to the selected sound field control key and the corresponding coefficients, and transfers this data to the DSP through interface 19. *Id.* at 3:61–4:24. Krokstad discloses a DSP-controlled amplifier for use in a hearing aid. Ex. 1007, Abstract. Krokstad further discloses that the DSP can provide signals to a power amplifier if needed. *Id.* at 18, Fig. 4d. In Krokstad, a personal computer is used to program the DSP with different functions and parameters that are optimized for each particular user. *Id.* at 21. The computer is removably connectable to the amplifier and DSP via an RS232 port. *Id.* at 21, Fig. 5a.

1. Claim 1

Below we discuss independent claim 1 from which all other claims challenged in this ground depend. Claim 1 recites an input port for receiving an input signal. Sudo teaches DSP 2 has an input port connected to A/D converter 1. Ex. 1005, Fig. 1. Petitioner has shown by a preponderance of the evidence that Sudo discloses this limitation.

Claim 1 recites “a signal processing circuit comprising a digital signal processor capable of receiving at least one of a signal processing function and a signal processing function parameter, wherein the signal processing circuit receives the input signal from the input port and modifies the input signal.”

Petitioner asserts that Sudo's disclosure of interface 19, which receives a program and coefficients, meets this limitation. Pet. 25 (citing Ex. 1005, col. 4, ll. 1–5, 8–16). Petitioner has shown by a preponderance of the evidence that Sudo discloses this limitation.

In addition, claim 1 recites “a power amplifier for amplifying the modified input signal received from the signal processing circuit and outputting an amplifier signal to an output device.” Petitioner asserts that Krokstad's disclosure of a power amplifier meets this limitation. Pet. 26 (citing Ex. 1007, 18, ll. 17–22). Petitioner has shown by a preponderance of the evidence that Krokstad discloses this limitation.

Claim 1 further recites “a programming signal input port for receiving at least one programming signal from the external programmer” and an “external programmer . . . being removably connectable to the programming signal input port for modifying at least one of a signal processing function and a signal processing function parameter defined in said signal processing circuit.” Petitioner asserts that Sudo's interface 19 that receives programming signals from microcomputer 20 meets a portion of this limitation. Pet. 26. The signal received from microcomputer 20 modifies functions (sound field of hall 1 or hall 2) and parameters (coefficient data). *Id.* (citing Ex. 1005, 3:61–4:17). As discussed below in Section IV. H., we find that Sudo does not disclose a removable connection. Nonetheless, Petitioner asserts that Krokstad's removable connection to a personal computer meets the other portion of this limitation. Pet. 26–27 (citing Ex. 1007, 21). Thus, on the record before us, Petitioner has shown by a preponderance of the evidence that Krokstad discloses this limitation.

Petitioner argues that a person of ordinary skill in the art would have been motivated to program the DSP of Sudo with a programmer that is connected via a removable connection such as the RS232 port shown in Krokstad, “in order to allow the programmer to be easily connected to or disconnected from the DSP or to allow a general purpose computer that could be used for other tasks to be used in programming the DSP.” Pet 25; *see* Ex. 1003 ¶¶ 36–37. Thus, Petitioner has provided sufficient rationale to combine Sudo and Krokstad.

Patent Owner argues that “Petitioner’s . . . analysis [] ignores the numerous technical hurdles that would prevent the connection between the DSP and microcomputer in Sudo being modified to include the RS232 interface of Krokstad.” PO Resp. 34. Patent Owner first argues that a person of ordinary skill would not modify Sudo to include a removable programmer because of speed constraints in Sudo. PO. Resp. 34–35. Patent Owner argues that Petitioner’s declarant, Dr. Ellis, admits that the RS232 connection is not suitable if used as the interface to the microcomputer in Sudo. PO Resp. 35–36 (citing Ex. 2002, 180:24–181:13. Thus, Patent Owner argues, it would not have been obvious to modify Sudo to incorporate the RS232 interface of Krokstad because it would render Sudo unsuitable for its intended purpose. PO Resp. 36 (citing *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). We disagree.

