UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

1964 EARS, LLC,
Petitioner,

v.

JERRY HARVEY AUDIO HOLDING, LLC,
Patent Owner.

_____

Case IPR2017-01091
Patent 8,925,674 B2

_____

PATENT OWNER'S NOTICE OF APPEAL

Notice is hereby given, pursuant to 37 C.F.R. § 90.2(a)(1), that Patent Owner Jerry Harvey Audio Holding, LLC, hereby timely appeals under 35 U.S.C. §§ 141, 142, and 319 to the United States Court of Appeals for the Federal Circuit from the Final Written Decision entered on April 2, 2019 (Paper 74) and from all underlying orders, decisions, rulings, and opinions. A copy of the Final Written Decision is attached hereto as Exhibit A.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), the issues on appeal include, but are not limited to: the Board's determination that claims 1–11 and 13–20 of U.S. Patent 8,925,674 were shown to be unpatentable; the Board's denial of Patent Owner's Motion to Amend; and, any finding or determination supporting or relating to these issues, as well as all other issues decided adversely to Patent Owner in any order, decision, ruling, or opinion.

Pursuant to 35 U.S.C. § 142 and 37 C.F.R. § 90.2(a), this Notice is being filed with the Director of the United States Patent and Trademark Office, and a copy of this Notice is being concurrently filed with the Patent Trial and Appeal Board. In addition, a copy of this Notice and the required docketing fee are being filed with the Clerk's Office for the United States Court of Appeals for the Federal Circuit via CM/ECF.

Respectfully submitted,

Date: June 4, 2019

By: /Daniel B. Ravicher/

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CERTIFICATE OF SERVICE AND FILING

I hereby certify that on the date indicated below, in addition to being filed and served electronically through the Board's E2E System, a true and correct copy of the foregoing "**PATENT OWNER'S NOTICE OF APPEAL**," was served on the Director of the United States Patent and Trademark Office, via Express Mail overnight delivery at the following address:

Office of the General Counsel
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

I also hereby certify that on the date indicated below, a true and correct copy of the foregoing "**PATENT OWNER'S NOTICE OF APPEAL**," and the filing fee, were or will be filed with the Clerk's Office of the United States Court of Appeals for the Federal Circuit through the Court's CM/ECF system.

I also hereby certify that on the date indicated below, a true and correct copy of the foregoing "**PATENT OWNER'S NOTICE OF APPEAL**," was served, by electronic mail, upon Petitioner's counsel of record as follows:

Hillary Brooks hillary@brooksquinn.com
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Date: June 4, 2019

By: /Daniel B. Ravicher/
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EXHIBIT A

Trials@uspto.gov
571-272-7822

Paper 74
Entered: April 2, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

1964 EARS, LLC,
Petitioner

v.

JERRY HARVEY AUDIO HOLDING, LLC,
Patent Owner.

Case IPR2017-01091
Patent 8,925,674 B2

Before BRIAN J. McNAMARA, JOHN F. HORVATH, and AARON W. MOORE, *Administrative Patent Judges*.

MOORE, *Administrative Patent Judge*.

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

ORDER ON MOTION TO AMEND
35 U.S.C. § 316(d) and 37 C.F.R § 42.121

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I. INTRODUCTION

A. Background

1964 Ears, LLC ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–21 of U.S. Patent No. 8,925,674 B2 (Ex. 1001, "the '674 patent"). Paper 1 ("Pet."). Jerry Harvey Audio Holding, LLC ("Patent Owner") filed a Preliminary Response. Paper 7 ("Prelim. Resp.").

On October 3, 2017, we instituted an *inter partes* review of claims 1–11, 13–18, and 20 on several grounds of unpatentability. Paper 8 ("Inst. Dec."), 62–63. Patent Owner then filed a Patent Owner Response (Paper 20, "PO Resp.") and Petitioner filed a Reply (Paper 22, "Pet. Reply").

Following the Supreme Court's decision in *SAS Inst., Inc. v. Iancu*, 138 S. Ct. 1348 (2018), we modified the Institution Decision to include review of all claims on all grounds presented in the Petition. *See* Paper 43. Petitioner then requested, and was granted, adverse judgment with respect to the anticipation ground based on Saggio. *See* Paper 52. Patent Owner filed a Supplemental Response regarding the added claims (Paper 57, "Supp. Resp."), Petitioner filed a Supplemental Reply (Paper 58, "Supp. Reply"), and Patent Owner filed a Supplemental Sur-Reply (Paper 64, "Supp Sur-Reply").

Patent Owner has also filed a Contingent Motion to Amend (Paper 21, "Mot. to Amend"), Petitioner filed an Opposition (Paper 23, "Mot. to Amend Opp."), Patent Owner filed a Reply (Paper 31, "Mot. to Amend Reply"), and Petitioner filed a Sur-Reply (Paper 33, "Mot. to Amend Sur-Reply").

Patent Owner also filed a Motion for Observations (Paper 35), and Petitioner filed a Response (Paper 41).

Petitioner filed a Motion to Exclude (Paper 37), Patent Owner filed a Motion to Exclude (Paper 65), and each party filed an Opposition and a Reply (Papers 40, 42, 67, 69).

An oral hearing was held on December 17, 2018, and a transcript of the hearing is included in the record. Paper 73 ("Tr.").

The Board has jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–11 and 13–20 of the '674 patent are unpatentable. We further determine that claims 12 and 21 of the '674 patent have not been shown to be unpatentable.

B. Related Matters

Petitioner and Patent Owner identify *Jerry Harvey Audio Holding, LLC et al. v. 1964 Ears, LLC (WA) et al.*, 6:16-cv-00409-CEM-KRS (M.D. Fla.) as a related matter involving both parties and the '674 patent. Pet. 2, Paper 5.

Patent Owner identifies IPR2017-01084, involving Patent No. 8,567,555 B2, and IPR2017-01092, involving Patent No. 9,197,960 B2 as related matters. Paper 5.

Petitioner identifies *Jerry Harvey Audio Holding, LLC et al. v. 1964 Ears, LLC et al.*, 6:14-cv-02083-CEM-KRS (M.D. Fla.), involving both parties and Patent No. 8,897,463 B2, as a related matter. Pet. 3. Petitioner also identifies as a related matter IPR2016-00494, involving Patent No. 8,897,463 B2. *Id.*

C. The ’674 Patent

The ’674 patent is titled “Phase Correcting Canalphone System and Method.” It describes how there are many different types of personal listening devices, such as headphones, earbuds, and canalphones, and that canalphones are substantially smaller than a person’s outer ear and differ from earbuds in that they are “placed directly in one end of the ear canal.” *Id.* at 1:22–31. According to the patent, both earbuds and canalphones are held in position by friction between the ear and the device rather than by the support system found in most headphones. *See id.* at 1:31–34. The patent states that canalphones also may be held in place by retainers that engage a portion of a listener’s head. *See id.* at 1:34–35.

In an embodiment including what is referred to as “sound bores,” the ’674 patent discloses a canalphone system having a high frequency sound bore, a low frequency sound bore next to the high frequency sound bore, a high frequency acoustic driver delivering sound through the high frequency sound bore, and a low frequency acoustic driver delivering sound through the low frequency sound bore. *See id.* at 2:9–25.

In an embodiment including what is referred to as “sound tubes,” the ’674 patent discloses a canalphone system having a high frequency audio driver, a low frequency audio driver adjacent to the high frequency audio driver, and an acoustical-timer “to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing.” *Id.* at 2:49–57. As the ’674 patent explains:

> The acoustical-timer further includes a low audio sound-tube to carry a low audio signal from the low audio driver to outside of the canalphone housing, and a high audio sound-tube to carry a high audio signal from the high audio driver to the outside of the canalphone housing, the high audio sound-tube phase corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube. The low audio sound-tube may be sized based upon its time response for the low audio signal to pass through the low audio sound-tube.
>
> The high audio sound-tube may be longer to slow down the high audio signal's arrival to the outside of the canalphone housing so that it is closer in time to the low audio signal from the low audio driver arrival to the outside of the canalphone housing. The arrival of the high audio [signal] to the outside of the canalphone housing is less than 0.05 milliseconds difference than the low audio signal from the low audio driver arrival to the outside of the canalphone housing.

Id. at 2:58–3:8. The '674 patent also describes an electronic implementation for the "acoustical-timer":

> The acoustical-timer may include a processor to phase correct a high audio signal from the high audio driver to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver to the outside of the canalphone housing.
>
> The processor may use digital signal processing to control the high audio signal's arrival at the outside of the canalphone housing to be closer in time to the low audio signal from the low audio driver's arrival to the outside of the canalphone housing. The arrival of the high audio [signal] to the outside of the canalphone housing is less than 0.05 milliseconds difference than the low audio signal from the low audio driver arrival to the outside of the canalphone housing.

Id. at 3:15–27. The patent further explains that "[t]he acoustical-timer may use a time response for the low audio signal to pass through the canalphone

housing as a control point to set all other audio signals' phase in the system." *Id.* at 3:28–31.

Alternatively, in characterizing its system as a method, the '674 patent describes (1) providing a high audio driver carried by a canalphone housing, (2) providing a low audio driver carried by the canalphone housing adjacent to the high audio driver, and (3) phase correcting a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing. *See id.* at 3:36–44. For the phase correction in such a method, the '674 patent describes two implementations, one using a longer sound-tube for the high audio driver than the low audio driver, and the other using digital signal processing. *See id.* at 3:55–4:5. For the mechanical implementation, the '674 patent states:

> The method may further include slowing down the high audio signal's arrival to the outside of the canalphone housing so that it is closer in time to the low audio signal from the low audio [signal's] arrival to the outside of the canalphone housing by making the high audio sound-tube longer.
>
> The method may additionally include timing the arrival of the high audio signal to the outside of the canalphone housing compared to the low audio signal from the low audio [signal's] arrival to the outside of the canalphone housing is within 0.05 milliseconds of each other.

Id. at 3:57–67. For the electronic implementation, the '674 patent states that "[t]he method may also include using digital signal processing to phase correct a high audio signal from the high audio driver directed to the outside of the canal-phone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." *Id.* at 3:67–4:5.

The ’674 patent also refers to computer readable program codes to provide canalphone phase correction:

> The computer readable program codes may be configured to cause the program to provide a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver. The computer readable program codes may also be configured to cause the program to phase correct a high audio signal from the high audio driver to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver to the outside of the canalphone housing.

Id. at 4:27–35.

Figure 6 of the ’674 patent is reproduced below:

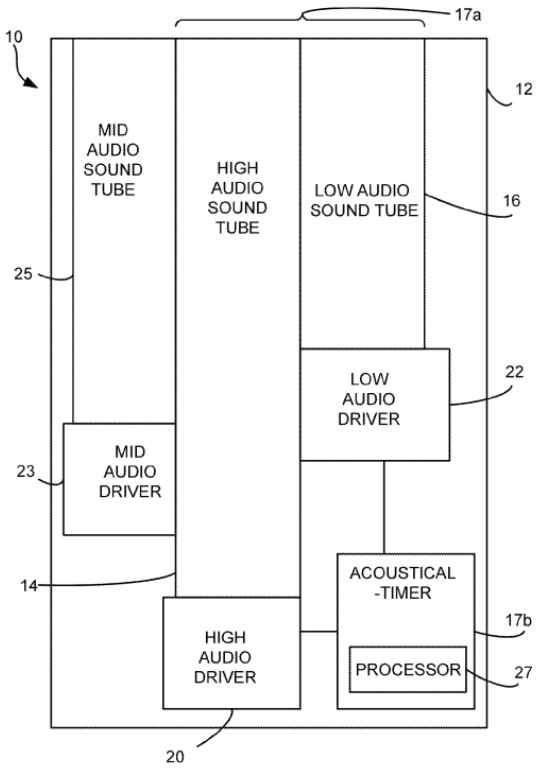

FIG. 6

“*Figure 6 is a schematic block diagram of a system in accordance with various embodiments.*” *Ex. 1001, 4:54–55.*

The ’674 patent describes that acoustical-timer 17a “and/or” 17b are provided to phase correct a high audio signal from high audio driver 20 directed to the outside of canalphone housing 12 with delivery of a low audio signal from low audio driver 22 directed to the outside of the canalphone housing. *See id.* at 7:15–20. With respect to acoustical-timer 17a, the ’674 patent refers to low audio sound-tube 16, which carries a low audio signal from low audio driver 22 to the outside of canalphone housing 12, and high audio sound-tube 14, which carries a high audio signal from high audio driver 20 to the outside of canalphone housing 12. *See id.* at 7:21–27. The ’674 patent states that phase correction of the high audio with respect to the low audio is achieved by sizing high audio sound-tube 14 so that it is longer than low audio sound-tube 16. *See id.* at 7:27–29. The patent also states that high audio sound-tube 14 is made longer to slow down the high audio signal’s arrival to the outside of the canalphone housing so that it is closer in time to the arrival of the low audio signal from the low audio driver to the outside of the canalphone housing. *See id.* at 7:33–37.

