

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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1964 EARS, LLC,  
Petitioner

v.

JERRY HARVEY AUDIO HOLDING, LLC,  
Patent Owner.

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Case IPR2017-01092  
Patent 9,197,960 B2

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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 1–18 of U.S. Patent No. 9,197,960 (Ex. 1001, “the ’960 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 and 13–18 on several grounds of unpatentability. Paper 8 (“Inst. Dec.”), 2. Patent Owner then filed a Patent Owner Response (Paper 19, “PO Resp.”) and Petitioner filed a Reply (Paper 21, “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 42. Petitioner then requested, and was granted, adverse judgment with respect to certain references and claims. *See* Paper 51. Patent Owner filed a Supplemental Response (Paper 56, “Supp. Resp.”) regarding the added claims, Petitioner filed a Supplemental Reply (Paper 57, “Supp. Reply”), and Patent Owner filed a Supplemental Sur-Reply (Paper 62, “Supp Sur-Reply”).

Patent Owner has also filed a Contingent Motion to Amend (Paper 20, “Mot. to Amend”), Petitioner filed an Opposition (Paper 22, “Mot. to Amend Opp.”), Patent Owner filed a Reply (Paper 30, “Mot. to Amend Reply”), and Petitioner filed a Sur-Reply (Paper 32, “Mot. to Amend Sur-Reply”).

Patent Owner also filed a Motion for Observations (Paper 34), and Petitioner filed a Response (Paper 40).

Petitioner filed a Motion to Exclude (Paper 36), Patent Owner filed a Motion to Exclude (Paper 64), and each party filed an Opposition and a Reply (Papers 39, 41, 66, 68).

An oral hearing was held on December 17, 2018, and a transcript of the hearing is included in the record. Paper 72 (“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 13–18 of the ’960 patent are unpatentable. We further determine that Petitioner has not shown that claim 12 of the ’960 patent is 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 ’960 patent. Pet. 2; Paper 5.

Patent Owner identifies IPR2017-01084, involving Patent No. 8,567,555 B2, and IPR2017-01091, involving Patent No. 8,925,674 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 '960 Patent*

The '960 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 1:19–29. 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 1:29–32. 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 1:32–33.

In an embodiment including what is referred to as “sound bores,” the '960 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 driver delivering sound through the low frequency sound bore. *See Ex. 1001, 2:7–23.*

In an embodiment including what is referred to as “sound-tubes,” the '960 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 2:47–55. As the ’960 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 2:56–3:6. The ’960 patent also describes an electronic implementation of 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 3:13–25. 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 3:26–29.

Alternatively, in characterizing its system as a method, the ’960 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 3:34–42. For the phase correction in the method, the ’960 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 3:53–4:3. For the mechanical implementation, the ’960 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 3:55–65. For the electronic implementation, the ’960 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 canalphone housing with delivery of a low audio signal from the low

audio driver directed to the outside of the canalphone housing.” *Id.* at 3:65–4:3.

The ’960 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 4:25–33.

Figure 6 of the ’960 patent is reproduced below:

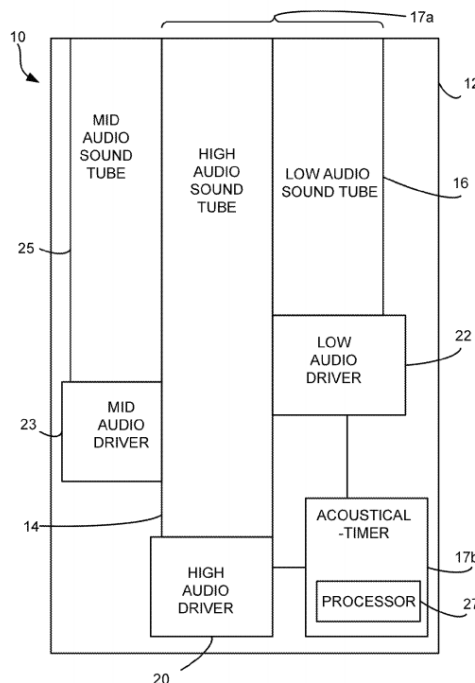


**FIG. 6**

“Figure 6 is a schematic block diagram of a system in accordance with various embodiments.” *Ex. 1001*, 4:52–53.

The '960 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 7:12–17. With respect to acoustical-timer 17a, the '960 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 7:18–24. The '960 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 7:24–26. 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 7:30–34.

The '960 patent describes that the low frequency sound bore and the high frequency sound bore may together form a single unit prior to their installation in the canalphone. *See id.* at 1:45–48; 2:31–34; 5:26–30. This is said to “aid[] in the assembly of the canalphone.” *Id.* at 6:5–6. “Stated another way, because the single unit 15 is one piece, the installation of the single unit into the canalphone 12 is easier than trying to install the low frequency sound bore 16 and the high frequency sound bore 14 as separate components.” *Id.* at 6:6–10.

*D. Illustrative Claims*

Of the challenged claims, claims 1 and 9 are independent. Claim 1 is drawn to an apparatus, and claim 9 is drawn to a method. Claims 1 and 9 are reproduced below.

1. A system comprising:
  - a canalphone housing;
  - a low audio sound-tube to carry a low audio signal to the canalphone housing's outside; and
  - a high audio sound-tube to carry a high audio signal to the canalphone housing's outside, 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, and the high audio sound-tube's length is greater than 3 millimeters but less than 10 millimeters.
  
9. A method comprising:
  - combining a low audio sound-tube and a high audio sound-tube as a single unit; and
  - installing the single unit into a canalphone housing.

Ex. 1001, 12:26–35; 12:60–63.

*E. Evidence Relied Upon*

Petitioner relies on the following references:

| Reference   |                            | Date           | Exhibit  |
|-------------|----------------------------|----------------|----------|
| Saggio      | U.S. App. 2011/0058702 A1  | Mar. 10, 2011  | Ex. 1004 |
| Harvey '806 | U.S. Pat. No. 7,317,806 B2 | Jan. 8, 2008   | Ex. 1005 |
| Dombrowski  | U.S. App. 2006/0159298 A1  | July 20, 2006  | Ex. 1006 |
| LoPresti    | U.S. App. 2007/0223735 A1  | Sept. 27, 2007 | Ex. 1007 |

|             |                                                                                                                     |               |          |
|-------------|---------------------------------------------------------------------------------------------------------------------|---------------|----------|
| Knowles TB6 | <i>Effects of Acoustical Termination Upon Receiver Response</i> , Knowles Electronics, Inc., Technical Bulletin TB6 | Aug. 16, 2010 | Ex. 1008 |
| Dahlquist   | U.S. Pat. No. 3,824,343                                                                                             | July 16, 1974 | Ex. 1009 |

Petitioner also relies on declarations of Bob Young, which are Exhibits 1003, 1033, and 1047.

*F. Grounds of Unpatentability Instituted for Trial*

The following grounds of unpatentability remained at trial:

| Reference(s)                       | Basis | Claim(s) Challenged   |
|------------------------------------|-------|-----------------------|
| Saggio                             | § 103 | 1, 3–5, and 8         |
| Saggio and Knowles TB6             | § 103 | 2                     |
| Saggio and Dombrowski              | § 103 | 6, 7, 9–11, and 13–18 |
| Harvey '806                        | § 102 | 1                     |
| Harvey '806 and Knowles TB6        | § 103 | 2                     |
| Harvey '806                        | § 103 | 1 and 3–5             |
| Harvey '806 and Dombrowski         | § 103 | 6, 7, and 9–18        |
| Saggio and Dahlquist               | § 103 | 1, 3–5 and 8          |
| Saggio, Dahlquist, and Knowles TB6 | § 103 | 2                     |
| LoPresti and Dombrowski            | § 103 | 9                     |

## 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 also “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, 2144–46 (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 “determine[d] that the phrase ‘the high audio sound-tube phase corrected with respect to the low audio sound-tube’ means ‘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. 15.

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 corrected’ 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 2–3 (citing Ex. 1033 ¶ 15).

Having reviewed Petitioner’s argument and evidence, we retain the construction of the phase correction terms in the Institution Decision, as repeated above. 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. 70:1–2), but the original construction already includes the very similar concept “at the outside of the canaphone housing.” For that reason, and because Petitioner does not argue that the change would make a difference in the outcome (*see* Tr. 66:7–13), we maintain the construction the parties used in preparation for the trial.

*B. Partial Adverse Judgment*

We initially instituted *inter partes* review to determine the patentability of all of the claims challenged in the Petition except claim 12, on a subset of the grounds raised in the Petition. *See* Inst. Dec. 2. After SAS, we modified our Institution Decision to include all of the challenged claims based on all of the challenged grounds. *See* Paper 42, at 3.