Patent Owner does not assert that a removable connection itself is incompatible with Sudo. Rather Patent Owner asserts that the specific connections used by Krokstad are incompatible with Sudo. *See* PO Resp. 36. Patent Owner misses the point. The obviousness inquiry does not ask “whether the references could be physically combined but whether the

claimed inventions are rendered obvious by the teachings of the prior art as a whole.” *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (en banc); *see also In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (“The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”)

The Supreme Court has made clear that we apply “an expansive and flexible approach” to the question of obviousness. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2007).

Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

Id. at 418. As the Supreme Court recognized, in many cases a person of ordinary skill “will be able to fit the teachings of multiple patents together like pieces of a puzzle,” recognizing that a person of ordinary skill “is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 420–21. Both parties’ declarants agree that Sudo’s high-speed connection could be implemented using a PCI bus, which is a removable connection. Ex. 2002, 178:10–17; Ex. 1012, 93:1–94:19. Thus, given the motivation to create a removable connection, such as the one disclosed in Krokstad, we are persuaded that implementation of that connection in Sudo would not render it unsuitable for its intended purpose.

Thus, for the reasons stated above, Petitioner has shown by a preponderance of the evidence that Krokstad and Sudo teach this limitation. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 1 would have been obvious based on Sudo and Krokstad.

2. Claim 2

Claim 2 recites the operation of the control circuit. Specifically, this claim requires the control circuit to receive the programming signal and convert the programming signal to a control signal to be sent to the signal processing circuit for modifying at least one of the signal processing function and the signal processing function parameter defined in the signal processing.

Krokstad describes a control circuit (control unit (CU)) that converts a programming signal received from a personal computer into control signals that modify (reprogram) the signal processing functions and parameters defined by the signal processing circuit. Pet. 29–30; Ex. 1007, 21:18–23.

Based on the foregoing, we are persuaded that Krockstad discloses the limitations recited in claim 2. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 2 would have been obvious based on Sudo and Krokstad.

3. Claim 3

Claim 3 recites that the digital signal processor includes a storage device. Specifically, this claim requires storing at least one of the signal processing function and the signal processing function parameter produced by the control circuit.

The DSP in Sudo has memories for storing a programming function (program RAM 14) and signal processing function parameters (coefficient data RAM 9). Pet. 31–32; Ex. 1005, Fig. 1.

Based on the foregoing, we are persuaded that Sudo discloses the limitations recited in claim 3. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 3 would have been obvious based on Sudo and Krokstad.

4. Claim 4

Claim 4 recites that the control circuit comprises a programmable microprocessor. “Krokstad shows the use of a control unit (CU) that receives the programming signals and transmits them to the memories of the DSP to change the function and parameters of the DSP.” Pet. 33; Ex. 1007, 21:1–5. Petitioner asserts that “[a] person of ordinary skill in the art would have recognized that the control unit of Krokstad would be implemented as a programmable microprocessor.” Pet. 33; *see* Ex. 1003 ¶ 20.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 4. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 4 would have been obvious based on Sudo and Krokstad.

5. Claim 5

Claim 5 recites a “storage device for storing at least one programming signal. Krokstad discloses a DSP having a number of storage devices (RAM3–RAM6) for storing programming signals.” Pet. 34–35; Ex. 1007, 20:9–16, Fig. 5a. Petitioner argues that “[a] person of ordinary skill in the art would have considered the use of a storage device for storing programming signals to have been obvious in view of Sudo as a convenient way to store the programming signals in the DSP.” Pet. 35; Ex. 1003 ¶ 51.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 5. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 5 would have been obvious based on Sudo and Krokstad.

6. Claim 6

Claim 6 recites “an amplifier housing where the signal processing circuit and power amplifier are located in the amplifier housing. Krokstad discloses a DSP-controlled amplifier where the components are located in an amplifier housing.” Pet. 36; Ex. 1006, 8:7–8. Petitioner contends that “[i]n Krokstad, the digital to analog converter is a high output converter to avoid need for a power amplifier.” Pet. 36. “However, Krokstad indicates that if a power amplifier is required, one could be used in the output stage and connected to the output of the digital to analog converter as shown in Figure 4d.” Pet. 36; Ex. 1006, 18:17–22.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 6. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 6 would have been obvious based on Sudo and Krokstad.

7. Claim 9

Claim 9 recites that the external programmer include an input/output port, data input device and a controller. Sudo teaches these features. Pet. 41–42.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 9. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 9 would have been obvious based on Sudo and Krokstad.