D. Illustrative Claims

Of the challenged claims, claims 1, 9, and 21 are independent. Claim 1 is drawn to an apparatus, claim 9 is drawn to a method, and claim 21 is drawn to a computer program product embodied in a tangible media. These three claims are reproduced below.

1. A system comprising:

a high audio driver carried by a canalphone housing;

a low audio driver carried by the canalphone housing adjacent the high audio driver; and

an acoustical-timer to phase correct a high audio signal from the high audio driver directed to the outside of the

canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing.

9. A method comprising:

providing a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver; and

phase correcting a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing.

21. A computer program product embodied in a tangible media comprising:

computer readable program codes coupled to the tangible media to provide canalphone phase correction, the computer readable program codes configured to cause the program to:

provide a high audio driver carried by the canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver; and

phase correct a high audio signal from the high audio driver to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver to the outside of the canalphone housing.

Ex. 1001, 12:30–38; 13:8–15; 14:28–40.

E. Evidence Relied Upon

Petitioner relies on the following references:

Reference		Date	Exhibit
Saggio	US App. 2011/0058702 A1	Mar. 10, 2011	Ex. 1004
Harvey ’806	US Pat. No. 7,317,806 B2	Jan. 8, 2008	Ex. 1005
Prakash	US Pat. No. 6,405,227 B1	June 11, 2002	Ex. 1006
Dahlquist	US Pat. No. 3,824,343	July 16, 1974	Ex. 1007

Petitioner also relies on declarations of Bob Young, which are Exhibits 1003, 1030, and 1041.

F. Grounds of Unpatentability Instituted for Trial

The following grounds of unpatentability remained at trial:[1]

References(s)	Basis	Claims Challenged
Saggio	§ 103	1–5, 9–12, 14, 17–20
Saggio and Prakash	§ 103	6–8, 15, 16, and 21
Saggio and Dahlquist	§ 103	1–5, 9–14, and 17–20
Saggio, Dahlquist, and Prakash	§ 103	6–8, 15, 16, and 21
Harvey ’806	§ 102	1, 2, 4, 5, 9, 10, 13, and 14
Harvey ’806	§ 103	3, 11, 12, and 17–20
Harvey ’806 and Prakash	§ 103	6–8, 15, 16, and 21

[1] We instituted on all grounds and claims in the Petition except claims 12, 19, and 21, and we added claims 1, 2, 4, 9, and 10 as obvious over Saggio. *See* Inst. Dec. 62–63. After *SAS*, we added claims 12, 19, and 21 to the proceeding. *See* Paper 43. We then granted Petitioner’s motion for adverse judgment on Ground 1, which was anticipation by Saggio. *See* Paper 52.

II. ANALYSIS

To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001). While the elements must be arranged in the same way as is recited in the claim, "the reference need not satisfy an *ipsissimis verbis* test," i.e., there is no requirement that the terminology in the anticipatory prior art reference and the claim be exactly the same. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832–33 (Fed. Cir. 1990)). "A reference anticipates a claim if it discloses the claimed invention 'such that a skilled artisan could take its teachings in *combination with his own knowledge of the particular art and be in possession of the invention*.'" *In re Graves*, 69 F.3d 1147, 1152 (Fed. Cir. 1995) (*quoting In re LeGrice*, 301 F.2d 929, 936 (CCPA 1962)). Prior art references must be considered together with the knowledge of one of ordinary skill in the pertinent art. *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994).

It "is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." *In re Preda*, 401 F.2d 825, 826 (CCPA 1968). For anticipation, the dispositive question is whether one skilled in the art would reasonably understand or infer from a reference that every claim element is disclosed in that reference. *Eli Lilly v. Los Angeles Biomedical Research Institute*, 849 F.3d 1073, 1074–1075 (Fed. Cir. 2017).

The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art;

(2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). One seeking to establish obviousness based on more than one reference also must articulate sufficient reasoning with rational underpinning to combine the teachings from the references. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007).

With regard to the level of ordinary skill in the art, we determine that no express finding is necessary because the level of ordinary skill in the art in this case is reflected by the prior art applied by Petitioner. *See* Inst. Dec. 11; *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978). Neither party disputes that finding.

A. Claim Construction

In *inter partes* reviews filed before November 13, 2018, the Board construes claims in an unexpired patent according to their broadest reasonable construction in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b) (2016); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016); 83 Fed. Reg. 51,340. Consistent with that standard, claim terms are generally given their ordinary and customary meaning, as would have been understood by one of ordinary skill in the art in the context of the entire disclosure. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). There are, however, two exceptions to that rule: "1) when a patentee sets out a definition and acts as his own lexicographer," and "2) when the patentee disavows the full scope

of a claim term either in the specification or during prosecution." *Thorner v. Sony Comp. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

For it to be said that an inventor has acted as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). It is improper to add into a claim an extraneous limitation, i.e., one that is added wholly apart from any need for the addition. *See, e.g., Hoganas AB v. Dresser Indus., Inc.*, 9 F.3d 948, 950 (Fed. Cir. 1993); *E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed. Cir. 1988).

Only terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

In the Institution Decision, we construed "acoustical-timer" to cover "acoustical-timer 17a and acoustical-timer 17b as disclosed in the Specification of the '674 patent." Inst. Dec. 12. As neither party disputes that construction, we maintain it here.

In the Institution Decision, we also construed the phrases beginning with "phase correct" or "phase correcting" to mean "correcting the phase of the high audio signal so that the phase relationship between the high audio signal and the low audio signal at the outside of the canalphone housing is closer to their original phase relationship at the time of their generation by their respective drivers." Inst. Dec. 16.

Patent Owner does not address the construction of the phase correction terms. Petitioner asserts that "[t]echnologically speaking this construction is incorrect" because "to a POSA at the time of the alleged invention, 'phase correct' and 'phase correcting' meant bringing two signals 'in phase' at the crossover frequency, at the point at which they reach the listener's ear," but that "the inaccuracy did not affect the Board's overall analysis." Reply 1–2 (citing Ex. 1030 ¶ 6–22).

Having reviewed Petitioner's argument and evidence, we retain the construction of the phase correction terms in the Institution Decision. The fundamental difference appears to be that Petitioner wants to "focus[] on . . . what [the] phase relationship is at the point where it reaches the listener" (Tr. 62:7–8), but the original construction already includes the very similar concept "at the outside of the canalphone housing." For that reason, and because Petitioner does not argue that the change would make a difference in the outcome (*see* Tr. 59:1–7), we maintain the construction the parties used in preparation for the trial.

B. Cited Art

1. Harvey '806

Harvey '806 names Jerry J. Harvey, the sole named inventor on the '674 patent, as a co-inventor. Harvey '806 was issued on January 8, 2008, more than one year prior to the earliest possible effective filing date that can be established by Patent Owner for any challenged claim in the '674 patent. Accordingly, Harvey '806 is available as § 102(b) art.

Harvey '806 discloses an earpiece, also known as an in-ear-monitor or canalphone, that employs two or more balanced armature drivers that are optimized for a particular (e.g., low, medium, or high) frequency range. *See*

id. at 1:24–26, 1:59–2:5, 6:5–8. A crossover network or filter divides the frequency spectrum of an input signal into multiple regions, i.e., low and high components, or low, medium, and high components, and respectively provides these components to corresponding armature drivers that are optimized for each region. *See id*. at 2:1–5, 3:48–50. Figure 3 of Harvey '806 is reproduced below:

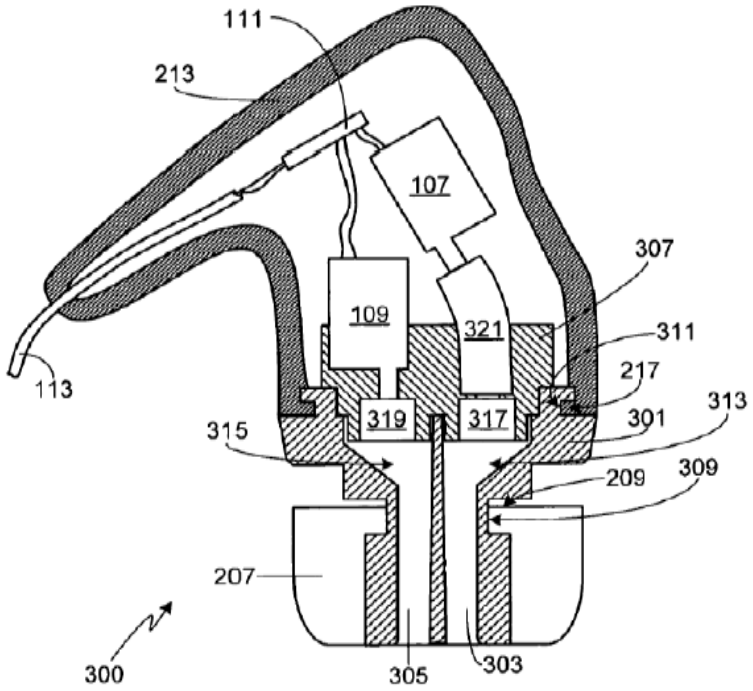

FIG. 3

Harvey '806's "FIG. 3 is a cross-sectional view of a generic earpiece that includes a pair of sound delivery tubes and a predetermined driver offset." Ex. 1005, 3:1–3.

Cross-over network 111 provides respective low and high frequency components of an input signal on line 113 to low frequency armature driver 107 and high frequency armature driver 109. *See id*. at 1:66–2:5, 3:46–50. The frequency response of low and high frequency armature drivers 107 and

109 can be respectively tuned by dampers 317 and 319. *See id*. at 5:29–40, 5:61–65. The sounds produced by armature drivers 107 and 109 are respectively delivered to the ear canal via sound tubes 303 and 305. *See id*. at 5:6–9. When canalphone 300 includes more than two armature drivers, the outputs from the two lower frequency drivers are merged into a first sound tube, while the output from the third higher frequency driver is maintained in a second sound tube. *See id*. at 2:35–40.

Harvey '806 explains that the filtering effects of cross-over network 111, and the relative displacement of armature drivers 107 and 109 within housing 213, can introduce an unwanted phase shift between the sounds produced by the armature drivers. *See id*. at 6:12–16, 6:30–36. Harvey '806 identifies and refers to the phase shift introduced by frequency dividing network, driver roll-off rates, driver bandwidth, and exit plane sound tube displacement as "inherent" to an earpiece design. *See id*. at 6:49–52. Harvey '806 describes that that inherent phase shift can be minimized by varying the lengths of sound tubes 303 and 305, e.g., extending sound tube 303 by an additional sound tube 321. *See id*. at 6:37–65. The lengths of sound tubes 303 and 305 are thus chosen to tune canalphone 300. *See id*. at 5:58–6:2.