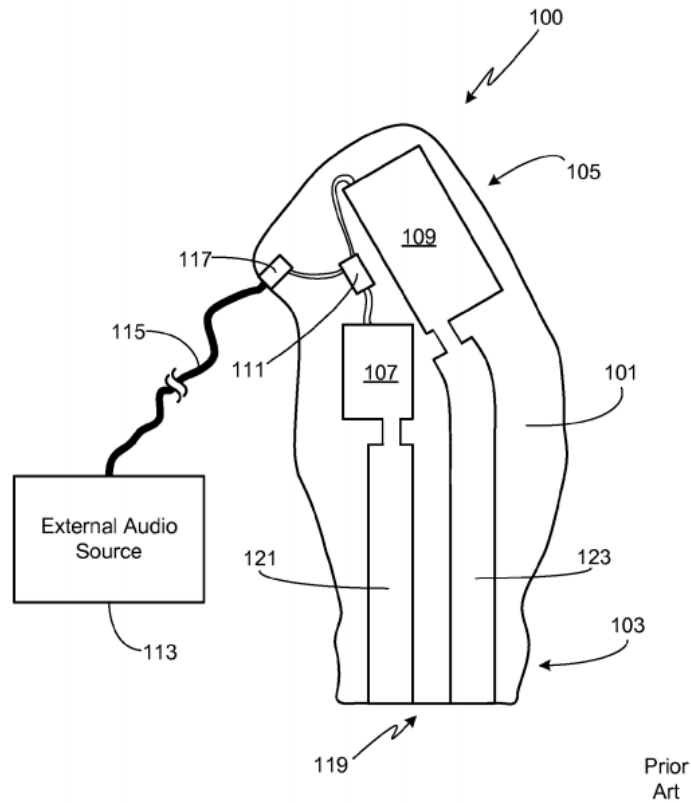
Petitioner then requested partial adverse judgment on anticipation of claim 8 by Harvey ’806, obviousness of claims 6, 7, and 9–18 in view of Saggio and Dahlquist, and anticipation of claim 9 by Dombrowski. *See* Paper 48, at 3. We granted Petitioner’s request (*see* Paper 51) and, as a consequence, Petitioner has failed to show by a preponderance of evidence that (a) claim 8 was anticipated by Harvey ’806, (b) claims 6, 7, and 9–18 were obvious in view of Saggio and Dahlquist, and (c) claim 9 was anticipated by Dombrowski.

C. *Cited Art*

1. *Saggio*

Saggio is directed to “[in]-ear monitors,” which are “also referred to as canal phone 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:



*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 further explains 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.

2. *Harvey '806*

Harvey '806 names Jerry J. Harvey, the sole named inventor on the '960 patent, as a coinventor. 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 '960 patent. Accordingly, Harvey '806 is available as § 102(b) art.

Figure 3 of Harvey '806 is reproduced below:

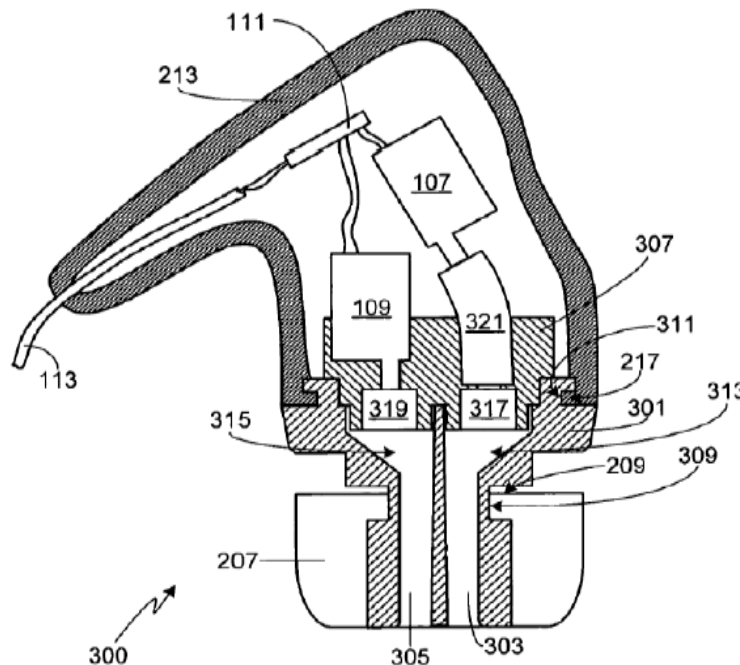


FIG. 3

*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, 5:6–9.*

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

Ex. 1005, 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. 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 earpiece design. *See id.* at 6:49–52. Harvey '806 describes that the inherent phase shift can be minimized by varying the lengths of sound tubes 303 and 305, e.g., by 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.

### 3. *Dombrowski*

Dombrowski discloses a hearing instrument, such as a hearing aid, that can be a behind-the-ear (BTE), in-the-ear (ITE), in-the-canal (ITC), or completely-in-the-canal (CIC) device. *See Ex. 1006 ¶¶ 1–2, 49, 59.* The hearing instrument contains at least two receivers having different frequency responses, such as a high frequency receiver and a low frequency receiver. *See id. ¶¶ 50, 54.* In one embodiment, the two receivers can be placed in a housing that sits outside a user’s ear canal, for example, in the concha of the user’s ear. *See id. ¶¶ 58–59.* In this embodiment, the sound from the two receivers can be delivered to the ear canal via two sound conduction channels. *See id. ¶ 58.* The two sound conduction channels can be mechanically coupled to each other, for example, as two bores in a single sound conduction tube. *See id.*

Figure 6 of Dombrowski is reproduced below.

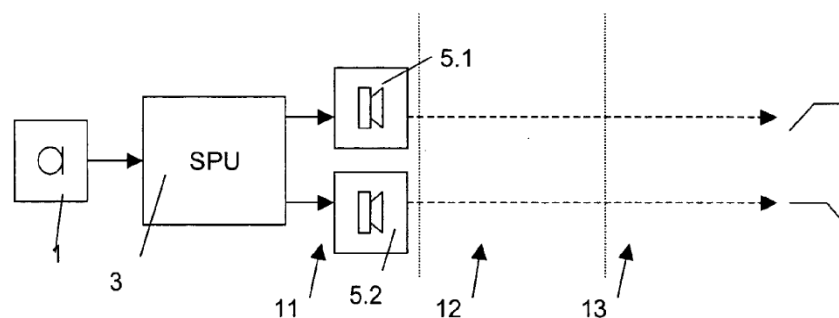


Fig. 6

*“Figure 6 [is] a schematic representation of a hearing aid with two receivers, where both are placed outside the ear canal.” Id. ¶ 123.*

Dombrowski’s microphone 1 converts an acoustic signal to an electrical signal, and transmits the electrical signal to signal processing unit (SPU) 3.

*See id.* ¶¶ 167, 178. SPU 3 filters the electrical signal, and transmits the low/high frequency signal components to respective low/high frequency receivers 5.1/5.2. *See id.* SPU 3 may be an analog, digital, or hybrid circuit, and may be implemented with discrete or integrated circuit components. *See id.* ¶ 116. Low and high frequency receivers 5.1/5.2 can be placed outside the user's ear canal, for example, in the user's concha. *See id.* ¶¶ 58–59, 180. Two sound transmission channels 17 (not shown), which need not be physically separated, lead from receivers 5.1/5.2 to the user's ear canal. *See id.* ¶¶ 180–181. For example, channels 17 may be two bores 37/38 formed in a single sound conduction tube 36. *See id.* ¶¶ 58, 182, Fig. 7 (panel C). Each bore 37/38 may contain a conventional, passive, acoustic filter. *Id.* ¶ 182. Alternatively, channels 17 may be two sound conduction tubes 51/52 mechanically coupled to one another. *See id.* ¶¶ 58, 186, Fig. 8.

#### 4. Knowles TB6

Knowles TB6 discloses how changing the length and diameter of a sound tube affects the frequency response of the sound tube. *See* Ex. 1008, 1–2. Figure 3 of Knowles TB6 is reproduced below.

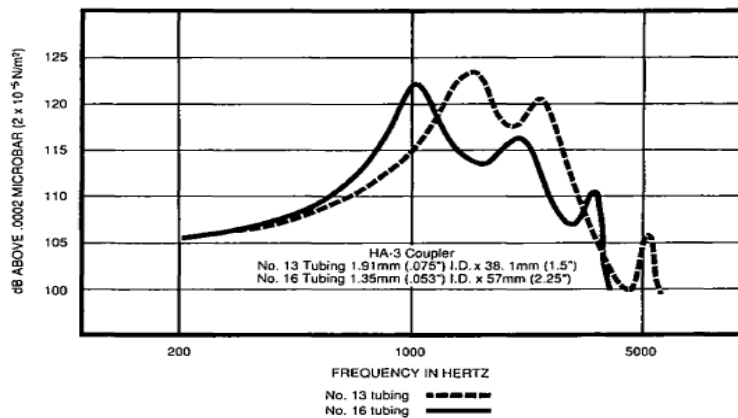


FIGURE 3. Effects of Tubing Length and Diameter Combined.

*Figure 3 is titled “Effects of Tubing Length and Diameter Combined”*

Figure 3 discloses the combined effects of varying the length and inner diameter of a sound tube on the sound tube's frequency response, specifically, the change in response when a 38.1 mm sound tube having a 1.91 mm inner diameter (No. 13 tubing) is replaced with a longer 57 mm sound tube having a smaller 1.35 mm inner diameter (No. 16 tubing). *Id.*

Knowles TB6 also discloses how adding an acoustic damper to the end of a sound tube affects the frequency response of the sound tube depending on its placement. See Ex. 1007, 3. Figure 4 of Knowles TB6 is reproduced below.