8. Claim 10

Claim 10 recites

[T]hat the external programmer include a display screen for displaying input programming information and information read by the controller. Krokstad discloses a DSP controlled amplifier that is programmed with a personal computer and it was well known that personal computers include display screens that could display input programming information and information read by the personal computer. Therefore, a person of ordinary skill in the art would have considered the use of a display screen to have been obvious.

Pet. 43–44; Ex. 1003 ¶ 63.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 10. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 10 would have been obvious based on Sudo and Krokstad.

9. Claim 11

Claim 11 recites that the external programmer further comprises a storage device for storing the input programming information and previously selected control signals. Sudo discloses that microcomputer 20 includes a

ROM that stores the programs and coefficients used for programming the DSP. Pet. 44; Ex. 1005, 3:63–67. In addition, Sudo teaches that it was well known to update the DSP settings when a desired sound field is switched. *See* Ex. 1005, 1:37–40.

[A] person of ordinary skill in the art would have considered it obvious in light of Sudo to store previously entered control signals in the storage memories in order to determine when the user has made a switch in a desired sound field and it was time to download a new program to the DSP.

Pet. 44–45; Ex. 1003 ¶¶ 65–66.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 11. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 11 would have been obvious based on Sudo and Krokstad.

10. Claim 12

Claim 12 recites that the data input device has a plurality of keys. Krokstad describes that the DSP is programmed with a personal computer (Ex. 1007, 21:8–23) and that it is well known that personal computers include keyboards having a plurality of keys. Pet. 46; Ex. 1003 ¶¶ 68–69. “Therefore, a person of ordinary skill in the art would have considered the use of a data input device with a plurality of keys as disclosed by Krokstad to have been an obvious way of entering data into the external programmer.” Pet. 46; Ex. 1003 ¶¶ 68–69.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 12. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 12 would have been obvious based on Sudo and Krokstad.

11. Claim 13

Claim 13 recites that the controller of the external programmer comprises a microprocessor that receives programming information from at least one of an input device and a control circuit of the amplifier. Krokstad describes that the DSP is programmed with a personal computer (Ex. 1007, 21:8–23) and it is well known that personal computers may include keyboards having a plurality of keys. “Therefore, a person of ordinary skill in the art would have considered the use of a data input device with a plurality of keys as disclosed by Krokstad to have been an obvious way of entering data into the external programmer.” Pet. 46; Ex. 1003 ¶¶ 68–69. Patent Owner’s argument regarding this claim is based on its narrow claim construction which we did not adopt.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 13. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 13 would have been obvious based on Sudo and Krokstad.

12. Claims 15 and 19

Claims 15 and 19 recite that the (external) programmer is a standard computer. Krokstad describes that the DSP is programmed with a personal computer. Ex. 1007, 21:8–23.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claims 15 and 19. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claims 15 and 19 would have been obvious based on Sudo and Krokstad.

13. Claim 21

Claim 21 recites that the DSP receives and stores a combination of at least two signal processing functions. Petitioner notes that Krokstad discloses a DSP in an amplifier that is programmed to provide at least three signal processing functions including compression, equalization and pre-compensation. Ex. 1007, 20:1–2. Petitioner asserts

A person of ordinary skill in the art would have considered programming a DSP in an amplifier to perform at least two signal processing functions to have been obvious in view of Krokstad as a way to achieve more than one desired audio effect with a single digital signal processor without having to provide additional circuitry.

Pet. 54; Ex. 1003 ¶¶ 95–98. We agree with Petitioner.

The '544 Patent incorporates by reference U.S. Patent Application No. 08/546,839, which later issued as U.S. Patent No. 5,652,542. Ex. 1001, 3:11–12. Patent Owner notes that the '544 Patent states “‘it is often necessary or desirable to change the signal processing function *or even combine several different signal processing functions in the signal processing circuit*. This is not possible with conventional amplifiers.’” PO Resp. 38–39; Ex. 2004, 2:62–65. Patent Owner asserts “[t]his description makes it clear that the claim element as [sic] issue requires at least two functions being *combined*.” PO Resp. 39; Ex. 2001 ¶ 125. Patent Owner’s declarant states that two functions can be combined to form a new function. Ex. 2001 ¶ 125.