2. Prakash

In pertinent part, Prakash teaches a microchip for use in a speaker system, where the chip includes a DSP (digital signal processor) that can "programmably delay audio signals for over 30 ms to synchronize the times of their arrival from speakers 312 at different distances to a listener position." Ex. 1006, 4:17–22, 5:12–67, Figs. 3–5.

3. Saggio

Saggio is directed to "[in]-ear monitors," which are "also referred to as canal phones and stereo earphones." Ex. 1004 ¶ 3. Saggio explicitly states that in its disclosure, the terms "in-ear monitor," "IEM," "canal phone," "earbud," and "earphone" may be used interchangeably. *Id.* ¶ 35. Saggio further states that it relates in particular "to an in-ear monitor with multiple sound bores optimized for a multi-driver configuration." *Id.* ¶ 2. Saggio discloses a multi-driver in-ear monitor that is coupled to an external audio source. *See id.* ¶ 9. Saggio describes how a circuit receives the electrical signal from the external audio source and provides separate input signals to the drivers contained within the in-ear monitor. *See id.* Saggio further describes how a plurality of sound delivery tubes acoustically couple the audio output from each of the drivers to the acoustic output surface of the in-ear monitor. *See id.*

A "prior art" configuration for an in-ear monitor or canalphone is illustrated in Figure 1 of Saggio, reproduced below:

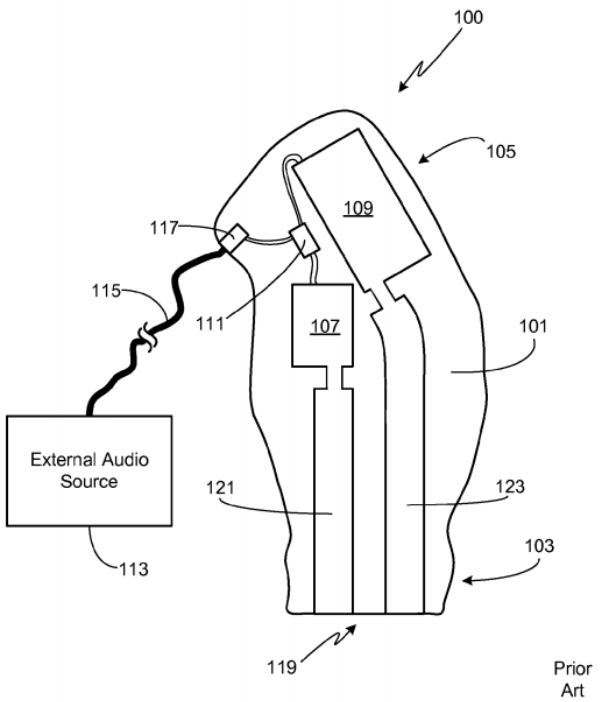

FIG. 1

Saggio's "FIG. 1 illustrates the primary elements of a custom fit in-ear monitor according to the prior art." Ex. 1004 ¶ 13.

Saggio describes driver 107 as a low-frequency driver and driver 109 as a high-frequency driver, and circuit 111 as receiving input from audio source 113 and providing outputs to drivers 107 and 109. *See id.* ¶ 36. Saggio states that "[t]he output from drivers 107 and 109 is delivered to the end surface 119 of the IEM via a pair of delivery tubes 121 and 123, respectively." *Id.* ¶ 37.

4. Dahlquist

Dahlquist is directed to a loud speaker assembly incorporating multiple transducers for outputting sound in different frequency bands. *See* Ex. 1007, 6:24–43. "Transducer" in Dahlquist refers to a diaphragm, a cone,

or dome type permanent magnet speaker. *See id*. at 4:20–23. Figure 2 of Dahlquist is reproduced below:

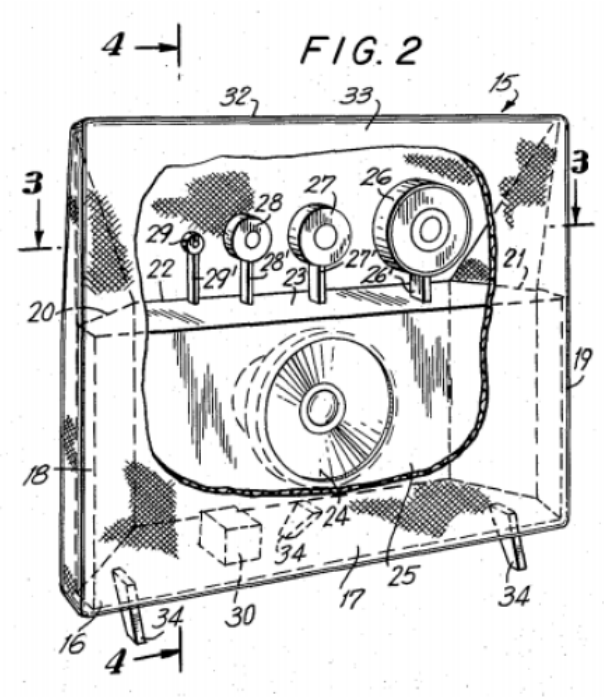

Figure 2 "is a perspective view of a loud speaker assembly . . . with parts of the grille broken away to show details of construction." Ex. 1007, 4:6–8.

Speaker assembly 15 includes woofer enclosure portion 16, which includes base or bottom wall 17, side walls 18, 19, rearwardly angled back wall portions 20, 21, rear wall 22, and top wall 23. *See id*. at 4:24–34. Woofer member 24 is mounted to front wall 25. *See id*. at 34–36. Additional transducers 26, 27, 28, and 29 are included for producing mid-range, upper mid-range, high frequency, and ultra high frequency bands. *See id*. at 4:37–40. Dahlquist positions its speakers in accordance with the "rise time" characteristic of the sound they produce, i.e., the speaker with the longer rise time being set closer to a listener. *See id*. at 7:37–51. Dahlquist further describes how "the position of the speakers are offset from one

another in the direction of the listening axis, with the woofer 24 being disposed forwardly of the mid-range speaker 26, which is in turn disposed forwardly as respects upper-mid-range driver 27, which is in turn disposed forwardly of tweeter 28, which is in turn disposed forwardly of super tweeter 29." *Id*. at 7:30–36. Thus, the higher the frequency of the sound, the further rearward the speaker is placed, and the greater the distance the sound from that speaker has to travel to reach the listener. Such positioning is to help achieve essentially simultaneous arrival of all sound signals at the ear of a listener. *See id*. at 7:38–59.

C. Anticipation by Saggio

We initially instituted *inter partes* review to determine the patentability of all of the claims challenged in the Petition on only a subset of the grounds raised in the Petition. *See* Inst. Dec. 62–63. We subsequently modified our Institution Decision to review all of the challenged claims on all of the challenged grounds. *See* Paper 43.

Petitioner then requested partial adverse judgment on Ground I, anticipation by Saggio. *See* Paper 49, 3–4. We granted Petitioner's request (*see* Paper 52) and, as a consequence, Petitioner has failed to show by a preponderance of evidence that Saggio anticipates any claim.

D. Obviousness Based On Saggio Alone

For the reasons stated below, we conclude that claims 1–5, 9–11, 14, 17, 18, and 20 would have been obvious in view of Saggio alone.

1. Claims 1 and 9

a. High and Low Audio Drivers

Claim 1 recites "a high audio driver carried by a canalphone housing," and "a low audio driver carried by the canalphone housing adjacent to the high audio driver." Claim 9 recites a corresponding step of "providing a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver." Ex. 1001, 12:31–33; 13:9–11.

We are persuaded by Petitioner's assertion, supported by the testimony of Mr. Young (*see* Ex. 1003 ¶ 26), and not disputed by Patent Owner, that a person of ordinary skill in the art would have understood a "high audio driver" to be synonymous with an HFD (high frequency driver), and a "low audio driver" to be synonymous with an LFD (low frequency driver). *See* Pet. 15. To satisfy the above-noted limitations, Petitioner relies on the embodiments of Saggio as illustrated in Saggio's Figures 1, 4, 6, 14, 15, and 17. *See id*. at 15–16. For instance, Figure 1 of Saggio illustrates low frequency driver 107 adjacent high frequency driver 109, and both drivers are carried within IEM 100. Figure 4 of Saggio illustrates low frequency driver 409 adjacent high frequency driver 407, and both drivers are carried within IEM 400. Figure 14 of Saggio illustrates low frequency driver 1413 adjacent high frequency driver 1409, and both drivers are carried within IEM 1400. Similarly, the embodiments of Figures 6, 15, and 17 satisfy these same limitations.

b. Acoustical Timer and Phase Correction

Claim 1 further recites "an acoustical-timer to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." Ex. 1001, 12:34–38. Claim 9 does not recite an acoustical-timer, but does recite a step of "phase correcting a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." *Id*. at 13:12–15.

As discussed above, the meaning of the term "acoustical-timer" covers the structure of acoustical-timer 17a in the '674 patent, which includes a low audio sound-tube to carry a low audio signal from a low audio driver to outside of a canalphone housing, and a high audio sound-tube to carry a high audio signal from a high audio driver to outside of the canalphone housing. *See id.* at 7:21–27. In acoustical-timer 17a of the '674 patent, the high audio sound-tube is longer than the low audio sound-tube. *Id.* at 7:27–29. Petitioner identifies such a structure in the embodiments shown in Saggio's Figures 1, 4, 6, 14, 15, and 17. *See* Pet. 16–17. Petitioner contends that although patent drawings may not be relied on to show particular sizes of elements if the specification is otherwise silent, patent figures properly can be used to establish relative sizes between parts. *See id.* at 17. We agree. "In those instances where a visual representation can flesh out words, drawings may be used in the same manner and with the same limitations as the specification." *Autogiro Co. v. United States*, 384

F.2d 391, 398 (Ct. Cl. 1967); *see also In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979); *In re Wolfen-Sperger*, 302 F.2d 950, 959 (CCPA 1962).

Each of Figures 1, 4, 6, 14, 15, and 17 of Saggio shows a high audio sound-tube that is longer than the low audio sound-tube, which is the same structure as acoustical timer 17a of the '674 patent that we have determined is encompassed by the "acoustical-timer" limitation of claim 1. For instance, in Figure 1, sound-tube 123 is longer than sound-tube 121. In Figure 4, sound-tube 401 is longer than sound-tube 403. In Figure 14, sound-tube 1401 is longer than sound-tube 1403. In Figure 17, sound-tube 1701 is longer than sound-tube 1702. Those figures thus all show an acoustical-timer having a structure covered by the structure of "acoustical-timer" limitation of claim 1.

Regarding phase correction, Saggio explains how "it will be appreciated that the output from each driver as well as the phase relationship between the two drivers may be tuned by varying the length of the sound-tubes and the positions of the driver outputs relative to one another." Ex. 1004 ¶ 46 (emphasis added). Thus, Saggio expressly recognizes that there may be an undesirable difference in the phase relationship between the high frequency signal and the low frequency signal, and expressly describes "fine tuning" that "phase relationship." *Id*. We conclude in light of this disclosure that it would have been obvious to one with ordinary skill to implement phase correction as recited in claims 1 and 9.

Patent Owner argues that "[w]hile Saggio taught canalphones with two drivers of different frequencies, Saggio did not teach that the signals are phase corrected." PO Resp. 10–11. Patent Owner further argues that "the relied on citation—Saggio, ¶ 0046 ('the phase relationship between the two

drivers may be tuned by varying the length of the sound tubes and the positions of the driver outputs relative to one another')—says nothing about whether the phase relationship would be improved or degraded by making the high driver's sound tube longer." *Id*. at 11–12.

Petitioner responds that "Saggio ¶ 46 states the phase relationship can be 'tuned' by varying sound tube length," that "'[t]uning' means optimizing," and that "a POSA would understand Saggio as teaching optimizing the phase relationship by varying tube lengths." Reply 10.