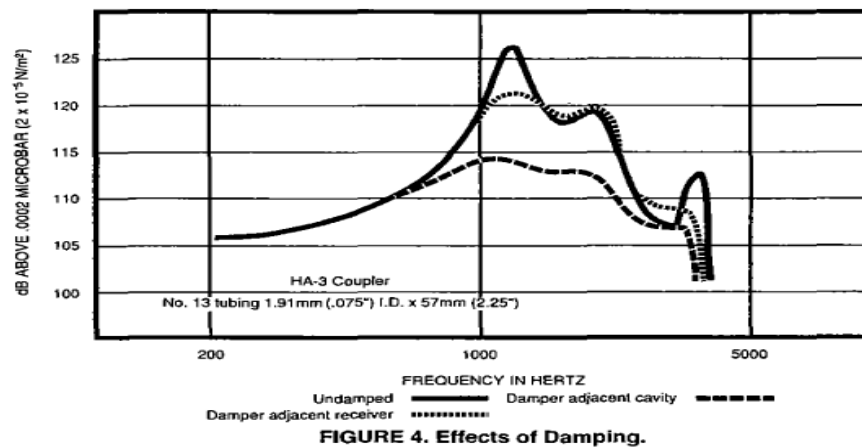


*Figure 4 is titled "Effects of Damping"*

Figure 4 discloses how the frequency response of a sound tube is affected by placing an acoustic damper adjacent to either the inlet/receiver end of the sound tube or the outlet/cavity end of the sound tube. *Id.*

## 5. *Dahlquist*

Dahlquist is directed to a loud speaker assembly incorporating multiple transducers for outputting sound in different frequency bands. See Ex. 1009, 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:

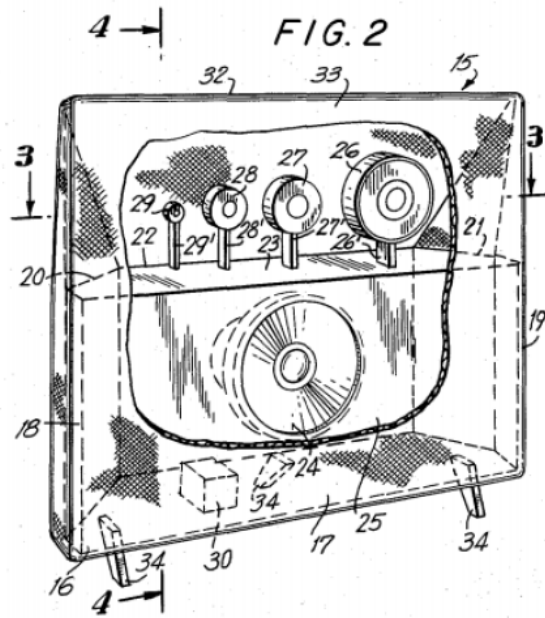


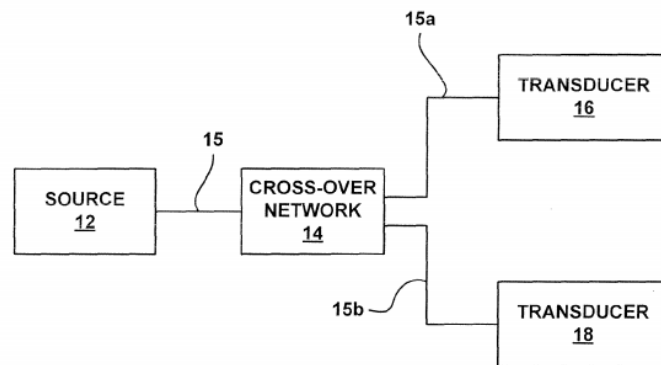
*Figure 2 “is a perspective view of a loud speaker assembly . . . with parts of the grille broken away to show details of construction.” Ex. 1007, 4:6–8.*

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 positions 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.

6. *LoPresti*

LoPresti, titled “Electroacoustic Transducer System and Manufacturing Method Thereof,” states that its transducer system and manufacturing method can be used in many different applications, including listening devices such as hearing aids, earphones, headphones, and insert earphones. *See Ex. 1007* ¶ 17. Figure 1 is reproduced below:



*LoPresti’s Figure 1 is “is a block diagram of [an] exemplary electroacoustic transducer system”. Ex. 1007* ¶ 9.

“The transducers 16, 18 receive selected frequency ranges of bands of the signals 15a, 15b from the cross-over network 14 and convert the selected ranges or bands to acoustic energy.” *Id.* ¶ 18. “[T]he transducers 16, 18 may be low-range frequency (LF) receivers also known as woofers, mid-

range frequency (MF) receivers, high range frequency (HF) receivers also known as tweeters, or combination thereof.” *Id.* LoPresti describes that transducers 16 and 18 include respective sound ports 76a and 76b each of which can be connected to a respective sound tube to allow acoustic energy to be transmitted to a user. *See id.* ¶ 24. Specifically, LoPresti states:

An optional sound tube (not shown) may directly connect to the front volumes 72a, 72b and is formed on the housings 52, 53 by any known techniques to allow acoustic energy to be transmitted to the user via the sound ports 76a, 76b. It will be understood that more than one sound tube may be provided without departing from the scope of the invention. For instance, as shown the sound port 76a is communicating with a first sound tube and the sound port 76b is communicating with a second sound tube.

*Id.*

*D. Obviousness Based On Saggio*

Petitioner contends that (a) claims 1, 3–5, and 8 would have been obvious in view of Saggio alone; (b) claim 2 would have been obvious in view of Saggio and Knowles TB6; (c) claims 6, 7, and 9–18 would have been obvious in view of Saggio and Dombrowski; (d) claims 1 and 3–18 would have been obvious in view of Saggio and Dahlquist; and (e) claim 2 would have been obvious in view of Saggio, Dahlquist, and Knowles TB6. *See Pet.* 16–35. For the reasons stated below, we agree.

*1. Claims 1, 3–5, and 8: Saggio Alone*

*a. Claim 1*

Claim 1 recites “a canalphone housing,” “a low audio sound-tube to carry a low audio signal to the canalphone housing’s outside,” and “a high audio sound-tube to carry a high audio signal to the canalphone housing’s

outside.” *Id.* at 12:27–31. To satisfy these limitations, Petitioner relies on the embodiments of Saggio illustrated in Saggio’s Figures 1 and 17. *See* Pet. 16. For instance, Figure 1 of Saggio illustrates canalphone housing 101, low frequency audio sound-tube 121 that carries low frequency sound to outside of the canalphone, and high frequency audio sound-tube 123 that carries high frequency sound to outside of the canalphone. *See* Ex. 1004 ¶¶ 36–37. Figure 17 also illustrates a canalphone housing and separate sound-tubes 1701 and 1702 to carry low frequency audio and high frequency audio to outside of the canalphone. Petitioner’s assertions are supported by the testimony of Mr. Young (*see* Ex. 1003 ¶ 47), and Patent Owner does not dispute that these limitations are met in Saggio.

Claim 1 further recites that “the high audio sound-tube [is] phase corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube.” Ex. 1001, 12:31–34. Relying on the testimony of Mr. Young, Petitioner argues that, in view of Saggio’s disclosure, a person of ordinary skill in the art would have found it obvious to phase correct by lengthening the high frequency sound tube. *See* Pet. 18 (citing Ex. 1003 ¶¶ 49–50; Ex. 1004 ¶ 46).<sup>1</sup> We agree.

Saggio specifically explains 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. Saggio thus expressly recognizes that the original phase relationship between the high

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<sup>1</sup> We do not agree with Petitioner that the mere fact that the high audio sound-tube is longer than the low-audio sound-tube is sufficient to show phase correction. *See* Inst. Dec. 19–21.

frequency signal and the low frequency signal, at the time of generation, is subject to deterioration by the time they are outputted from the canaphone, and further expressly describes “fine tuning” that “phase relationship” by varying the length of the sound-tubes. *Id.* In light of that disclosure, we conclude Petitioner has shown that it would have been obvious to one with ordinary skill to implement phase correction of the high audio sound-tube with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube.

Patent Owner argues that “[w]hile Saggio taught canaphones with two drivers of different frequencies, Saggio did not teach that the signals are phase corrected.” PO Resp. 13. 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 14. 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 that 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) is sufficient to show “phase correction” as that term is used in the ’960 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 the quality of sound.

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 ’960 patent in Fig. 7.” PO Resp. 14. 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 ’960 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 ’960 patent would produce such results, and it follows that Saggio, which, we find, describes the same structure and techniques for correcting phase, 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 additionally argues that Petitioner has not made any showing about whether one with ordinary skill in the art would have had a reasonable expectation of success when making the length of the high audio sound-tube longer than that of the low audio sound-tube, to phase correct the high audio sound-tube with respect to the low audio sound-tube. See PO Resp. 18–19. This argument is also ineffective, because the evidence relied

on by Petitioner, i.e., that Saggio expressly instructs its readers to “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 tune the phase relationship with the other sound tube carrying the lagging signal. It is not reasonably disputable that delaying the arrival of a signal that has a phase lead will synchronize the leading signal with the lagging signal, at least up to the point of a phase match. There is nothing unpredictable about that scenario.

Claim 1 further recites that “the high audio sound-tube’s length is greater than 3 millimeters but less than 10 millimeters.” Ex. 1001, 12:34–35. Petitioner acknowledges that Saggio does not expressly disclose specific tube lengths, but asserts that “where, as here, the general working conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art.” Pet. 18 (citing *In re Aller*, 220 F.2d 454, 456 (CCPA 1955)). We agree. Even though the recited range has not been shown by Petitioner to be an “optimum” range, it is, nonetheless, a working range. We note further that the Specification does not identify any unexpected result stemming from the high audio sound-tube having a length greater than 3 millimeters and less than 10 millimeters, and Patent Owner has not asserted any unexpected result based on the claimed range or otherwise argued this limitation. Petitioner’s expert, Mr. Young, provides testimony supporting the conclusion that the claimed range would have been obvious to one with ordinary skill in the art. See Ex. 1003 ¶ 51.

For the foregoing reasons, we conclude that claim 1 would have been obvious in view of Saggio alone.

*b. Claim 3*

Claims 3 depends from claim 1, and adds “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.” Ex. 1001, 12:39–41.