The cited portion relied on by Patent Owner, however, does not describe such a new combined function and nowhere in the Specification is such a combination described. We find a broad reading of this limitation

supports that at least two functions are received and stored in together not combined as a new function and then received and stored.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 21. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 21 would have been obvious based on Sudo and Krokstad.

14. Claim 25

Claim 25 recites “that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a compression function. Krokstad discloses a DSP in an amplifier that is programmed to receive and store a compression function and parameters.” Pet. 57–58; Ex. 1007, 20:1–16.

Based on the foregoing, we are persuaded that Sudo and Krokstad teach the limitations recited in claim 25. In view of the above, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 25 would have been obvious based on Sudo and Krokstad.

15. Summary

Upon review of Petitioner’s analysis and supporting evidence and Patent Owners analysis and supporting evidence, we are persuaded that Petitioner has shown by a preponderance of evidence that claims 1–6, 9–13, 15, 19, 21, and 25 would have been obvious over Sudo and Krokstad.

E. Claims 7, 24, and 26 – Obviousness over Sudo, Krokstad, and APA

Petitioner argues that claims 7, 24, and 26 are unpatentable under 35 U.S.C. § 103(a) over Sudo, Krokstad, and APA. Pet. 38–39, 56–57, 59. APA refers to the ’544 patent’s disclosure, inter alia, that amplifiers having a

plurality of control knobs for controlling gain, volume, an equalizer circuit, a level threshold, etc., on a control panel of the amplifier were “conventional” or well known in the art. *See* Ex. 1001, 5:46–55.

Claim 7 recites a control panel, wherein said programming signal input port is provided on the control panel. As noted above, APA teaches that it was well known in the art to include controls for modifying an amplifier on a control panel. Pet. 38; Ex. 1001 5:50–54. Patent Owner argues that in Sudo the control panel is keyboard 21, and, thus, it would not be obvious to combine interface 19 with the keyboard because the system would not be able to operate in that configuration. PO Resp. 41–42.

Petitioner asserts that the issue is whether interface 19 would be placed on the APA control panel. Reply 7. We agree with Petitioner. A person of ordinary skill would have considered putting interface 19 of Sudo or the RS232 port of Krokstad on the control panel of the admitted prior art amplifier as an obvious way to group the input controls for the amplifier. Pet. 38; Reply 6; Ex. 1003 ¶ 56.

Claim 24 recites that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for an equalizing function. Krokstad discloses a DSP in an amplifier that is programmed to receive and store an equalizing function and parameters. Ex. 1007, 20:1–16. APA also indicates that this function was known to be provided in an amplifier. Pet. 55; Ex. 1001, 5:52.

Claim 25 recites that the DSP receives and stores at least one of a signal processing function and a signal processing function parameter for a compression function. Krokstad discloses a DSP in an amplifier that is programmed to receive and store a compression function and parameters.

Ex. 1007, 20:1–16. APA also indicates that this function was known to be provided in an amplifier. Pet. 55; Ex. 1001, 5:52.

Petitioner also asserts that a person of ordinary skill in the art would have considered “the placement of a programming signal input port [of the type shown by Krokstad] on a control panel that included other knobs, etc., for the amplifier [as known from the APA] to be an obvious way to conveniently group the inputs to the amplifier.” *Id.* at 38–39 (citing Ex. 1003 ¶ 56). Thus, we are persuaded the Petitioner has provided sufficient rationale to combine Sudo, Krokstad, and APA. Upon review of Petitioner’s analysis and supporting evidence and Patent Owners analysis and supporting evidence, we are persuaded that Petitioner has shown by a preponderance of evidence that claims 7, 24, and 26 would have been obvious over Sudo, Krokstad, and APA.

F. Claim 8 – Obviousness over Sudo, Krokstad, and TMS320

Petitioner argues that claim 8 is unpatentable under 35 U.S.C. § 103(a) over Sudo, Krokstad, and TMS320. Pet. 40–41. TMS320 discloses non-volatile memories (ROM and EPROM) in a DSP. *See* Ex. 1008, 6.

Claim 8 recites “a non-volatile storage means for storing a set [sic] performance characteristics.” TMS320’s disclosure of non-volatile memory meets this limitation. Pet. 40–41. Patent Owner’s argument regarding this limitation is based on its proposed narrow interpretation of the claim, which we did not adopt. PO Resp. 45–48.