We agree with Petitioner, because we find Saggio's description of how "the output from each driver as well as the phase relationship between the two drivers may be tuned by varying the length of the sound tubes and the positions of the driver outputs relative to one another" (Ex. 1004 ¶ 46) sufficient to show "phase correction" as that term is used in the '674 patent. We find that "tuning" the "phase relationship," as those terms are used in Saggio, refers to changing the phase relationship between the high and low signals to improve, or optimize, the quality of sound. *See* Ex. 1035 (defining tuning to include the concept of optimizing).

Patent Owner further argues that Petitioner "fails to provide any evidence showing Saggio's signals are phase corrected like the phase response graph provided by the '674 patent in Fig. 7." PO Resp. at 11. We are not persuaded by that argument. Because Saggio specifically describes how one can adjust the structure of the earpiece to "tune" the phase relationship, we see no reason why the reference would need to include a graph showing the results. This is particularly true given that the '674 patent does not provide any dimensions or other structural specifications for the embodiment(s) that would produce the results shown in Figure 7. Absent

such disclosure, we are left with the assumption that all embodiments of the '674 patent would produce such results, and it follows that Saggio, which, we find, describes the same structure and techniques for adjusting the phase relationship, would accomplish the same results. Patent Owner does not point to any relevant structural differences between Saggio's canalphones and the structure described in the '674 patent, and further acknowledges that arriving at the result shown in Figure 7 of the '674 patent using the disclosed structure of Saggio would not require more than routine experimentation. (*See* Tr. 137:13–139:4.)

Patent Owner's argument that there would not have been a reasonable expectation of success (*see* Prelim Resp. 16–19) is also unpersuasive. The evidence relied on by Petitioner, i.e., that Saggio expressly instructs its readers to "fine tune" the phase relationship by varying the length of the sound-tubes, already conveys a reasonable expectation of success that lengthening whichever sound-tube is carrying the leading audio signal will fine tune the phase relationship with the other sound tube carrying the lagging signal. It is not reasonably disputed that delaying the arrival of a signal that has a phase lead will tend to synchronize the leading signal with the lagging signal, at least up to the point of a match, and there is nothing unpredictable about that scenario.

Regarding the idea that delaying the arrival of a signal that has a phase lead will synchronize the leading signal with the lagging signal, Patent Owner argues that "no such evidence appears in the record, and it is indeed contradicted by the Board's finding that merely having one sound tube longer than the other will not necessarily result in phase correction." PO Resp. 17–18. We do not agree. Again, there cannot be a reasonable dispute

that delaying a leading signal will tend to bring it more into phase with a trailing signal. This is not "contradicted by the Board's finding that merely having one sound tube longer than the other will not necessarily result in phase correction." That finding concerned a different issue, namely, that changing the length of a tube can either increase or decrease the phase difference.

We conclude that claims 1 and 9 would have been obvious in view of Saggio alone.

2. Claim 2

Claim 2 depends from claim 1 and further recites that the acoustical-timer includes "a low sound-tube to carry a low audio signal from the low audio driver to outside of the canalphone housing" and "a high audio sound-tube to carry a high audio signal from the high audio driver to the outside of the canalphone housing, the high audio sound-tube phase corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube." Ex. 1001, 12:39–47.

As discussed above in the context of claim 1, Saggio discloses a low audio sound-tube for carrying low audio signal from a low audio driver to outside of a canalphone housing, and a high audio sound-tube for carrying a high audio signal from a high audio driver to outside of the canalphone housing. As also explained above, paragraph 46 of Saggio sufficiently accounts for phase correction by sizing the high audio sound-tube so that it is longer than the low audio sound-tube.

In light of Saggio's disclosure that "the output from each driver as well as the phase relationship between the two drivers may be tuned by varying the length of the sound-tubes and the positions of the driver outputs

relative to one another" (Ex. 1004 ¶ 46), it would have been obvious to one with ordinary skill to check phases of the two signals as they exit the canalphone housing, and, in the event that the high frequency audio signal is undesirably ahead of the low frequency audio signal, make the high audio sound-tube longer than the low audio sound-tube.

We conclude that claim 2 would have been obvious in view of Saggio alone.

3. Claims 3 and 11

Claim 3 depends from claim 2, and further recites "wherein the low audio sound-tube is sized based upon its time response for the low audio signal to pass through the low audio sound-tube." *Id*. at 12:48–50. Claim 11 similarly adds to claim 9 "sizing the low audio sound-tube based upon its time response for the low audio signal to pass through the low audio sound-tube." *Id*. at 13:25–27. We agree with Petitioner that one with ordinary skill in the art would have understood these requirements as specifying that the low audio sound-tube is sized based on how long it takes a low audio signal to pass through it.

We find that these limitations are met by Saggio, particularly given the paragraph 46 disclosure explaining that the phase relationship between the high frequency signal and the low frequency signal may be fine-tuned by varying the length of the sound tubes and the position of the drivers. That disclosure reasonably would have conveyed to one with ordinary skill that, to maintain the original phase relationship between signals, the length of a sound-tube should be decided at least in part on the basis of the time required for a signal to travel through the sound-tube.

For these reasons, and in the absence of any counterargument regarding these claims by Patent Owner, we conclude that claims 3 and 11 would have been obvious in view of Saggio alone.

4. Claim 4

Claim 4 depends from claim 2 and adds "wherein the high audio sound-tube is longer to slow down the high audio signal's arrival to the outside of the canalphone housing so that it is closer in time to the low audio signal from the low audio driver's arrival to the outside of the canalphone housing." Ex. 1001, 12:51–55.

As discussed in the context of claim 2, in the event the high audio signal is undesirably ahead of the low audio signal, it would have been obvious to one with ordinary skill in the art to make the high audio sound-tube longer than the low audio sound-tube. That is because making the high audio signal travel farther to reach the exit of the canalphone delays its arrival to the exit of the canalphone. For the same reason, in that scenario, a longer high audio sound-tube delays the high audio signal's arrival to the outside of the housing so that it is closer in time to the low audio signal's arrival to the outside of the housing. Thus, the added limitation of claim 4 would have been obvious to one with ordinary skill in light of Saggio's disclosure.

In the absence of any Patent Owner counterargument, we conclude that claim 4 would have been obvious in view of Saggio alone.

5. Claims 5 and 14

Claim 5 depends from claim 4 and further recites that "the arrival of the high audio [signal] to the outside of the canalphone housing is less than

0.05 milliseconds difference than the low audio signal from the low audio driver arrival to the outside of the canalphone housing." *Id*. at 12:56–60. Claim 14 depends from claim 10 and recites "timing the arrival of the high audio [signal] to the outside of the canalphone housing compared to the low audio signal from the low audio driver arrival to the outside of the canalphone housing is within 0.05 milliseconds of each other." *Id*. at 13:37–41. These added limitations essentially are the same and, we find, would have been obvious.

Mr. Young testified that a person of ordinary skill in the art "would have been motivated to calculate the offset necessary to result in a particular time-of-arrival difference, and bring the time-of-arrival difference to a minimum." Ex. 1003 ¶ 72. In view of that testimony, and given that the '674 patent does not identify any particular significance or importance to "less than 0.05 milliseconds," we find it would have been obvious, and within the level of ordinary skill in the art, to select the recited time difference as a workable or optimal value. *See In re Aller*, 220 F.2d 454, 456 (CCPA 1955); *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990) (finding that when the difference between a claimed invention and the prior art is some range or other variable, patentability can only be found when the claimed range is critical, such as a range that achieves unexpected results relative to the prior art). Patent Owner does not claim the 0.05 millisecond time difference is critical or achieves an unexpected result, and does not otherwise argue for the patentability of claims 5 and 14.

We conclude that claims 5 and 14 would have been obvious in view of Saggio alone.

6. Claim 10

Claim 10 depends from claim 9 and further recites "carrying a low audio signal from the low audio driver to outside of the canalphone housing via a low audio sound-tube" and "carrying a high audio signal from the high audio driver to the outside of the canalphone housing via a high audio sound-tube phase corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube." Ex. 1001, 13:17–24.

These limitations are effectively the same as those recited in claim 2 discussed above, and we thus conclude that claim 10 would have been obvious in view of Saggio alone for the reasons discussed above with respect to claim 2.

7. Claim 17

Claim 17 depends from claim 9 and further recites "using a time response for the low audio signal to pass through the canalphone housing as a control point to set all other audio signals' phase in the system." Ex. 1001, 14:12–15.

As discussed above, Saggio discloses embodiments including a low audio sound tube and a high audio sound tube, where the high audio sound-tube is longer than the low audio sound-tube. As also discussed above in the context of claims 2 and 10, it would have been obvious to one with ordinary skill in the art to perform phase correcting of the high audio sound-tube by making the high audio sound-tube longer than the low audio sound-tube. We agree with Mr. Young that "[i]n order to size the high audio sound-tube to be longer than the low audio sound-tube, one obviously needs to know the length of the low audio sound-tube" and "[t]he length can be determined from the time it takes the low audio signal to pass through the sound-tube."

Ex. 1003 ¶ 94. We further agree that "it would have been obvious to [a person of ordinary skill in the art] to use the time-of-arrival for the low audio signal as a "control point" by which to determine the appropriate high frequency sound-tube length." *Id*. Patent Owner does not offer contrary argument or evidence.

For these reasons, we conclude that claim 17 would have been obvious in view of Saggio alone.

8. Claim 18

Claim 18 adds to claim 10 "standardizing high audio sound-tube lengths based upon at least two low audio sound tube lengths." Ex. 1001. 14:17–19.

Mr. Young testified that "[i]t would have been obvious to a POSA to standardize the length of Saggio's high frequency sound-tube based on at least two low frequency sound-tube lengths" because "custom IEMs can have more than one low frequency sound-tube length, owing to different ear anatomies" and that one "would have been motivated to standardize the high frequency sound-tube's length based on at least two low frequency sound-tube lengths in order to find one high tube length that would work in more than one IEM, which would effect economies of scale." Ex. 1003 ¶ 106. We find Mr. Young's analysis persuasive, and Patent Owner does not does not offer contrary argument or evidence.

For these reasons, we conclude that claim 18 would have been obvious in view of Saggio alone.

9. Claim 20

Claim 20 depends from claim 18, and further recites "aligning the standardized high audio sound-tube lengths' end with the respective one of the two low audio sound-tube lengths' end." Ex. 1001, 14:25–27.

As shown in Figures 1, 4, 6, 14, 15, and 17, Saggio's high and low sound-tubes have their ends are aligned at the eartip, where they exit the canalphone housing. As that observation is supported by the testimony of Mr. Young (*see* Ex. 1003 ¶ 111) and not disputed by Patent Owner, we conclude that claim 20 would have been obvious in view of Saggio alone.

E. Obviousness of Claims 6–8, 15, and 16 in View of Saggio and Prakash

Petitioner contends that claims 6–8, 15, and 16 would have been obvious in view of Saggio and Prakash. *See* Pet. 25–27, 29–31, 33–34. For the reasons stated below, we agree.

1. Claims 6, 7, and 15

Claim 6 depends from claim 1 and further recites that "the acoustical-timer includes a processor to phase correct a high audio signal from the high audio driver to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver to the outside of the canalphone housing." Ex. 1001, 12:61–65. Claim 7 adds to claim 6 that "the processor uses digital signal processing to control the high audio signal's arrival at the outside of the canalphone housing to be closer in time to the low audio signal from the low audio driver's arrival to the outside of the canalphone housing." *Id*. at 12:66–13:3. Claim 15 depends from claim 9 and further recites "using digital signal processing to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing

with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." *Id*. at 14:1–6.