Mr. Young testifies that a person of ordinary skill in the art “would understand this limitation to refer to sizing the low audio sound-tube based upon the time it takes for the low audio signal to pass through the sound-tube,” and that “[t]he time it takes for an audio signal to pass through a tube is a ‘time response,’ as claimed.” Ex. 1003 ¶ 69. Petitioner explains:

A POSA [person of ordinary skill in the art] would have been motivated to calculate the tube length needed for a desired time-of-arrival for the low audio signal, and thus size Saggio’s low audio sound-tube based on the time it takes for an audio signal to pass through the tube, because doing so would allow the POSA to design Saggio’s IEM to meet a desired time-of-arrival for the low audio signal. Young ¶ 71. It is common in IEM design to base sound-tube length on a desired result; for instance, varying sound-tube length to obtain a desired frequency response has been known for decades. *Id.* (citing Ex. 1008, 1011).

Pet. 23. Petitioner’s assertions are not disputed by Patent Owner and are supported by the testimony of Mr. Young. See Ex. 1003 ¶¶ 69–71.

We conclude that claim 3 would have been obvious in view of Saggio alone.

*c. Claim 4*

Claim 4 adds to claim 3 “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’s arrival to the outside of the canalphone housing.” Ex. 1001, 12:42–46.

As discussed above in the context of claim 1, Petitioner has shown that it would have been obvious, in light of Saggio's disclosure, to phase correct the high audio sound-tube with respect to the low audio sound-tube, in certain circumstances, and where appropriate, by making the length of the high audio sound-tube longer than that of the low audio sound-tube. In that same circumstance, the longer high audio sound-tube would 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. See Ex. 1003 ¶ 73. Patent Owner does not dispute that, or otherwise argue this claim.

We conclude that claim 4 would have been obvious in view of Saggio alone.

*d. Claim 5*

Claim 5 depends from claim 4, adding "wherein 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." Ex. 1001, 12:47–51.

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," because "[d]oing so brings the audio signals 'closer in time,' improving the IEM's fidelity." Ex. 1003 ¶ 81. Given that, as discussed above, one with ordinary skill in the art would have wanted to keep the difference in time-of-arrival of the two signals to a minimum, we conclude that the particular requirement of "less than 0.05 milliseconds" would have been within the level of ordinary skill, as a matter of selecting a workable

and desired value. *See In re Aller*, 220 F.2d at 456. Patent Owner does not argue otherwise.

We conclude that claim 5 would have been obvious in view of Saggio alone.

*e. Claim 8*

Claim 8 adds to claim 1 “wherein at least one of the low audio sound-tube and the high audio sound-tube carries an acoustical damper without any rubber boot.” Ex. 1001, 12:57–59.

Saggio discloses that acoustical dampers may be used within the sound-tubes or interposed between the drivers and the sound-tubes, without mentioning whether they would or would not be positioned with a rubber boot. *See* Ex. 1004 ¶ 54. Mr. Young testifies that the use of dampers in sound-tubes was well-known (*see* Ex. 1003 ¶¶ 93–94) and that placing dampers directly in sound-tubes without a boot was also well-known (*see* Ex. 1003 ¶ 95). Mr. Young further testifies that the state of the art at the time of the ’960 patent invention included using dampers in sound-tubes without any rubber boot. *See id.* Patent Owner does not dispute that testimony.

Crediting Mr. Young’s undisputed testimony, we conclude that claim 8 would have been obvious in view of Saggio alone.

*2. Claim 2: Saggio and Knowles TB6*

Claim 2 depends from claim 1, adding “wherein at least one of the low audio sound-tube and the high audio sound-tube has a reduced bore diameter due to high audio sound-tube’s length.” Ex. 1001, 12:36–38.

Claim 2 thus concerns altering the dimensions of a sound-tube such that its diameter is reduced while its length is increased.

Mr. Young testified that a person of ordinary skill in the art would understand claim 2 as referring “to the well-known practice of sound tube ‘tuning,’” “a decades-old concept,” and identifies Knowles TB6 as one such example. Ex. 1003 ¶¶ 61–62. As Mr. Young explained:

Knowles TB6 (Exhibit 1008), a technical bulletin published by Knowles Electronics, teaches sound tube “tuning,” i.e., varying the length and/or diameter of a sound tube to affect the driver response characteristics. Knowles TB6 includes a specific example of extending the sound tube’s length (from 38.1 mm to 57 mm) while reducing the tube’s diameter (from 1.91 mm to 1.35 mm), and states “tests indicate that a particular response variation will occur at a low frequency if the ratio of transmission line length to cross-sectional area is increased.”

*Id.* at 62.

Petitioner contends that it would have been obvious to one with ordinary skill in the art to extend the length of a sound-tube in Saggio’s IEM while reducing the sound tube’s diameter, as is taught by Knowles TB6, because it was well-known in the art to vary tube length and diameter in IEMs to “tune” the drivers. *See* Pet. 20. That assertion is supported by the above-noted testimony of Mr. Young, who further testifies:

[S]ound tube “tuning” is so common-place and well-known that a POSA would not actually need Knowles TB6 to know to, and to be motivated to, extend the tube length and reduce the tube diameter. Sound-tube “tuning” is the most common way to adjust driver frequency response. It is so common that, for example, Saggio simply mentions it in passing, saying at ¶ 46 “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. 1003 ¶ 65. Patent Owner does not dispute that sound-tube tuning was well-known in the art.

We credit Mr. Young’s undisputed testimony and conclude that claim 2 would have been obvious in view of Saggio and Knowles TB6.

3. *Claims 6, 7, 9–11, and 13–18: Saggio and Dombrowski*

a. *Claim 6*

Claim 6 adds to claim 1 “wherein the low audio sound-tube and the high audio sound-tube are joined as a single unit.” Ex. 1001, 12:52–53.

Petitioner acknowledges that Saggio does not expressly state that two sound-tubes are joined as a single unit. See Pet. 26. However, as noted by Petitioner (Pet. 26–27), Dombrowski discloses mechanically coupled sound-tubes for use in a hearing instrument. See Ex. 1006 ¶ 186, Fig. 8. Figure 8 of Dombrowski is reproduced below:

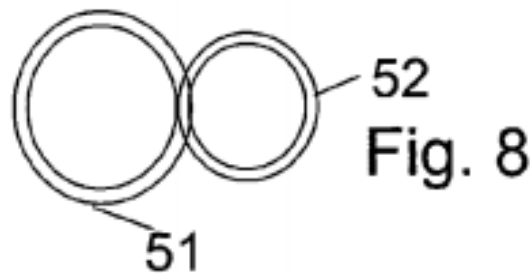


*Figure 8 of Dombrowski is “a cross section of a further connection element.” Ex. 1006 ¶ 125.*

Dombrowski states that “[t]he sound connection element of FIG. 8 is made up of two sound connection tubes 51, 52 mechanically coupled to each other.” Ex. 1006 ¶ 186. Mr. Young testifies that Dombrowski “discloses ‘mechanically coupled’ sound tubes for use in a hearing instrument,” and that Dombrowski “thus teaches the ‘single unit.’” Ex. 1003 ¶ 85. He further

testifies that “[i]t would have been obvious to a POSA to mechanically couple Saggio’s sound tubes, as taught by [Dombrowski], since doing so would make IEM assembly easier, which a POSA would recognize” and that “[i]n other words, it would have been obvious to a POSA to join Saggio’s low and high audio sound-tubes as a single unit, since doing so makes assembly easier, as a POSA would recognize.” *Id.* ¶ 86.

Patent Owner argues Petitioner has failed to demonstrate by a preponderance of evidence that the combination of Saggio and Dombrowski teaches adjoining one-piece low and high frequency sound bores to form a single unit prior to introducing them into a canalphone for several reasons. *See* PO Resp. 22–27.

First, Patent Owner argues “all Dombrowski teaches is two sound bores ‘mechanically coupled to each other’” and “does not teach that the mechanical coupling adjoins the two sound bores to form a single unit as claimed.” *Id.* at 23. Petitioner counters that the ’960 patent illustrates the meaning of this limitation in Figures 1 and 6, and that the meaning is consistent with the plain and ordinary meaning of “join,” which is “to put or bring together so as to form a unit.” *See* Pet. Reply 15 (citing Ex. 1043, 8). Thus, and relying on the testimony of Mr. Young, Petitioner argues that a person of ordinary skill in the art would have understood that Dombrowski’s coupled sound tubes “are brought together as a single unit.” *Id.* at 16 (citing Ex. 1033 ¶¶ 26–27).

We agree with Petitioner. Dombrowski teaches a canalphone having mechanically coupled sound tubes. *See* Ex. 1006 ¶¶ 53, 54, 58–59. To “couple” means “to join for combined effect” or “to fasten together.” Ex. 1043, 7. To “join” means “to put or bring together so as to form a unit.”

*Id.* at 8. Thus, given the plain and ordinary meaning of these terms, Dombrowski's mechanically coupled sound tubes are joined to form a single unit. *See In re Gleave*, 560 F.3d at 1334 (obviousness is not an *ipsissimis verbis* test). Indeed, Dombrowski expressly discloses that mechanically coupled sound tubes "may for example be formed as two bores in a *single* sound conduction tube." Ex. 1006 ¶ 58 (emphasis added).

Second, Patent Owner argues that "nothing in Fig. 8 or paragraphs 186 or 58 taught that the mechanical coupling occurs prior to the sound bores being introduced to a canalphone." PO Resp. 23–24. Patent Owner further argues that "[t]he vast majority of Dombrowski's disclosure is directed to hearing aids with a behind-the-ear component" and "[t]he portions of Dombrowski cited by Petitioner do not teach that the sound conduction elements are mechanically coupled prior to being introduced to an entirely in-the-ear canalphone that also contains two drivers." *Id.* at 24.