“A person of ordinary skill in the art would have considered the use of a non-volatile [storage means (memory)] in a DSP to have been obvious in light of the TMS320 Data Sheet as a convenient way to allow the DSP to

retain stored performance characteristics in the event that power was removed from the device.” Pet. 40–41 (citing Ex. 1003 ¶¶ 58–59). Thus, we are persuaded that Petitioner has provided sufficient rationale to combine Sudo, Krokstad, and TMS320. Upon review of Petitioner’s analysis and supporting evidence and Patent Owner’s analysis and supporting evidence, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 8 would have been obvious over Sudo, Krokstad, and TMS320.

G. Claims 14 and 18 – Obviousness over Sudo, Porambo, and Krokstad

Petitioner argues that claims 14 and 18 are unpatentable under 35 U.S.C. § 103(a) over Sudo, Porambo, and Krokstad. Pet. 48–51.

Claim 14 recites “the controller comprises a connector for removably connecting the programmer to the amplifier.” Petitioner asserts that “[a] person of ordinary skill in the art would have understood that the personal computer would include a connector that removably connects with the RS232 port [of Krokstad]” to allow disconnection of the computer. Pet. 48 (citing Ex. 1003 ¶¶ 76–78). Upon review of Petitioner’s analysis and supporting evidence and Patent Owner’s analysis and supporting evidence, the preponderance of evidence establishes that claim 14 would have been obvious over Sudo, Porambo, and Krokstad.

Claim 18 recites that “said amplifier executes operation according to said at least one of a signal processing function and a signal processing function parameter after said external programmer is disconnected from said amplifier.” Petitioner asserts that “[t]he amplifier [of Krokstad] clearly is designed to operate after the programming computer is removed from the RS232 port because a hearing aid would not be very useful if the wearer had

to carry around the personal computer used to program it.” Pet. 50–51. Based on the evidence presented in this proceeding, we are persuaded by Petitioner’s argument. Upon review of Petitioner’s analysis and supporting evidence and Patent Owner’s analysis and supporting evidence, we are persuaded that Petitioner has shown by a preponderance of evidence that claim 18 would have been obvious over Sudo, Porambo, and Krokstad.

H. Claims 1–6, 9–13, 15, and 19 – Obviousness over Sudo (Ex. 1005) and Porambo (Ex. 1006)

Petitioner argues that claims 1–6, 9–13, 15, and 19 are unpatentable under 35 U.S.C. § 103(a) over Sudo and Porambo. Pet. 21–24, 27–28, 30–36, 41–47, 49, and 51. Porambo teaches connecting the outputs of a DSP in a DSP-controlled audio system to power amplifier 34 and speaker load (speakers 16, 18, 20, 22). *See* Ex. 1006, fig. 1.

Below we discuss independent claim 1 from which all other claims challenged in this ground depend. Claim 1 recites “external programmer being removably connectable to the programming signal input port.” Petitioner asserts that Sudo’s microcomputer 20 “is removably connectable to the programming signal input port [because one c]ould disconnect the microcomputer 20 from the interface 19).” Pet. 24 (citing Ex. 1003 ¶ 13). Petitioner’s declarant, Dr. Ellis, testified that the “fact that the microcomputer 20 is shown connected to the DSP through the interface 19 suggests that the microcomputer 20 is not hardwired to the DSP but is connected via some sort of removable connection.” Ex. 1003 ¶ 13. Nonetheless, Petitioner admitted at oral argument that Sudo does not describe expressly a removable connection and “that within the four corners of Sudo and Porambo, those two documents do not, in and of themselves,

teach removability[.]” Tr. 86:17–25; 113:1–8. Patent Owner argues that “there is no disclosure in Sudo showing or suggesting that the microcomputer 20 is removably connectable to the DSP 2.” PO Resp. 22; Ex. 2001 ¶¶ 36–40, 85–88. Petitioner states that “both Dr. Ellis and Mr. Cordell agree that Sudo’s high-speed connection could be implemented using a PCI bus [and a] PCI bus satisfies Sudo’s speed requirement, and is, by definition, a removable connection.” Reply 3 (citing Ex. 2002, 178:10–17; Ex. 1012, 93:1–94:19). We find that this PCI solution addressed by the declarants, but not disclosed in Sudo, although relevant to certain issues discussed above, does not show the Sudo teaches or suggests a removable connection. Tr. 86:17–25; 113:1–8. In addition, unlike the arguments presented regarding the combination of Krokstad and Sudo, in the present ground relying on Porambo, there is no assertion that Porambo teaches a removable connection. Thus, we are not persuaded that Petitioner has shown sufficient evidence that an ordinarily skilled artisan would have understood Sudo’s connection to be removable, as recited in claim 1.