For these processor and digital signal processing limitations, Petitioner relies on Prakash's use of a chip, including a digital signal processor (DSP), in a speaker system to "programmably delay[] audio signals for over 30 ms to synchronize the times of their arrival from speakers 312 at different distances to a listener position." Pet. 26 (citing Ex. 1006, 4:17–22; 5:12–67; Figs. 3–5). According to Mr. Young, it would have been obvious to use Prakash's chip in Saggio's IEM because doing so "would enable the POSA to select tube lengths based on frequency response without regard to phase" in order to obtain a desired frequency response, and because "Prakash's chip could be used to delay the HFD signal as needed, while retaining the high audio sound-tube length that led to the desired frequency response." Ex. 1003 ¶ 81. He explains that "[s]ince tube lengths are typically selected for frequency response, the ability to retain the tube length that yielded the desired frequency response would motivate a POSA to use Prakash's chip in Saggio's IEM" to correct whatever phase difference is introduced by selecting the tube-length having the desired frequency response. *Id*.

In view of Mr. Young's testimony, we are persuaded that one of skill in the art would have had a reason with rational underpinning to use a chip like that of Prakash in a canalphone such as that of Saggio for phase correction by delaying signals.

Patent Owner argues that "Prakash taught that its processor was typically used in a car stereo, a much larger audio device than the very small size of canalphones" and that "Petitioner provides no reason why a POSA

would have expected to be able to fit a large processor appropriate for car stereos into a very small canalphone, and no reference provided by Petitioner does or suggests such." PO Resp. 17. This is unpersuasive. As Petitioner observes, "Prakash does not teach its chip is 'typically' used in car stereos, but rather that the example of FIG. 9, a car stereo, is a 'typical application.'" Reply 13–14 (citing Ex. 1006, 11:29–30). Moreover, it does not follow from the fact that an entire car stereo is larger than a canalphone that the car stereo's sound processor is too large for a canalphone. And the combination would not necessarily require that the exact same chip that is used in the car stereo be used in the canalphone; instead, the combination merely relies on Prakash's teachings that one can use a DSP to delay audio signals. There is no evidence that audio signal delaying DSPs were not available in a size that could be used with a canalphone. To the contrary, Mr. Young provided unrebutted testimony that it was known to use DSPs with in-ear hearing devices. *See* Ex. 1003 ¶ 80; *see also* Ex. 1008 ¶ 29, Fig. 1 (showing a hearing aid including DSP 4). Patent Owner points to nothing in the disclosure of the '674 patent that refers to either (1) a problem fitting a processor in a canalphone, or (2) providing a novel solution for that problem. From this, we conclude that it was within the knowledge of a person of ordinary skill in the art to select a suitably sized DSP for use in Saggio's canalphone. *See Hybritech Inc. v. Monoclonal Antibodies, Inc*., 802 F.2d 1367, 1384 (Fed. Cir. 1986) (finding that a patentee "need not teach, and preferably omits, what is well known in the art").

We accordingly conclude that claims 6, 7, and 15 would have been obvious in view of Saggio and Prakash.

2. Claim 8

Claim 8 depends from claim 7, and further recites that "the acoustical-timer uses a time response for the low audio signal to pass through the canalphone housing as a control point to set all other audio signals' phase in the system." *Id*. at 13:4–7.

The reasoning applied to the obviousness of claim 17 over Saggio alone applies here, and for those same reasons we conclude that claim 8 also would have been obvious in view of Saggio and Prakash.

3. Claim 16

Claim 16 depends from claim 15 and further recites "timing the arrival of the high audio [signal] to the outside of the canalphone housing compared to the low audio signal from the low audio driver arrival to the outside of the canalphone housing is within 0.05 milliseconds of each other." *Id*. at 14:7–11.

The added limitation of claim 16 is the same as that expressly recited in claim 14, and has already been addressed above in the discussion of claim 14 in the context of obviousness over Saggio. The same reasoning and analysis applies here and we conclude that claim 17 would have been obvious in view of Saggio and Prakash.

F. Obviousness of Claims 1–5, 9–11, 13, 14, 17, 18, and 20 in View of Saggio and Dahlquist

Petitioner contends that claims 1–5, 9–11, 13, 14, 17, 18, and 20 would have been obvious in view of Saggio and Dahlquist. *See* Pet. 47–56. For the reasons given below, we agree.

Petitioner specifically argues that "[i]t would have been obvious to offset Saggio's HFD rearward of the LFD, as taught by Dahlquist, by sizing

Saggio's high sound-tube to be longer than the low sound-tube." Pet. 48. For a reason to combine, Petitioner cites Mr. Young to the effect that "[a] POSA would be motivated to use Dahlquist's offset in Saggio's IEM to improve fidelity." *Id*. (citing Ex. 1003 ¶¶ 179–180).

We find that Petitioner's case for obviousness of claims 1–5, 9–11, 14, 17, 18, and 20 over Saggio alone is not made less persuasive by its additional reliance on the teachings of Dahlquist. That is, even if the teachings of Dahlquist do not add anything to the teachings of Saggio, the combined teachings of Saggio and Dahlquist are not any less than those of Saggio alone. Moreover, we determine that Dahlquist does add additional support for an obviousness finding.

Saggio's teaching that "it will be appreciated that the output from each driver as well as the phase relationship between the two drivers may be tuned by varying the length of the sound-tubes and the positions of the driver outputs relative to one another" (Ex. 1004 ¶ 46) generally expresses that any phase error between the drivers can be resolved by adjusting the lengths of the sound tubes and the relative position of the drivers. It does not specifically state whether the high frequency sound tube or the low frequency sound tube should be made longer, or whether the high frequency driver or the low frequency driver should be placed farther from a listener. That is left in the capable hands of the skilled artisan. Dahlquist, however, adds to Saggio the disclosure that, for phase synchronization, the distance from a speaker outputting higher frequency sound should be made longer than the distance from a speaker outputting lower frequency sound.

We recognize that Dahlquist is directed to external speakers and not to personal listening devices such as headphones, canalphones, earbuds, and

the like. However, the record indicates that the fundamental scientific principles governing propagation of sound and the frequency response of sound apply to inside and outside the ear alike.

Patent Owner does not point to evidence showing that Dahlquist's teachings regarding the relative positioning of the drivers would not apply in a canalphone. Instead, Patent Owner argues that Petitioner fails to provide evidence showing "a need for improved fidelity in canalphones at the time of invention" and that, "Petitioner merely relies on the assumption that improving fidelity in canalphones would be common sense, without any evidence to support that assumption." PO Resp. 14. This argument is not persuasive.

We find that the art of the record in this proceeding provides ample evidence that skilled artisans were interested in improving fidelity, both in sound systems in general and in canalphones in particular. *See, e.g.*, Ex. 1037; Ex. 1038, 2:38–54; Ex. 1039, 2:36–52. In fact, Saggio itself discloses that there may be undesirable deviation or error in the phase relationship between high frequency and low frequency outputs in a canalphone, and proposes to eliminate that problem by effecting appropriate adjustments in the relative length of sound-tubes carrying those outputs. *See* Ex. 1004 ¶ 46.

G. Obviousness of Claims 6–8, 15, and 16 in View of Saggio, Dahlquist, and Prakash

Petitioner contends that claims 6–8, 15, and 16 would have been obvious in view of Saggio, Dahlquist, and Prakash. *See* Pet. 47–56.

We have discussed above how Petitioner has made a sufficient showing of obviousness of claims 6–8, 15, and 16 over Saggio and Prakash.

As noted above, the addition of Dahlquist only makes the case of obviousness stronger, for the same reasons discussed above explaining why the addition of Dahlquist to Saggio makes the case of obviousness over Saggio alone stronger. We explained in Section II.E.1 why we are not persuaded by Patent Owner's argument about the size of Prakash's car stereo embodiment.

We conclude that claims 6–8, 15, and 16 would have been obvious in view of Saggio, Dahlquist, and Prakash.

H. Anticipation by Harvey '806

Petitioner contends that claims 1, 2, 4, 5, 9, 10, 13, and 14 were anticipated by Harvey '806. *See* Pet. 36–46. For the reasons given below, we agree.

1. Claims 1 and 9

a. High and Low Audio Drivers

Claim 1 recites "a high audio driver carried by a canalphone housing," and "a low audio driver carried by the canalphone housing adjacent to the high audio driver." Claim 9 analogously recites a step of "providing a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver." Ex. 1001, 12:31–33; 13:9–11.

"High audio driver" is synonymous with an HFD (high frequency driver), and "low audio driver" is synonymous with an LFD (low frequency driver). Petitioner asserts that "Harvey '806 discloses an earpiece (in-ear monitor or canalphone) with an LFD adjacent an HFD, both drivers carried within the earpiece." Pet. 36 (citing Ex. 1005, 1:23–25; 3:46–48, 5:6–9,

7:31–52, Fig. 3, Fig. 6; Ex 1003 ¶ 117). We find Petitioner's position supported by the cited evidence, and Patent Owner does not argue otherwise.

b. Acoustical Timer and Phase Correction

As noted above, claim 1 also recites "an acoustical-timer to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." Ex. 1001, 12:34–38. Claim 9 analogously recites a step of "phase correcting a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." *Id*. at 13:12–15.

Petitioner accounts for the "acoustical-timer" limitation of claim 1 by finding in Harvey '806 the structure of acoustical-timer 17a in the '674 patent, which includes a low audio sound-tube to carry a low audio signal from a low audio driver to outside of a canalphone housing, and a high audio sound-tube to carry a high audio signal from a high audio driver to outside of the canalphone housing. Ex. 1001, 7:21–27. In acoustical-timer 17a of the '674 patent, the high audio sound-tube is longer than the low audio sound-tube. *Id*. at 7:27–29. As shown in Figure 3 of Harvey '806, the sound from low frequency driver 107 is carried by sound tube 303, and the sound form high frequency driver 109 is carried by sound tube 305. *See* Ex. 1005, 5:6–9.

Petitioner asserts that "Harvey '806 teaches phase correction between an HFD and LFD by sizing one sound-tube to be longer" and that "[w]hen the driver outputs are displaced relative to one another, a time delay is introduced between the frequency ranges produced by each of the drivers,"

introducing a phase shift between the frequency ranges. Pet. 36–37 (citing Ex. 1005, 2:32–45, 6:30–35). Petitioner further asserts that Harvey '806 teaches determining the phase shift, which is then "corrected through the selection of an appropriate driver offset," where "[t]he offset is implemented through a two-piece sound delivery tube that results in an extension of the offset driver's sound-tube." Pet. 37 (citing Ex. 1005, 6:47–54, 6:61–65, Fig. 3 (two-piece tube 321/303 offsets driver 107); 7:38-45, Fig. 6 (two-piece tube 605/607 offsets driver 107).

We find the above-reproduced explanation to be supported by the cited evidence, and also persuasive. Mr. Young testifies that "Harvey '806 is not limited to offsetting the LFD, as Harvey '806 teaches both drivers 'can be fitted with sound delivery tube extensions, thus providing additional flexibility in adjusting the driver offset.'" Ex. 1003 ¶ 120 (citing Ex. 1005 at 7:47–52). Mr. Young further testifies that "given Harvey '806's teaching that both drivers may be fit with the extension (col. 7:47–52) . . . a POSA would understand Harvey '806 to teach offsetting the HFD from the LFD using Harvey '806['s] tube extension." *Id.*

Patent Owner argues Harvey '806 does not anticipate because it does "not teach phase correcting signals from two drivers in a canalphone by making the sound tube for the high driver longer, as claimed by the '674 patent." PO Resp. 7. Petitioner asserts that Patent Owner's argument "ignores Harvey '806's teaching at 7:47–52 and Mr. Young's testimony on the same." Reply 3–4 (citing Ex. 1003, ¶ 120). Petitioner further argues that "Patent Owner incorrectly 'treats Harvey '806's statement that it is 'preferable to keep the high frequency driver as close as possible to the

eartip' as a requirement that Harvey '806's offsetting can only be done by extending the tube for the LFD." Reply 4.