We do not agree with Patent Owner. Dombrowski teaches a "hearing instrument" that includes two receivers and two mechanically coupled sound tubes, i.e., two sound tubes adjoined to form a single unit for the reasons discussed above. *See* Ex. 1006 ¶¶ 53, 54, 58. The receivers can be located outside the ear canal, including in the concha, and the "hearing instrument" can be used by people with normal hearing for audio listening. *Id.* ¶¶ 59, 115. Thus, Dombrowski's "hearing instrument" can be a canalphone or IEM having receivers placed in the concha as shown in the prior art. *See, e.g.*, Ex. 1005, Fig. 1 (showing acoustic drivers 107 and 109 in concha portion 105 of IEM 100).

Finally, Patent Owner argues Petitioner has failed to demonstrate the obviousness of combining the teachings of Saggio and Dombrowski because

Petitioner has provided no evidence that by doing so, a person of ordinary skill in the art would have had a reasonable expectation of success. PO Resp. 27.

As in our Institution Decision, we conclude that “[g]iven the level of ordinary skill in the art as reflected by the prior art references, e.g., different configurations of multiple sound-tubes installed within the canaphone housing of Saggio, mechanically coupling two sound-tubes to each other along their longitudinal axes would not have imposed substantial difficulty.” Inst. Dec. 29. Petitioner’s proposed combination would have had a reasonable expectation of success because the sound tubes used in the systems of both Saggio and Dombrowski serve the same basic function—conducting sound from a listening device’s acoustical driver to an outlet in a user’s ear canal. Nothing in Dombrowski suggests that its mechanically coupled sound tubes are inferior to its non-mechanically coupled sound tubes, or less able to conduct sound from the hearing instrument’s acoustical drivers to the outlet in a user’s ear canal. Therefore, modifying Saggio’s sound tubes by mechanically coupling them in the manner taught by Dombrowski would not prohibit Saggio’s coupled sound tubes from conducting sound to Saggio’s outlet. That is, a person of ordinary skill in the art would have recognized Petitioner’s proposed combination of Saggio and Dombrowski would have had a reasonable expectation of success.

We have considered Petitioner’s and Patent Owner’s evidence and arguments as described above. We are persuaded that Petitioner has established, by a preponderance of evidence, that the combination of Saggio and Dombrowski teaches the low and high audio sound tubes are joined as a single unit by mechanically coupling them. We further find that Petitioner

has articulated a rational reason to combine the teachings of Saggio and Dombrowski, and that the combination would have had a reasonable expectation of success. We conclude that claim 6 would have been obvious in view of Saggio and Dombrowski.

*b. Claim 7*

Claim 7 depends from claim 6 and adds “wherein the single unit is positioned at an angle between 30 degrees and 65 degrees with respect to a high acoustical driver and a low acoustical driver.” *Id.* at 12:54–56.

Petitioner asserts that “discovering the optimum or working ranges involves only routine skill in the art.” Pet. 18 (citing *In re Aller*, 220 F.2d at 456).

The '960 patent does not describe any special advantages flowing from the claimed range. Mr. Young testifies:

At ¶ 37, Saggio teaches using curved tubes “to accommodate the contours of the ear canal to which the IEM is fit.” Saggio also states “the exact configuration of the sound delivery tubes . . . depend on a number of factors.” Saggio ¶ 56. It would have been obvious to position Saggio’s sound tubes at an angle between 30 and 65 degrees with respect to the drivers, or any other angle, since ear anatomy influences positioning. Note that the '960 patent doesn’t describe any supposed advantage of the claimed range, and I am not personally aware of any advantage.

Ex. 1003 ¶ 90.

In view of that testimony, and because Patent Owner does not contend there is any unexpected result or advantage of the recited range, we conclude that claim 7 would have been obvious in view of Saggio and Dombrowski.

c. *Claim 9*

Claim 9 is directed to a method that includes “combining a low audio sound-tube and a high audio sound tube as a single unit” and “installing the single unit into a canalphone housing.” Ex. 1001, 12:60–63.

Our reasoning applied to the limitation of claim 6, as discussed above, accounts for claim 9, except for the requirement that the single unit must be put together first outside of the canalphone housing and then be installed as a single unit into the canalphone housing. For this, Petitioner relies on Mr. Young:

According to the '960 patent, the “single unit” formed from combining the sound-tubes “is one piece,” thereby “aid[ing] in the assembly of the canalphone” because “installation of the single unit into the canalphone 12 is easier than trying to install the [sound-tubes] as separate components.” '960 pat., 6:5–10. There’s nothing “novel” in this statement; clearly if two things are joined together to form a “single unit” it will be easier to install them than if they were installed separately.

Ex. 1003 ¶ 55. We find this testimony credible, especially given that there are only two choices for installation—combine the two parts into a single unit and then install the single unit, or first install one part and then the other in a manner that will create a single unit with the first.

Mr. Young further testifies that it would have been obvious “to combine Saggio’s low and high audio sound-tubes as a single unit and then install the single unit into the canalphone housing, since doing so makes assembly easier, as a POSA would recognize.” *Id.* ¶ 58. This testimony establishes that the motivation for one with ordinary skill in the art to combine the low and high audio sound-tubes into a single unit prior to installation of that unit into the canalphone housing derives from the basic

skill already possessed by one with ordinary skill in the art, namely, the knowledge that doing so would make IEM assembly easier.

Patent Owner argues Mr. Young’s testimony that it would have been obvious to couple Saggio’s sound tubes mechanically prior to placing them in a housing to make IEM assembly easier is conclusory, and improperly relies on common sense to supply a missing claim limitation. PO Resp. 25–27. Patent Owner argues that as a result, Petitioner’s analysis of this limitation presents “the type of evidence that is insufficient to support an allegation that a POSA would have been motivated to do what was not done in the prior art.” *Id.* at 27 (citing *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1362 (Fed. Cir. 2016)). Petitioner responds that “Dombrowski teaches the ‘single unit’ limitations,” and had no need to “explicitly state the sound tubes are coupled prior to introducing them to the housing” because a person of ordinary skill in the art would have inferred this teaching from Dombrowski because he or she is a person of ordinary creativity and “not an automaton.” Reply at 18 (quoting *KSR* 550 U.S. at 421).

We agree with Petitioner. As explained above, Petitioner relies on Mr. Young’s testimony regarding the knowledge available to a person of ordinary skill in the art to teach coupling Saggio’s sound tubes prior to introducing them into the canalphone. See Pet. 19 (citing Ex. 1003 ¶ 57–58); Pet. Reply 18 (citing Ex. 1033 ¶ 28–30). Such knowledge—even if based on, or similar to, “common sense”—may demonstrate the obviousness of limitations that are missing from the prior art if explained with sufficient reasoning. See *Perfect Web Tech., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328 (Fed. Cir. 2009) (“Common sense has long been recognized to inform the analysis of obviousness if explained with sufficient reasoning.”); *id.* at

1329 (“while an analysis of obviousness always depends on evidence . . . it also may include recourse to logic, judgment, and common sense available to the person of ordinary skill that do not necessarily require explication in any reference or expert opinion”). This is especially true in cases, such as this one, where the knowledge and common sense of a person of ordinary skill in the art is used “to supply a limitation that [is] admittedly *missing* from the prior art [and] the limitation in question [is] unusually simple and the technology particularly straightforward.” *Arendi*, 832 F.3d at 1362. As we explained in the Institution Decision, “it is self-evident even to a layman that installing a single unit obviates the need for multiple installations of separate parts within a confined space.” Inst. Dec. 32.

We conclude that claim 9 would have been obvious in view of Saggio and Dombrowski.

*d. Claim 10*

Claim 10 depends from claim 9 and further recites “positioning the single unit at an angle between 30 degrees and 65 degrees with respect to a high acoustical driver and a low acoustical driver.” Ex. 1001, 12:64–67.

This claim corresponds to claim 7 discussed above, our explanation and reasoning with regard to claim 7 applies here, and, for those reasons, we conclude that claim 10 would have been obvious in view of Saggio and Dombrowski.

*e. Claim 11*

Claim 11 depends from claim 9 and further recites “sizing the high audio sound-tube phase as corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube, and the high

audio sound-tube's length is greater than 3 millimeters but less than 10 millimeters." Ex. 1001, 13:1–5.

The limitations of claim 11 correspond to limitations of claim 1 discussed above, and our explanation and reasoning with regard to those limitations applies here. For those reasons, we conclude that claim 11 would have been obvious in view of Saggio and Dombrowski.

*f. Claim 13*

Claim 13 depends from claim 9, adding “slowing down a high audio signal's arrival to the outside of the canalphone housing so that it is closer in time to a low audio signal's arrival to the outside of the canalphone housing by making the high audio sound-tube longer.” Ex. 1001, 13:9–13.

This claim corresponds to limitations within claim 1 discussed above, our explanation and reasoning with regard to those limitations applies here, and, for those reasons, we find that claim 13 would have been obvious in view of Saggio and Dombrowski.

*g. Claim 14*

Claim 14 adds to claim 9 “timing the arrival of a high audio [signal] to the outside of the canalphone housing compared to a 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, 13:14–18.

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 ¶¶ 80–81. Given that one of skill in the art would have wanted to keep the difference in time-of-arrival of the two signals to a

minimum, the particular requirement of “less than 0.05 milliseconds,” which is not argued by Patent Owner to be a critical parameter, would have been within the level of ordinary skill in the art, and simply a matter of selecting a workable or optimal value. *See In re Aller*, 220 F.2d at 456.

We conclude that 9 would have been obvious in view of Saggio and Dombrowski.