Upon review of Petitioner’s analysis and supporting evidence and Patent Owner’s analysis and supporting evidence, we are persuaded that Petitioner has *failed* to show by a preponderance of evidence that claim 1 would have been obvious over Sudo and Porambo. Thus, we are persuaded that Petitioner also has *failed* to show by a preponderance of evidence that claims 2–6, 9–13, 15, and 19, which depend ultimately from claim 1, would have been obvious over Sudo and Porambo. Pet. 27, 28, 30–36, 41–47, 49, 51.

I. Claims 7, 20, 21, 23, 24, 25, and 26 – Obviousness over Sudo, Porambo, and APA

Petitioner argues that claims 7, 20, 21, 23, 24, 25, and 26 are unpatentable under 35 U.S.C. § 103(a) over Sudo, Porambo, and APA. Pet. 37–38, 52–59. Given that we find that claim 1 would not have been obvious over Sudo and Porambo, we find that Petitioner also has failed to show unpatentability over Sudo, Porambo, and APA of claims 7, 20, 21, 23, 24, 25, and 26, which depend ultimately from claim 1. Pet. 27, 28, 30–36, 41–47, 49, 51. We note in this regard that the APA fails to cure the deficiency in the combination of Sudo and Porambo.

J. Claim 8 – Obviousness over Sudo, Porambo and TMS320 (Ex. 1008)

Petitioner argues that claim 8 is unpatentable under 35 U.S.C. § 103(a) over Sudo, Porambo, and TMS320. Pet. 39–40. Given that we find that claim 1 would not have been obvious over Sudo and Porambo, we find that Petitioner has also failed to show unpatentability over Sudo, Porambo, and TMS320 of claim 8, which depends ultimately from claim 1. Pet. 27, 28, 30–36, 41–47, 49, 51. We note in this regard that TMS320 fails to cure the deficiency in the combination of Sudo and Porambo.

V. CONCLUSIONS

For the reasons set forth above, we are persuaded that Petitioner has shown by a preponderance of the evidence that:

1. claims 1–6, 9–13, 15, 19, 21, and 25 are unpatentable under 35 U.S.C. § 103 over Sudo and Krokstad;
2. claims 7, 24, and 26 are unpatentable under 35 U.S.C. § 103 over Sudo, Krokstad, and APA;
3. claim 8 is unpatentable under 35 U.S.C. § 103 over Sudo, Krokstad, and TMS320; and
4. claims 14 and 18 are unpatentable under 35 U.S.C. § 103 over Sudo, Krokstad, and Porambo;

We further conclude that claims 20 and 23 have not been shown to be unpatentable by a preponderance of the evidence.

VI. ORDER

Accordingly, it is

FURTHER ORDERED that claims 1–15, 18, 19, 21, and 24–26, of U.S. Patent 5,652,544 have been shown to be unpatentable;

FURTHER ORDERED that claims 20 and 23 of the '544 patent have not been shown to be unpatentable; and

FURTHER ORDERED that because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2014-00131
Patent 5,652,544

FOR PETITIONER:

Rodney C. Tullett
Chun M. Ng
Kaustav Das
Grant E. Kinsel
PERKINS COIE LLP
RTullett@perkinscoie.com
CNg@perkinscoie.com
KMDas@perkinscoie.com
GKinsel@perkinscoie.com
patentprocurement@perkinscoie.com

FOR PATENT OWNER:

N. Andrew Crain
Robert Gravois
Kenneth Knox
THOMAS | HORSTEMEYER, LLP
andrew.crain@thomashorstemeyer.com
robert.gravois@thomashorstemeyer.com
kenny.knox@thomashorstemeyer.com