We agree with Petitioner that Harvey '806 is not limited to offsetting the LFD, as it specifically teaches that "*both* drivers can be fitted with sound delivery tube extensions, thus providing additional flexibility in adjusting the driver offset." Ex. 1005, 7:47–52 (emphasis added). We credit Mr. Young's unrebutted testimony that "given Harvey '806's teaching that both drivers may be fit with the extension . . . a POSA would understand Harvey '806 to teach offsetting the HFD from the LFD using Harvey '806['s] tube extension" and that "Harvey '806 [thus] teaches acoustical-timer 17a." Ex. 1003 ¶ 120.

We are unpersuaded by Patent Owner's argument that Harvey '806 does not anticipate because it teaches that "it is preferable to keep the high frequency driver as close as possible to the eartip, thus requiring driver offsetting to be performed on the lower frequency driver" rather than the higher frequency driver. We first note that claims 1 and 9 do not require that the high tube be longer than the low tube. Thus, this argument is inapplicable to these claims. Regarding the other claims, we read "preferable" in Harvey '806 to mean just that, a *preference*, not a requirement, and conclude that one of skill in the art would understand the disclosure to encompass both a preferable embodiment with a longer low driver tube and a less preferable embodiment with a longer high driver tube.

Moreover, because Harvey '806 specifically describes "adjusting the driver offset," we see no reason why Harvey '806 would need to include a graph showing results, as Patent Owner argues. *See* PO Resp. 8–9. As noted above, the '674 patent does not provide dimensional or other structural

specifications for the embodiment(s) that would produce the results shown in Figure 7 and, absent such disclosure, we are left with the assumption that all embodiments of the ’674 patent would produce such results. It follows that Harvey ’806, which, we find, describes the same structural techniques for correcting phase, would also accomplish the same results.

For anticipation, the dispositive question is whether one skilled in the art would reasonably understand or infer from a prior art reference that every claim element is disclosed in that reference. *Eli Lilly*, 849 F.3d at 1074–1075. It is not necessary that language identical to that appearing in the claim be found in the prior art. We find Harvey ’806 discloses each of the elements recited in claims 1 and 9, and, therefore, anticipates claims 1 and 9.

2. Claims 2 and 10

Claim 2 depends from claim 1, and claim 10 depends from claim 9. Both dependent claims require a high audio tube sized to be longer than a low audio tube.

Because a person of ordinary skill in the art would understand Harvey ’806 teaches such an embodiment, as discussed above in connection with claims 1 and 9, we conclude that claims 2 and 10 were anticipated by Harvey ’806.

3. Claims 4 and 13

Claim 4 depends from claim 2, and claim 13 depends from claim 10. Both claims require that the longer high audio sound-tube slow down the high audio signal’s arrival to the outside of the canalphone housing so that it is closer in time to the low audio signal’s arrival to the outside of the canalphone housing.

We have already discussed above, in the context of claims 1 and 9, that a person skilled in the art would have understood the disclosure of Harvey '806 to teach phase correction by making the high audio sound-tube longer than the low audio sound-tube. The limitation added by claims 4 and 13 is inherently met by a longer high audio sound-tube, because it takes sound longer to travel a farther distance.

We accordingly conclude that claims 4 and 13 were anticipated by Harvey '806.

4. Claims 5 and 14

Claim 5 depends from claim 4, and claim 14 depends from claim 13. Both require that the arrival of the high and low audio signal to the outside of the canalphone housing be within 0.05 milliseconds of each other.

Mr. Young testifies that "the signals' time-of-arrival difference results from the difference in tube length," "[a] POSA can readily calculate the time-of-arrival difference for any offset, simply by knowing the length of the offset," and "[f]or example, the claimed 0.05 ms results from a high sound-tube that is 17.15 mm longer than the low sound-tube." Ex. 1003 ¶ 137. Mr. Young further explains that Harvey '806 teaches a driver offset, i.e., difference in tube length, of 3.75 mm, that 3.75 mm is less than 17.15 mm, and that a sound signal would travel the 3.75 mm offset in 0.01 ms, a difference of "less than 0.05 milliseconds" as claimed. *See* Ex. 1003 ¶¶ 138–39. Patent Owner does not dispute this analysis.

We credit Mr. Young's testimony and accordingly conclude that claims 5 and 14 were anticipated by Harvey '806.

I. Obviousness in View of Harvey '806 Alone

Petitioner contends that claims 3, 11, 12, and 17–20 would have been obvious in view of Harvey '806 alone. *See* Pet. 36–46. We agree.

As an initial matter, Patent Owner argues, consistent with the anticipation arguments, that Harvey '806 cannot properly form the basis of an obviousness rejection because it does "not teach phase correcting signals from two drivers in a canalphone by making the sound tube for the high driver longer, as claimed by the '674 patent" and that, instead, it teaches "the exact opposite, making the sound tube for the high driver *shorter*." PO Resp. 13. Patent Owner further argues "[t]he fact that some portions of Harvey '806, when discussing driver offsetting, do not always repeat that it is the low driver being offset with a longer tube does not mean that Harvey '806 taught or suggested offsetting either the low driver or the high driver as Petitioner suggests." *Id*. For the reasons articulated in connection with the anticipation analysis, we do not agree with Patent Owner's contentions. *See* Section II.H.1.

Patent Owner also argues that Petitioner "fails to provide any evidence showing any of the prior art signals are phase corrected as claimed by the '674 patent, such as by providing a phase response graph like that provided by the '674 patent in Figure 7." PO Resp. 18. This argument is also addressed, and found unpersuasive, above. *See* Section II.D.1.b.

Patent Owner further argues that "[o]n the issue of expectation of success, Petitioner does not provide any evidence at all" and that "[n]owhere in the Petition does Petitioner discuss why one of ordinary skill in the art, even if motivated to selectively modify or combine the teachings of the prior art to mirror the claimed invention, would have had a reasonable expectation

of success in doing so." PO Resp. 16. Specifically, Patent Owner argues "there was no expectation of success in phase correcting signals by making the sound tube for the high driver longer than the sound tube for the low driver" because "Harvey '806 expressly taught that to achieve phase correction in canalphones it was 'required' that the low driver be offset with a longer sound tube." PO Resp. 17. We do not agree with this argument because, as explained above, Harvey '806 does not "require" that the low driver have a longer tube. *See* Section II.H.1.b.

1. Claims 3 and 11

Claim 3 depends from claim 2, which depends from claim 1. Claim 11 depends from claim 10, which depends from claim 9. Both claims 3 and 11 further require sizing the low audio sound tube based on its time response for the low audio signal to pass through the low audio sound-tube.

As discussed above in the context of alleged obviousness of claims 3 and 11 over Saggio, we find that a person with ordinary skill in the art would have understood these requirements as specifying that the low audio sound-tube is sized based on how long it takes a low audio signal to pass through it. *See* Ex. 1003 ¶ 130. One with ordinary skill in the art would have known that in order to maintain the original phase relationship between signals, the length of a sound-tube would need to be determined at least in part on the basis of the length of time a signal requires to travel through the sound-tube.

For these reasons, and in the absence of any counterargument or evidence from Patent Owner, we conclude that claims 3 and 11 would have been obvious in view of Harvey '806 alone.

2. Claim 17

Claim 17 depends from claim 9 and further recites "using a time response for the low audio signal to pass through the canalphone housing as a control point to set all other audio signals' phase in the system." Ex. 1001, 14:12–15.

As discussed above, Petitioner has made a sufficient showing that Harvey '806 discloses an embodiment in which the high audio sound-tube is made longer than the low audio sound-tube and that length differential is used to provide phase correction between the signals. We agree with Mr. Young that "[i]n order to size the high audio sound-tube to be longer than the low audio sound-tube, one obviously needs to know the length of the low audio sound-tube" and "[t]he length can be determined from the time it takes the low audio signal to pass through the sound-tube." Ex. 1003 ¶ 156. We further agree that "it would have been obvious to a POSA to use the time-of-arrival for the low audio signal as a "control point' by which to determine the appropriate high frequency sound-tube length." *Id*. Patent Owner does not dispute this, and does not offer contrary argument or evidence.

For these reasons, we conclude that claim 17 would have been obvious in view of Harvey '806 alone.

3. Claim 18

Claim 18 adds to claim 10 "standardizing high audio sound-tube lengths based upon at least two low audio sound tube lengths." Ex. 1001, 14:17–19.

Mr. Young testifies that "[i]t would have been obvious to a POSA to standardize the length of Harvey's high frequency sound-tube based on at least two low frequency sound-tube lengths" because "custom IEMs can

have more than one low frequency sound-tube length, owing to different ear anatomies" and one "would have been motivated to standardize the high frequency sound-tube's length based on at least two low frequency sound-tube lengths in order to find one high tube length that would work in more than one IEM, which would effect economies of scale." Ex. 1003 ¶ 168.

We credit Mr. Young's testimony, and, in the absence of any counterargument or evidence from Patent Owner, conclude that claim 18 would have been obvious in view of Harvey '806 alone.

4. Claim 20

Claim 20 depends from claim 18, and further recites "aligning the standardized high audio sound-tube length's end with the respective one of the two low audio sound-tube lengths' end." Ex. 1001, 14:25–27. Petitioner argues that "Harvey '806's sound-tubes are aligned at the eartip, where they exit the housing." Pet. 47 (citing Ex. 1005, Fig. 3, Fig. 6). The observation is supported by the testimony of Mr. Young (*see* Ex. 1003 ¶ 172) and we thus conclude that claim 20 would have been obvious in view of Harvey '806 alone.

J. Obviousness in View of Harvey '806 and Prakash

1. Claims 6, 7, and 15

Claim 6 depends from claim 1, and further recites that the acoustical-timer includes a processor to phase correct a high audio signal from the high audio driver to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver to the outside of the canalphone housing." Ex. 1001, 12:61–65. Claim 7 depends from claim 6, and further recites that the processor uses digital signal processing to control the high

audio signal's arrival at the outside of the canalphone housing to be closer in time to the low audio driver's arrival to the outside of the canalphone housing. *See id*. at 12:66 to 13:3. Claim 15 depends from claim 9 and further recites "using digital signal processing to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing." *See id*. at 14:1–6.

For these processor and digital signal processing limitations, Petitioner relies on Prakash's use of a chip, including a digital signal processor (DSP), in a speaker system to "programmably delay audio signals to synchronize arrival times" from speakers 312 at different distances to a listener position. Pet. 26. According to Mr. Young, it would have been obvious to use Prakash's chip in the device of Harvey '806 because doing so would enable one "to select tube lengths based on frequency response without regard to phase" in order to select a desired frequency response, and "then use Prakash's chip to delay the HFD signal as needed while retaining the high audio sound-tube length that yielded the desired frequency response," in order to reduce the phase delay for the selected tube length. Ex. 1003 ¶ 146. He explains that "[s]ince tube lengths are typically selected for frequency response, the ability to retain the tube length that yielded the desired frequency response would motivate a POSA to use Prakash's chip in Harvey '806's IEM." *Id.*

In view of Mr. Young's testimony, we are persuaded that one of skill in the art would have had a reason with rational underpinning to use a chip like that of Prakash in a canalphone such as that of Harvey '806 for phase correction by delaying signals. Patent Owner's arguments regarding

combining the teachings of Harvey ’806 with the teachings of Prakash are unpersuasive for the reasons explained in Section II.E.1.

We accordingly conclude that claims 6, 7, and 15 would have been obvious in view of Harvey ’806 and Prakash.

2. Claim 8

Claim 8 depends from claim 7, and further recites “wherein the acoustical-timer uses a time response for the low audio signal to pass through the canalphone housing as a control point to set all other audio signals’ phase in the system.” Ex. 1001, 13:4–7.