*h. Claim 15*

Claim 15 depends from claim 9 and adds “using a time response for a 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, 14:1–4.

Petitioner asserts that “[t]o size the high sound-tube to be longer than the low sound-tube, one obviously needs to know the length of the low sound-tube, which can be determined from the time it takes the low audio signal to pass through the sound-tube,” and that, as a result, “it would have been obvious to use the time-of-arrival for the low audio signal as a ‘control point,’ by which to determine the appropriate high sound-tube length.” Pet. 32–33 (citing Ex. 1003 ¶ 111).

We agree with this analysis, which Patent Owner does not dispute, and conclude that claim 15 would have been obvious in view of Saggio and Dombrowski.

*i. Claim 16*

Claim 16 adds to claim 9 “standardizing high audio sound-tube lengths based upon at least two low audio sound-tube lengths.” Ex. 1001, 14:5–7.

Mr. Young testifies that “custom IEMs can have more than one low frequency sound-tube length, owing to different ear anatomies” and that “a POSA 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 ¶ 115. Patent Owner advances no counter argument regarding standardization, and Patent Owner’s other arguments have been addressed above.

We conclude that claim 16 would have been obvious in view of Saggio and Dombrowski.

*j. Claim 17*

Claim 17 depends from claim 16 and further recites “fabricating an assembly of a standardized high audio sound-tube length with a respective one of the two low audio sound-tube lengths to make installation in the canalphone housing easier and to provide repeatable acoustic characteristics.” Ex. 1001, 14:9–13.

As discussed above in the context of claim 16, standardizing high audio sound-tube lengths based on at least two low audio sound-tube lengths would have been obvious to one with ordinary skill in the art. For essentially the same reasons, we find that fabricating an assembly of a standardized high audio sound-tube length with a respective one of the two low audio sound-tube lengths to make installation in the canalphone housing easier and to provide repeatable acoustic characteristics would have been obvious to one with ordinary skill in the art. See Ex. 1003 ¶ 120. Patent Owner does not argue otherwise.

We conclude that claim 17 would have been obvious in view of Saggio and Dombrowski.

*k. Claim 18*

Claim 18 adds to claim 17 “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, 14:14–16.

Petitioner asserts that Saggio’s sound-tubes are aligned at the eartip where they exit the canalphone housing. See Pet. 34 (citing Figures 1, 4, 6, 14, 15, and 17 of Saggio). This is supported by the testimony of Mr. Young (see Ex. 1003 ¶ 123), and Patent Owner does not offer counterargument.

We conclude that claim 18 would have been obvious in view of Saggio and Dombrowski.

*4. Claims 1–5 and 8: Saggio and Dahlquist*

In addition to arguing obviousness based on Saggio alone, Petitioner contends 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.<sup>2</sup> For a reason to combine, Petitioner cites Mr. Young’s testimony that “[a] POSA would be motivated to use Dahlquist’s offset in Saggio’s IEM to improve fidelity.” *Id.* (citing Ex. 1003 ¶¶ 207; Ex. 1009, 3:54–60, 9:6–13).

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<sup>2</sup> As noted in Section II.B, Petitioner was granted adverse judgment as to obviousness of claims 6, 7, and 9–18, the “single unit” claims, in view of Saggio and Dahlquist. Thus, we need only consider Petitioner’s challenges to the patentability of claim 1 and its dependent claims 2–5 and 8 over Saggio and Dahlquist.

Patent Owner responds that “Petitioner fails to provide any evidence that shows there was a need for improved fidelity in canalphones at the time of invention” and that, “[i]nstead, Petitioner merely relies on the assumption that improving fidelity in canalphones would be common sense, without any evidence to support that assumption.” PO Resp. 17.

We do not agree with Patent Owner’s analysis. Saggio itself discloses that there is an 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 adjusting the relative lengths of the sound-tubes carrying those outputs. Ex. 1004 ¶ 46. We find that Saggio and other art of the record in this proceeding provide 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.

Petitioner’s case for obviousness of claims 1–5 and 8 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,” 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. Ex. 1004 ¶ 46. It does not

specifically express 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.

For these reasons, and the reasons given above when discussing Saggio alone (see Section II.D.1), we conclude that claims 1–5 and 8 would have been obvious in view of Saggio and Dahlquist.

*E. Anticipation by Harvey '806*

Petitioner contends claim 1 was anticipated by Harvey '806. See Pet. 35–37. For the reasons stated below, we agree.

Claim 1 recites “a canalphone housing,” “a low audio sound-tube to carry a low audio signal to the canalphone housing’s outside,” and “a high audio sound-tube to carry a high audio sound signal to the canalphone’s outside.” Ex. 1001, 12:27–32. To satisfy these limitations, Petitioner asserts that Harvey '806 “discloses an earpiece (in-ear monitor or canalphone) with a housing, and high and low sound-tubes to carry high and low audio signals to the housing’s outside. Pet. 35 (citing Ex. 1005, 5:6–40, Fig. 3 (sound-tubes 305, 321/303); 7:31–52 (sound-tubes 603, 605/607)). The assertion is supported by the testimony of Mr. Young (see Ex. 1003 ¶ 131), which Patent Owner does not dispute.

Claim 1 further recites that “the high audio sound-tube [is] phase corrected with respect to the low audio sound-tube by sizing it to be longer than the low audio sound-tube.” Ex. 1001, 12:31–34. Petitioner contends:

Harvey '806 teaches phase correction between an HFD and LFD by sizing one sound-tube to be longer. Ex. 1005, 2:32–45. “When 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. *Id.*, 6:30–35. Harvey '806 teaches determining the phase shift, which is then “corrected through the selection of an appropriate driver offset.” *Id.*, 6:47–54. The offset is implemented through a two-piece sound delivery tube that results in extension of the offset driver’s sound-tube. *Id.*, 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).

Pet. 35–36.

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.” 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 extending the LFD tube, 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 un rebutted testimony 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” and that “Harvey '806 [thus] teaches acoustical-timer 17a.” Ex. 1003 ¶ 120.

We are unpersuaded by Patent Owner’s argument based on Harvey '806’s teaching 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.” We read “preferable” in the reference to mean just that, a preference, not a requirement, and conclude that one of skill in the art would have understood 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, and similar to Saggio, because Harvey '806 specifically describes “adjusting the driver offset,” we see no reason why the reference would need to “provid[e] a phase response graph like that provided by the '960 patent in Figure 7” as Patent Owner argues. PO Resp. 11. As noted above, the '960 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 '960 patent would produce such results. It follows that Harvey '806, which, we find, describes the same structural techniques for correcting phase, would accomplish those same results.

Claim 1 additionally recites that “the high audio sound-tube’s length is greater than 3 millimeters but less than 10 millimeters.” Ex. 1001, 12:34–35. Petitioner argues that

Harvey '806’s 3.75 mm offset results in a high sound-tube length greater than 3 millimeters, as a 3.75 mm offset means the high sound-tube is at least 3.75 mm long. Young ¶ 135; Ex. 1005, 6:55-65, 7:38-52 (offset not limited to LFD). 3.75 mm is

greater than 3 millimeters but less than 10 millimeters. Young ¶ 135.

Pet. 37. Mr. Young also testified, as discussed above, that one with ordinary skill in the art would have understood Harvey '806's extension for the low frequency sound-tube as applicable, in the alternative, to the high frequency sound-tube of Harvey '806. Ex. 1003 ¶ 134. We do not agree with Patent Owner that Harvey '806 only discloses extending the length of the low frequency sound-tube, and Patent Owner does not otherwise argue that this limitation is not met in Harvey '806.

For the foregoing reasons, we conclude that claim 1 was anticipated by Harvey '806.

*F. Obviousness Based On Harvey '806*

Petitioner argues that (a) claim 2 would have been obvious in view of Harvey '806 and Knowles TB6, (b) claims 3–5 would have been obvious in view of Harvey '806 alone, and (c) claims 6, 7, 9–11, and 13–18 would have been obvious in view of Harvey '806 and Dombrowski. See Pet. 38–47. For the reasons stated below, we agree.

*1. Claim 2: Harvey '806 and Knowles TB6*

Claim 2 depends from claim 1, adding “wherein at least one of the low audio sound-tube and the high audio sound-tube has a reduced bore diameter due to high audio sound-tube's length.” Ex. 1001, 12:36–38. Claim 2 thus concerns altering the dimensions of a sound-tube such that its diameter is reduced while its length is increased.

Mr. Young testifies “a person of skill in the art would understand this limitation to refer to the well-known practice of sound tube ‘tuning.’” Ex. 1003 ¶ 144. He opines that “[i]t would have been obvious . . . to extend tube

length and reduce tube diameter, as taught by Knowles TB6, in Harvey '806's IEM . . . in order to affect the frequency response and 'tune' the drivers, as taught by Knowles TB6." *Id.* Patent Owner does not dispute that sound-tube tuning was well-known in the art.

We credit Mr. Young's undisputed testimony and conclude that claim 2 would have been obvious in view of Harvey '806 and Knowles TB6.

2. *Claims 3–5: Harvey '806 Alone*

a. *Claim 3*

Claim 3 depends from claim 1, and adds "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." Ex. 1001, 12:39–41.

We have discussed this limitation in the context of the obviousness of claim 3 over Saggio. (See Section II.D.1.b.) For essentially the same reasons, we find that Petitioner has shown claim 3 would have been obvious in view of Harvey '806. Mr. Young credibly testified that one "could readily calculate the length of sound-tube needed for a particular [signal's] time-of-arrival" and would have been motivated to do that "because doing so would allow the POSA to design Harvey's IEM to meet a desired time-of-arrival for the low audio signal." Ex. 1003 ¶ 148. Patent Owner does not offer a counter argument.