As discussed above in the context of claim 17, to size the high frequency sound-tube longer than the low frequency sound-tube to effect phase correction, one with ordinary skill in the art would have known and found it obvious to use the time-of-arrival of the low audio signal as a “control point” by which to determine the appropriate sound-tube length. *See* Ex. 1003 ¶ 156. The same reasoning applies when using chip 300 of Prakash to delay the high audio signal, and one with ordinary skill in the art would have known to use the time-of-arrival of the low audio signal as a “control point” to determine an appropriate delay. In that regard, Mr. Young testifies that “Prakash’s delay 516 delays input signals by a ‘desired interval.’” Ex. 1003 ¶ 155. Mr. Young further testifies that to use Prakash’s chip to delay Harvey ’806’s HFD signal by a desired interval,” one would need a “control point” by which to programmably delay the signal, and that the time it takes the low audio signal to pass through the canalphone housing is an obvious control point from the perspective of one with ordinary skill in the art. *Id*.

We accordingly conclude that claim 8 would have been obvious in view of Harvey '806 and Prakash.

3. Claim 16

Claim 16 recites "timing the arrival of the high audio [signal] to the outside of the canalphone housing compared to the low audio signal from the low audio driver arrival to the outside of the canalphone housing is within 0.05 milliseconds of each other." Ex. 1001, 14:7–11.

Prakash describes that chip 300 can programmably delay audio signals (*see* Ex. 1006, 4:17–22) and, given that the stated goal of Prakash is to synchronize the times of arrival of separate audio signals, we are sufficiently persuaded that one with ordinary skill would have known to implement sufficient delay to achieve synchronization of the signals within a certain acceptable and/or workable range, such as 0.05 milliseconds, which has not been identified as critical. *See In re Aller*, 220 F.2d at 456.

For these reasons, and in the absence of any counterargument or evidence from Patent Owner, we conclude that claim 16 would have been obvious in view of Harvey '806 and Prakash.

K. Claims Added After SAS

In the Supplemental Response addressing the challenges to claims 12, 19, and 21 added after *SAS*, Patent Owner stated that "[b]ecause the burden is not on Patent Owner to prove claims 12, 19, and 21 are patentable, and because the Board already found that Petitioner would not prevail in establishing the unpatentability of those claims, Patent Owner rests on the record." Supp. Resp. 2. Petitioner then offered argument and evidence concerning these claims. *See* Supp. Reply 1–14. In the Supplemental Sur-

Reply, Patent Owner argued that "[u]nder 37 C.F.R. 42.23(b), '[a] reply may only respond to . . . [the] patent owner response,'" and "because Patent Owner's Supplemental Response did not assert any new evidence or raise any new arguments, there was nothing Petitioner was permitted to respond to in its Supplemental Reply." Supp. Sur-Reply 1. Patent Owner further argued that Petitioner's argument and evidence thus "are out of scope under Rule 42.23 and should not be considered by the Board." *Id*.

Patent Owner's argument is not correct. Although 37 C.F.R. 42.23(b) states that, in general, "[a] reply may only respond to . . . patent owner response," our August 2018 Trial Practice Guide Update specifically provides that "in response to issues arising from the Supreme Court's decision in *SAS* . . . , the Board will permit the petitioner, in its reply brief, to address issues discussed in the institution decision." In view of this guidance, and because the approach urged by Patent Owner would unfairly deprive Petitioner of any opportunity to respond to the Institution Decision, we consider Petitioner's arguments and evidence below.

1. Claim 12

Claim 12 depends from claim 11, and further recites "selecting the low audio sound-tube's size to be acoustically proper and as short as can be readily fit into the canalphone housing." Ex. 1001, 13:28–30. In the Institution Decision, we observed that the '674 patent defines "acoustically proper" as meaning that "the audio sound tube does not *promote distortion due to its length*" and that the phrase "as short as can be readily fit into the canalphone housing" is described in the Specification as referring to "the fact that the physical dimensions of the canalphone housing *creates placement issues* with regards to the low audio driver 22 and the other

system 10 components such as the high audio driver 20 and respective sound tubes." Inst. Dec. 31 (citing Ex. 1001, 8:50–55). We could, however, "discern no objective standard for determining a threshold beyond which length a soundtube is deemed to promote distortion and under which length a sound-tube is deemed not to promote distortion," concluding that "[i]t simply is not clear when a length of sound-tube is deemed to promote distortion and when it is not." Inst. Dec. 31. We further could find "no objectively determinable meaning for what 'creates placement issues' with regard to the low audio driver 22 and the other system 10 components such as the high audio driver 20 and respective sound tubes, and what does not." *Id*. at 31–32. "Because we [could not] reasonably determine the proper scope of claim 12, we [could not] conclude that there is a reasonable likelihood that the Petitioner would prevail in establishing that Saggio would render claim 12 obvious" and, therefore, did not originally institute on claim 12. *Id*. at 32. As required by *SAS*, however, Petitioner's challenges to claim 12 were subsequently added back into this proceeding.

As noted, Patent Owner's Supplemental Response rested on the record. Supp. Resp. 2. Petitioner then argued, citing deposition testimony of Mr. Young, that "under the broadest reasonable interpretation of 'acoustically proper,' *any* low audio sound-tube length would meet the limitation, because no sound-tube length 'promotes distortion,' therefore any tube length is 'acoustically proper.'" Supp. Reply 5–6. Regarding "as short as can be readily fit into the canalphone housing," Petitioner argued that "Mr. Young testified that he understood what 'as short as can be readily fit into the canalphone housing' meant, and he understood the 'placement

issues' passage from the specification." *Id*. at 8 (citing Ex. 1050, 18:12–21:18).

Having reviewed Petitioner's argument and evidence, we still fail to find any basis for determining whether a sound tube is "size[d] to be acoustically proper." Petitioner's argument that *any* tube is so sized would read the limitation out of the claim entirely, and is not consistent with the notion, implicit in the claim itself, that some sizes are acoustically proper and some are not. We also still fail to find any basis for assessing how short a tube can be without implicating "placement issues." Mr. Young testified that there would *always* be "placement issues" to resolve (*see* Ex. 1050, 20:21–25), and that such issues would need to be resolved by varying factors in addition to tube length (*id*. 24–25 "you would need to look at the placement of all this kit"). Thus, the minimum tube length is dependent on a number of other (unidentified and unclaimed) factors in a given canalphone, and could not be determined for the open-ended canalphone recited in claim 12, having an indeterminate number and type of internal canalphone components.

We accordingly still find ourselves unable to interpret this claim to have meaningful bounds and, thus, unable to determine whether the cited art teaches tubes sized "to be acoustically proper and as short as can be readily fit into the canalphone housing." Due to the ambiguity in the claim language, we determine that Petitioner has not shown that the prior art renders claim 12 unpatentable.

2. Claim 19

In the Institution Decision, we concluded that we could not determine the proper scope of claim 19 because the claim improperly depends from

claim 17 instead of claim 18, "which would otherwise provide clear antecedent basis for 'the two low audio sound-tube lengths"' recited in claim 19, and declined institution on that basis. *See* Inst. Dec. 34. Petitioner's challenges to claim 19 were added back into the proceeding after *SAS*, Patent Owner declined to address these challenges (*see* Supp. Resp. 2), and Petitioner argues that the dependency of claim 19 is an obvious error that we can correct (*see* Supp. Reply 9–11).

We agree with Petitioner that the error in claim 19 is evident and that, for purposes of determining Petitioner's challenge to this claim, we may consider it as dependent from claim 18. *Cf. CBT Flint Partners, LLC v. Return Path, Inc.*, 654 F.3d 1353, 1358 (Fed. Cir. 2011) (holding obvious errors in a claim can be corrected in construing the claim). And, considering claim 19 as depending from claim 18, we also agree with Petitioner, for the reasons stated in the Petition, and not contested by Patent Owner, that claim 19 would have been obvious in view of Harvey '806 alone and Saggio alone. *See* Pet. 34–35 (Saggio), 46 (Harvey '806).

3. Claim 21

Claim 21 recites "computer readable program codes configured to cause the program to . . . provide a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver." In the Institution Decision, we found that "[a]n audio driver in the context of the '674 patent is a physical structure that creates sound to be delivered by a sound tube" and that "[n]o explanation . . . is given in the Specification as to how, and it is not apparent how, program code possibly provides a physical structure generating sound." Inst. Dec. 38. We concluded that although Petitioner "relies on Prakash to account for the

program code aspect of claim 21," Petitioner had "not cited to anything in Prakash that even refers to program code providing a physical structure of any kind, much less a physical structure constituting an acoustic driver generating sound." *Id.* at 38–39. We concluded that Petitioner had not shown a reasonable likelihood that it would prevail in establishing that claim 21 was obvious and, thus, did not institute with respect to the claim.

Petitioner's challenges to claim 21 were also added back into the proceeding after *SAS*, Patent Owner declined to address them (*see* Supp. Resp. 2), and Petitioner argues that the claim "'fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention,' and is therefore indefinite." Supp. Reply 14, quoting *Nautilus, Inc. v. Biosig Instr., Inc.*, 134 S. Ct. 2120, 2124 (2014).

Although we agree with Petitioner that it is unclear how one might use "computer readable program codes to cause [a] program" to "provide a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver," indefiniteness of existing claims is not an issue that can be resolved in this proceeding. *See* 35 U.S.C. § 311(b). On this record, we find that Petitioner has not shown how this limitation is met in the prior art and, thus, conclude that Petitioner has not shown claim 21 to be unpatentable.

L. Motion to Amend

Because we determine that most of the original claims are unpatentable, we consider Patent Owner's contingent motion to amend.

For each claim challenged in an *inter partes* review, Patent Owner "may file 1 motion to amend the patent . . . [by] propos[ing] a reasonable number of substitute claims." 35 U.S.C. § 316(d)(1). A reasonable number

of substitute claims, by rebuttable presumption, is "one substitute claim . . . to replace each challenged claim." 37 C.F.R. § 42.121(a)(3).

Patent Owner proposes the following substitute independent claims 22 and 30:

> 22. A system comprising:
>
> a high audio driver carried by a canalphone housing;
>
> a low audio driver carried by the canalphone housing adjacent to the high audio driver; and
>
> an acoustical-timer to phase correct a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing;
>
> wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz.
>
> 30. A method comprising:
>
> providing a high audio driver carried by a canalphone housing, and a low audio driver carried by the canalphone housing adjacent to the high audio driver; and
>
> phase correcting a high audio signal from the high audio driver directed to the outside of the canalphone housing with delivery of a low audio signal from the low audio driver directed to the outside of the canalphone housing;
>
> wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz.

Mot. to Amend 2–4. Essentially, the proposed substitute claims add the limitation "wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz" to the issued claims they are intended to replace. *See id*. at 2–5.

Patent Owner identifies Fig. 7 of the application and patent, reproduced below, as providing the required support for the limitation added to the proposed substitute claims.

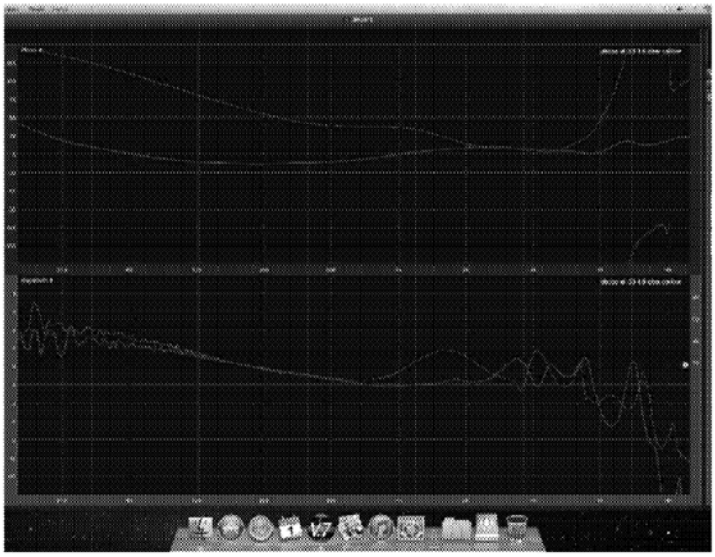

FIG. 7

"FIG. 7 is an exemplary graph of a phase corrected response of the system in FIG. 6." Ex. 1001, 4:56–57.

Petitioner opposes the Motion to Amend on procedural grounds (*see* Mot. to Amend Opp. 3–11), as well as by arguing that the proposed substitute claims would have been obvious (*see id*. at 11–18). We do not reach the procedural issues[2] because we find the proposed substitute claims are unpatentable over the cited art.

[2] *See Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (finding that an administrative agency is at liberty to reach a decision based on a single dispositive issue because doing so "can not only save the parties, the [agency], and [the reviewing] court unnecessary cost and effort," but can "greatly ease the burden on [an agency] faced with a . . . proceeding involving numerous complex issues and required by statute to reach its conclusion within rigid time limits").

1. Obviousness of Proposed Claims 22 and 30 in View of Harvey '806

Petitioner argues that "Harvey '806 teaches a phase corrected system as claimed, and a method of phase correcting as claimed, wherein the signals at the crossover are less than 45 degrees out-of-phase." Mot. to Amend Opp. 14 (citing Ex. 1041 ¶¶ 15–16). According to Petitioner, "[a] POSA would have been motivated to phase correct Harvey '806's signals to no more than 90 degrees out-of-phase at the crossover because Harvey '806 provides an example of correcting two signals that are *less* out of phase than 90 degrees." *Id*. (citing Ex. 1041 ¶ 16). Petitioner also argues that "to a POSA Harvey '806 teaches or suggests an IEM that reproduces audible sound from approximately 20Hz to above 11.5kHz," which is a "range [that] overlaps the claimed frequency range, such that *prima facie* obviousness exists" because "[t]he original disclosures do not contain any criticality showing that overcomes *prima facie* obviousness" *Id*. at 15.

2. Obviousness of Proposed Claims 22 and 30 in View of Saggio

Petitioner additionally argues that the proposed substitute claims would have been obvious over Saggio alone or in combination with Dahlquist. Mot. to Amend Opp. 16. Specifically, Petitioner argues that based on Saggio's disclosure of "tuning," "a POSA would have been motivated to vary the tube lengths to achieve a system with minimal phase offset at the crossover, which is where the 'phase relationship' between the two drivers potentially matters." *Id*. According to Petitioner, "[i]t would have been obvious to a POSA to use a high tube length that leads to 90 degrees or less of phase difference between the signals at the crossover,

since 90 degrees is midway between perfectly 'in phase' (0 degrees of phase difference at the crossover) and completely 'out of phase' (180 degrees of phase difference at the crossover)." *Id*. Regarding the frequency range, Petitioner argues that "Saggio states 'the desired upper limit for the frequency response of a high-fidelity monitor is at least 15 kHz'" and that "[b]ecause the generally accepted range of human hearing begins at 20Hz, to a POSA Saggio teaches or suggests an IEM that reproduces audible sound from approximately 20Hz to at least 15kHz," a range that "overlaps the claimed frequency range, such that *prima facie* obviousness exists." *Id*.

3. Patent Owner Arguments

Patent Owner argues that "[n]one of the originally cited prior art references provided any phase response curve showing signals that had been phase corrected" and that, "[c]onceding this utter failure of the prior art to teach the new limitation, 'wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz,' Petitioner performed a hindsight driven search to uncover a single reference [Ishii] relating to loudspeakers, not IEMs, that provides a single phase response curve." Mot. to Amend Reply 5. Patent Owner further argues that "even that reference does not teach a phase corrected response between 90 degrees and -90 degrees from 31.5Hz to 16kHz" and that "[e]ven when one could determine what Ishii taught, it was not within the range of the new limitation." *Id.*

These arguments concerning Ishii are not persuasive because they do not address Petitioner's explanation, summarized above, of how the new limitation would have been obvious in view of Harvey '806 and Saggio.

Patent Owner next argues that "there was no reason why one of skill in the art would have taken the prior art IEMs and sought to correct their

phase responses as claimed in the proposed amended claims." Mot. to Amend Reply 6. For support, Patent Owner asserts that Petitioner's expert "conceded there would have been no motivation at the time of invention of the patent here to phase correct signals in an IEM," that "[t]here was no recognized need for phase correction, nor was it a recognized problem," and that "[i]n fact, phase has nothing to do with fidelity of an IEM according to Petitioner's expert." *Id*. We find this argument unpersuasive because, as explained above, Harvey '806 and Saggio teach phase correction by varying tube lengths, and the ranges in the substitute claims appear to be, at best, optimizations. Nothing indicates that such results were unexpected or difficult to achieve, the patent does not identify specific structures or dimensions that would obtain the results, and Patent Owner has acknowledged that arriving at those results using the prior art structures would not require more than routine experimentation. (*See* Tr. 137:13–139:4.)

Patent Owner further argues that "[e]ven if motivated, there is no evidence in the record to support a finding that one of skill in the art could have succeeded at creating a phase corrected response in an IEM as claimed by the proposed amended claims." Mot. to Amend Reply 6. This argument also, however, does not address Petitioner's explanation of how the new limitation is obvious in view of Saggio and Harvey '806.

Patent Owner next argues that "Petitioner's entire argument on this point rests on the assumption that the proposed amended patent claims have a crossover and that at the crossover point the phase is between 90 and -90 degrees," but "the proposed amended claims do not recite crossovers and Petitioner's own expert conceded crossovers are not mentioned anywhere in

the patent." Mot. to Amend Reply 6–7. We do not agree that "Petitioner's entire argument 'rests on the assumption that the proposed amended patent claims have a crossover.'" The cited paragraph of the Young Declaration explains that one "would need to actually know what the crossover frequency is, and know what the phase is at that frequency, to know if there is 'phase correction.'" *See* Ex. 1041 ¶ 11–12. The point is simply that there must be overlap of the high and low signals—the "crossover frequency"—in order to have a phase difference to correct. The combination does not rely on a physical crossover.

Finally, Patent Owner asserts that Petitioner's argument fails because it addresses the phase at a crossover point, but "the phase at one point through that frequency range [being] between 90 and -90 degrees does not teach the phase being between 90 and -90 degrees through the frequency range from 31.5Hz to 16kHz." Mot. to Amend Reply 7. This argument is not persuasive because the new claim language does not require that the phase correction be "between 90 and -90 degrees through the frequency range from 31.5Hz to 16kHz." Instead, the claim simply requires that the "phase corrected response" be "between 90 degrees and -90 degrees from 31.5Hz to 16kHz," which, we broadly but reasonably interpret to mean only that somewhere within the 31.5Hz to 16kHz frequency range there is a phase corrected response that is between 90 and -90 degrees. This is taught or suggested in the prior art, as described above.

Moreover, we conclude that even if the claim is construed to require that the "phase correction" be "through the frequency range from 31.5Hz to 16kH," the teachings of Harvey '806 and Saggio concerning phase correction within that range would establish prima facie obviousness, which

Patent Owner makes no attempt to rebut. *See, e.g., In re Peterson*, 315 F.3d 1325, 1329 (Fed. Cir. 2003) ("In cases involving overlapping ranges, we and our predecessor court have consistently held that even a slight overlap in range establishes a prima facie case of obviousness."); *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 782–83 (Fed. Cir. 1985) (citing *In re Petering*, 301 F.2d 676, 682 (CCPA 1962)) (holding claims to an alloy unpatentable in view of a graph with a data point showing a composition within the claimed range).

4. Conclusion Regarding the Proposed Claims

For the reasons discussed in this section and above (*see* Sections II.D.1, II.F, II.H.1), we find proposed substitute claims 22 and 30 are unpatentable as obvious in view of Harvey '806, as obvious in view of Saggio, or as obvious in view of Saggio in combination with Dahlquist. And, because proposed substitute claims 23–29 mirror issued claims 2–8, and proposed substitute claims 31–41 mirror issued claims 10, 11, 13–18, and 20, we also find them obvious for the reasons identified in this section and the sections above discussing claims 2–8, 10, 11, 13–18, and 20 (*see* Sections II.D–J). The motion to amend is, accordingly, denied.

M. Petitioner's Motion to Exclude

Petitioner argues that "Patent Owner's cross-examination on the '674 and '960 patents" and "Patent Owner's cross-examination of Mr. Young on 'P.O. #8' were beyond the scope of cross-examination permitted by Fed. R. Evid. 611(b) and 37 C.F.R. § 42.53(d)(5)(ii)." Paper 37, 4–5.[3] Because we

[3] "P.O. #8" is a color version of Figure 7 of the '674 patent that was filed with the application. It was filed as Exhibit 2004.

do not rely on this material in reaching our decision, we dismiss these objections as moot.

Petitioner also argues that Ex. 2004, which on its face appears to be a color version of Fig. 7 of the '674 patent, should be excluded because (a) "Patent Owner did not produce any evidence to support a finding that Exhibit 2004 is what Patent Owner claims it is: a phase corrected response between 90 degrees and -90 degrees from 31.5Hz to 16kHz" and "[i]t is not evident from Exhibit 2004 that it is what Patent Owner claims it is at least because its axes are illegible"; (b) "Patent Owner did not file an affidavit by an individual having first-hand knowledge of how the data supposedly present in Exhibit 2004 was generated"; and (c) "Exhibit 2004 is hearsay because it is an out-of-court statement made by a declarant that has been offered to prove the truth of the matter asserted, namely, that Exhibit 2004 is a phase corrected response between 90 degrees and -90 degrees from 31.5Hz to 16kHz." Paper 37, 6–7. Because we do not reach the alleged procedural problems with the proposed amendment, we also dismiss these arguments as moot.

Petitioner additionally asserts that "[l]ines 50:10–16, 52:18–21, 51:14–18, 55:7–16, 56:6–10, 57:7–12, 57:14–58:17, 60:9–14, 65:2–13, and 65:22–25 of the May 1st deposition" of Mr. Young, which are "from a line of questioning on the phase correction teachings of Harvey '806," should "be excluded as beyond the scope of cross-examination permitted by Fed. R. Evid. 611(b) and 37 C.F.R. § 42.53(d)(5)(ii)." Paper 37, 8–9. Because we decide the Harvey '806 phase correction issue in Petitioner's favor, and do not rely on these passages, we dismiss these complaints as moot.

N. Patent Owner's Motion to Exclude

Patent Owner seeks to exclude Exhibits 1050–1055 because "Petitioner submitted [them] in support of its Supplemental Reply responding to Patent Owner's Supplemental Response," but "Patent Owner did not assert any new evidence or raise any new arguments in its Supplemental Response." Paper 65, 1. Because, as explained above, we conclude that Petitioner may respond to the Institution Decision even if Patent Owner does not (*see* Section II.K), these exhibits are not improper, and Patent Owner's motion is denied.

O. Constitutionality

Patent Owner disputes the constitutionality of these proceedings as improperly "extinguishing private property rights through a non-Article III forum without a jury." PO Resp. 19. After the Response was filed, the Supreme Court determined that patent rights are public rights, and that *inter partes* reviews before the Patent Trial and Appeal Board are, therefore, not unconstitutional. *See Oil States Energy Servs., v. Greene's Energy Grp.*, 138 S. Ct 1365, 1373 (2018).

III. CONCLUSION

Petitioner has shown, by a preponderance of the evidence, that claims 1–11 and 13–20 of the '674 patent are unpatentable. Petitioner has not shown, by a preponderance of the evidence, that claims 12 and 21 of the '674 patent are unpatentable.

IV. ORDER

For the reasons given, it is:

ORDERED that claims 1–11 and 13–20 of U.S. Patent 8,925,674 B2 have been shown to be unpatentable;

ORDERED that claims 12 and 21 of U.S. Patent 8,925,674 B2 have not been shown to be unpatentable;

ORDERED that Patent Owner's Motion to Amend is *denied*;

ORDERED that Petitioner's Motion to Exclude is *denied* as moot;

ORDERED that Patent Owner's Motion to Exclude is *denied*; and

FURTHER ORDERED that, because this is a Final Written Decision, the 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.

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