We conclude that claim 3 would have been obvious over Harvey '806 alone.

b. *Claim 4*

Claim 4 adds to claim 3 "wherein the high audio sound-tube is longer to slow down the high audio signal's arrival to the outside of the canaphone

housing so that it is closer in time to the low audio signal's arrival to the outside of the canalphone housing.” Ex. 1001, 12:42–46.

As discussed above in the context of claim 1, Petitioner has made a sufficient showing that Harvey '806 discloses 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. It takes a longer time for a signal to travel a farther distance. Thus, it necessarily would be the case that the longer high audio sound-tube would delay the high audio signal's arrival to the outside of the canalphone housing so that it would be closer in time to the low audio signal's arrival to the outside of the canalphone housing.<sup>3</sup> Patent Owner does not dispute that that is the case, or otherwise argue this claim.

We conclude that claim 4 would have been obvious in view of Harvey '806 alone.

*c. Claim 5*

Claim 5 depends from claim 4, adding “wherein 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.” Ex. 1001, 12:47–51.

Petitioner asserts that “the signals’ time-of-arrival difference results from the difference in tube length” and that “[a] POSA can readily calculate the time-of-arrival difference for any offset, simply by knowing the length of the offset.” Pet. 40 (citing Ex. 1003 ¶ 156). Petitioner further asserts that

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<sup>3</sup> We do not rely on Paragraph 153 of the Declaration of Mr. Young, which states that because claim 3 would have been obvious over Harvey '806, then claim 4, which depends from claim 3, also would have been obvious over Harvey '806. That is an incorrect statement of the law.

“Harvey ’806 teaches a driver offset, i.e., difference in tube length, of 3.75 mm” and that “a sound signal would travel Harvey’s 3.75 mm offset in 0.01 ms, a difference of ‘less than 0.05 milliseconds’ as claimed.” Pet. 40 (citing Ex. 1005, 6:55–65, FIG. 3, 7:38–52; Ex. 1003 ¶¶ 157–158). We agree with Petitioner’s analysis, which Patent Owner does not contest.

We conclude that claim 5 would have been obvious in view of Harvey ’806 alone.

3. *Claims 6, 7, 9–11, and 13–18: Harvey ’806 and Dombrowski*

a. *Claim 6*

Claim 6 adds to claim 1 “wherein the low audio sound-tube and the high audio sound-tube are joined as a single unit.” Ex. 1001, 12:52–53.

Petitioner acknowledges that Harvey ’806 does not expressly teach joining sound-tubes as a single unit. Pet. 40–41. However, as noted by Petitioner (Pet. 26–27), Dombrowski discloses mechanically coupled sound-tubes for use in a hearing instrument. See Ex. 1006 ¶ 186; Fig. 8. Figure 8 of Dombrowski (see Section II.D.3.a) illustrates a cross section of a connection element. Ex. 1006 ¶ 125. Dombrowski states that “[t]he sound connection element of FIG. 8 is made up of two sound connection tubes 51, 52 mechanically coupled to each other.” Ex. 1006 ¶ 186. Mr. Young testifies that Dombrowski “discloses ‘mechanically coupled’ sound tubes for use in a hearing instrument,” and that Dombrowski “thus teaches the ‘single unit.’” Ex. 1003 ¶ 162. He further testifies that “[i]t would have been obvious to a POSA to mechanically couple Harvey’s sound tubes, as taught by [Dombrowski], since doing so would make IEM assembly easier, which a POSA would recognize” and that, “[i]n other words, it would have been

obvious to a POSA to join Harvey's low and high audio sound-tubes as a single unit, since doing so makes assembly easier, as a POSA would recognize." *Id.* ¶ 163.

We find that Petitioner has offered reasoning with rational underpinning to apply the teachings of Dombrowski regarding joining together different sound tubes, to join together the low and high audio sound-tubes of Harvey '806. The cited disclosure sufficiently supports a finding that the two tubes are joined as a "single unit." A plain reading of Figure 8 of Dombrowski reveals that the two sound tubes are joined all along the longitudinal axes of the tubes.

Patent Owner's arguments have been addressed and found unpersuasive in the context of our discussion of obviousness of claim 6 over Saggio and Dombrowski. *See* Section II.D.3.a.

We conclude that 6 would have been obvious in view of Harvey '806 and Dombrowski.

*b. Claim 7*

Claim 7 depends from claim 6 and adds "wherein the single unit is positioned at an angle between 30 degrees and 65 degrees with respect to a high acoustical driver and a low acoustical driver." Ex. 1001 at 12:54–55.

Petitioner asserts that this claim is obvious because "discovering optimum or working ranges involves only routine skill in the art." Pet. 42 (citing *In re Aller*, 220 F.2d at 456). We agree, as the '960 patent does not describe any special advantages flowing from the claimed range and the conclusion of obviousness is supported by Mr. Young's testimony:

Harvey '806 states its sound-tubes "can be shaped, thus providing the earpiece designer flexibility in achieving both the

desired driver offset and earpiece packing efficiency.” See also Harvey ’806, Figure 7. It would have been obvious to position Harvey ’806’s sound tubes at an angle between 30 and 65 degrees with respect to the drivers, or any other angle, since ear anatomy influences positioning. It is common in custom IEMs for sound-tube positions with respect to the drivers to vary, since the component positioning is partially governed by ear anatomy; Harvey ’806 states as much at col. 4:1-5. Note that the ’960 patent doesn’t describe any supposed advantage of the claimed range, and I am not personally aware of any advantage.

Ex. 1003 ¶ 167.

In light of this testimony, and given that Patent Owner does not contend there is any unexpected advantage or result, we conclude that claim 7 would have been obvious over Harvey ’806 and Dombrowski.

*c. Claim 9*

Claim 9 is directed to a method that includes “combining a low audio sound-tube and a high audio sound tube as a single unit” and “installing the single unit into a canalphone housing.” Ex. 1001, 12:60–63.

Our analysis of claim 6 above accounts for claim 9, except for the requirement that the single unit must be put together first outside of the canalphone housing and then installed as a single unit into the canalphone housing. Mr. Young testifies, however:

It would have been obvious to a POSA to mechanically couple Harvey ’806’s sound tubes, as taught by [Dombrowski], since doing so would make IEM assembly easier, which a POSA would recognize. In other words, it would have been obvious to a POSA to combine Harvey ’806’s low and high audio sound-tubes as a single unit and then install the single unit into the canalphone housing, since doing so makes assembly easier, as a POSA would recognize.

Ex. 1003 ¶ 141. The testimony is credible, especially in light of the fact that there are only two choices for installation—combine the two parts into a single unit and then install the single unit, or first install one part and then the other in a manner that will create a single unit with the first. The testimony establishes that the motivation for one with ordinary skill in the art to combine the low and high audio sound-tubes into a single unit prior to installation of that unit into the canalphone housing derives from the basic skill already possessed by one with ordinary skill in the art, namely, that doing so would make IEM assembly easier.

Patent Owner’s arguments about the sufficiency of the evidence are addressed in the context of our discussion of obviousness of claim 9 over Saggio and Dombrowski. (See Section II.D.3.c)

We conclude that claim 9 would have been obvious over Harvey ’806 and Dombrowski.

*d. Claim 10*

Claim 10 depends from claim 9 and further recites “positioning the single unit at an angle between 30 degrees and 65 degrees with respect to a high acoustical driver and a low acoustical driver.” Ex. 1001, 12:64–67.

This claim corresponds to claim 7 discussed above, our explanation and reasoning with regard to claim 7 applies here, and, for those reasons, we conclude that claim 10 would have been obvious in view of Harvey ’806 and Dombrowski.

*e. Claim 11*

Claim 11 depends from claim 9 and further recites “sizing the high audio sound-tube phase as corrected with respect to the low audio sound-

tube by sizing it to be longer than the low audio sound-tube, and the high audio sound-tube's length is greater than 3 millimeters but less than 10 millimeters." Ex. 1001, 13:1–5.

This claim corresponds to limitations within claim 1 discussed above, our explanation and reasoning with regard to those limitations applies here, and, for those reasons, we conclude that claim 11 would have been obvious in view of Harvey '806 and Dombrowski.

*f. Claim 13*

Claim 13 depends from claim 9, adding “slowing down a high audio signal's arrival to the outside of the canalphone housing so that it is closer in time to a low audio signal's arrival to the outside of the canalphone housing by making the high audio sound-tube longer.” Ex. 1001, 13:9–13.

This claim corresponds to limitations within claim 1 discussed above, our explanation and reasoning with regard to those limitations applies here, and, for those reasons, we conclude that claim 13 would have been obvious in view of Harvey '806 and Dombrowski.

*g. Claim 14*

Claim 14 depends from claim 9 and recites “timing the arrival of a high audio [signal] to the outside of the canalphone housing compared to a 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, 13:14–18.

This limitation is essentially the same as that recited in claim 5, and our discussion above of claim 5 in the context of alleged obviousness over

Harvey '806 alone equally applies here. We conclude that claim 14 would have been obvious in view of Harvey '806 and Dombrowski.

*h. Claim 15*

Claim 15 depends from claim 9 and adds “using a time response for a 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, 14:1–4.

Petitioner asserts that “[t]o size the high sound-tube to be longer than the low sound-tube, one obviously needs to know the length of the low sound-tube, which can be determined from the time it takes the low audio signal to pass through the sound-tube,” and that, as a result, “it would have been obvious to use the time-of-arrival for the low audio signal as a ‘control point,’ by which to determine the appropriate high sound-tube length.” Pet. 32–33 (citing Ex. 1003 ¶ 111).

We agree with this analysis, which Patent Owner does not dispute. We thus conclude that claim 15 would have been obvious in view of Harvey '806 and Dombrowski.

*i. Claim 16*

Claim 16 adds to claim 9 “standardizing high audio sound-tube lengths based upon at least two low audio sound-tube lengths.” Ex. 1001, 14:5–7.

Mr. Young testifies that “custom IEMs can have more than one low frequency sound-tube length, owing to different ear anatomies” and that “a POSA 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 ¶ 191. Patent Owner advances no counter argument regarding standardization.

We conclude that claim 16 would have been obvious in view of Harvey ’806 and Dombrowski.

*j. Claim 17*

Claim 17 depends from claim 16 and further recites “fabricating an assembly of a standardized high audio sound-tube length with a respective one of the two low audio sound-tube lengths to make installation in the canaphone housing easier and to provide repeatable acoustic characteristics.” Ex. 1001, 14:9–13.

As discussed above in the context of claim 16, standardizing high audio sound-tube lengths based on at least two low audio sound-tube lengths would have been obvious to one with ordinary skill in the art. For essentially the same reasons, fabricating an assembly of a standardized high audio sound-tube length with a respective one of the two low audio sound-tube lengths to make installation in the canaphone housing easier and to provide repeatable acoustic characteristics would have been obvious to one with ordinary skill in the art. Mr. Young testified that one with ordinary skill would have recognized that fabricating an assembly of standardized sound-tubes would make IEM assembly easier (*see* Ex. 1003 ¶ 195), and Patent Owner does not argue otherwise.

We conclude that claim 17 would have been obvious in view of Harvey ’806 and Dombrowski.

*k. Claim 18*

Claim 18 adds to claim 17 “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, 14:14–16.

Petitioner asserts that Harvey ’806’s sound-tubes are aligned at the eartip where they exit the canalphone housing. Pet. 46. This is supported by the testimony of Mr. Young (*see* Ex. 1003 ¶ 198), and Patent Owner does not offer counterargument.

We conclude that claim 18 would have been obvious in view of Harvey ’806 and Dombrowski.

*G. Obviousness Based on LoPresti and Dombrowski*

Claim 9 is directed to a method that includes “combining a low audio sound-tube and a high audio sound tube as a single unit” and “installing the single unit into a canalphone housing.” Ex. 1001, 12:60–63.

LoPresti discloses a low audio sound-tube and a high audio sound-tube, as well as a canalphone housing, but does not disclose that the two sound-tubes are formed into a single unit, or forming that single unit first and then installing the single unit into the housing. With regard to both deficiencies, Petitioner relies on Dombrowski, and how a person of ordinary skill in the art would understand the teachings of Dombrowski. *See* Pet. 58.

As discussed above in the context of the obviousness of claims 6 and 9 over Saggio and Dombrowski (*see* Sections II.D.3.a & II.D.3.c), Dombrowski discloses forming two sound-tubes into a single unit, and Patent Owner’s arguments regarding Dombrowski and how a person of ordinary skill in the art would understand Dombrowski’s teachings are unpersuasive. (*Id.*)

We conclude that claim 9 would have been obvious in view of LoPresti and Dombrowski.

*H. Claim 12*

In the Supplemental Response addressing the claims added after SAS, Patent Owner stated that “[b]ecause the burden is not on Patent Owner to prove claim 12 is patentable, and because the Board already found that Petitioner would not prevail in establishing the unpatentability of claim 12, Patent Owner rests on the record.” Supp. Resp. 1. Petitioner then offered argument and evidence concerning the added challenges to claim 12. 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 argues 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 argument and evidence below.

Claim 12 depends from claim 9, 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, 13:6–8. In the Institution Decision, we observed that the ’960 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. 33–34 (citing Ex. 1001, 8:46–52). 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. 34. 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 34–35. Because we could not “reasonably determine the proper scope of claim 12,” we found that Petitioner had not shown a reasonable likelihood that it would prevail in establishing obviousness, and, therefore, did not originally institute on claim 12. *Id.* at 35. As required by SAS, however, Petitioner’s challenges to claim 12 were subsequently added to this proceeding.

As noted, Patent Owner's Supplemental Response rested on the record. Supp. Resp. 1. 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. 1059, 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. 1059, 20:21–25), and that such issues would need to be resolved by varying factors in addition to tube length (*id.* at 20:24–25: "you would look at the placement of all of 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 or as short as possible with implicating placement issues. Due to the ambiguity in the claim language, we determine that Petitioner has not shown that the prior art renders claim 12 unpatentable.

*I. 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).

A motion to amend "may not enlarge the scope of the claims of the patent or introduce new matter." 35 U.S.C. § 316(d)(3). New matter is any matter that lacks support in the original application. *See TurboCare Div. of Demag Delaval Turbomach. v. Gen. Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001) ("When [an] applicant adds a claim . . . the new claim[] . . . must find support in the original specification."). A proposed claim that introduces new matter is properly rejected under 35 U.S.C. § 112 for lack of written description. *See, e.g., In re Rasmussen*, 650 F.2d 1212, 1214 (CCPA 1981) ("The proper basis for rejection of a claim amended to recite elements thought to be without support in the original disclosure, therefore, is § 112, first paragraph . . ."). Thus, a proposed claim satisfies § 316(d)(3) when it does not enlarge the scope of the claims, and when the written description in

the original application “reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (*en banc*). For this reason, our Rules require a motion to amend to set forth “[t]he support in the original disclosure of the patent for each claim that is added or amended.” 37 C.F.R. § 42.121(b)(1).

Petitioner opposes the Motion to Amend on procedural grounds (see Mot. to Amend Opp. 3–15), as well as by arguing that the proposed substitute claims would have been obvious (*see id.* at 15–25). We do not reach the procedural issues because we find that the proposed substitute claims are not patentable over the cited art.<sup>4</sup>

1. *Proposed Substitute Claims 19–26*

Patent Owner proposes the following substitute independent claim 19, corresponding to original independent claim 1:

- 19. A system comprising:
  - a canalphone housing:
  - a low audio sound-tube to carry a low audio signal to the canalphone housing’s outside; and;
  - a high audio sound-tube to carry a high audio signal to the canalphone housing’s outside, 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, and the

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<sup>4</sup> *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”).

high audio sound-tube's length is greater than 3 millimeters but less than 10 millimeters;

wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz.

Mot. to Amend 2–3. Proposed substitute dependent claims 20–26 correspond to original dependent claims 2–8. *See id.* at 2–5. Essentially, the proposal is for substitute claims 19–26 to add the limitation “wherein the phase corrected response is between 90 degrees and -90 degrees from 31.5Hz to 16kHz” to each of issued claims 1–8.

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.

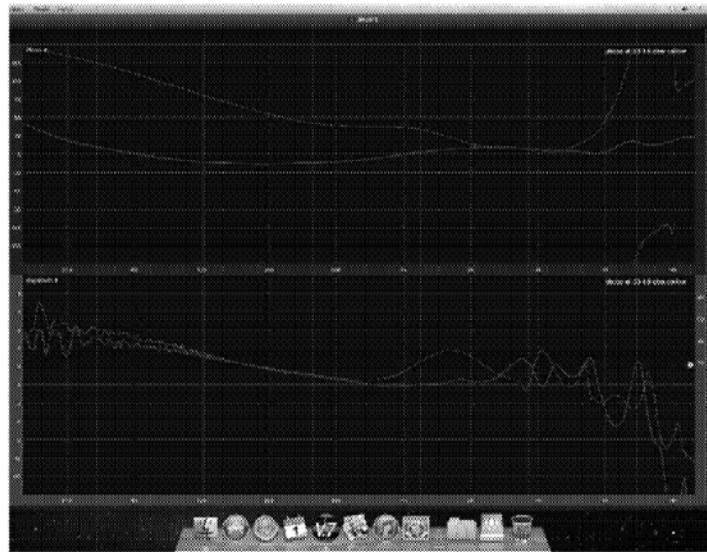


FIG. 7

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

Petitioner 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. 17 (citing Ex. 1047 ¶¶ 14–15). 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.* at 17–18 (citing Ex. 1047 ¶ 15). 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 18.

Petitioner additionally argues that the proposed substitute claims would have been obvious over Saggio alone, or Saggio in combination with Dahlquist. *See* Mot. to Amend Opp. 19–21. 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.* at 19–20. 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.* at 20. 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.*

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 6–7. Patent Owner further argues that “even [Ishii] 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.* at 7.

Patent Owner’s 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/Dahlquist.

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 7–8. 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.* at 7. We find this argument

unpersuasive because, as we found above, both 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 8. This argument also, however, does not address Petitioner’s explanation of how the new limitation is satisfied in 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 8. 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. 1047 ¶ 10. 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 9. 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 the case 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 16kHz," 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).

For the reasons discussed in this section and above (see Sections II.E, II.D.1, II.D.4), we find proposed claim 19 unpatentable as obvious in view of Harvey '806 and as obvious in view of Saggio alone or Saggio in combination with Dahlquist. And, because proposed substitute claims 20–26 mirror issued dependent claims 2–8, we also find them obvious for the reasons identified in this section and above (see Sections II.D–F). We accordingly deny the Motion to Amend as to claims 19–26.

2. *Proposed Substitute Claims 27–36*

Patent Owner proposes the following substitute independent claim 27, corresponding to original independent claim 9:

27. A method comprising:

combining a low audio sound-tube and a high audio sound-tube as a single unit; and installing the single unit into a canalphone housing;

wherein the sound-tubes are not combined by mechanical coupling.

Mot. to Amend 4. Proposed substitute dependent claims 28–36 correspond to issued dependent claims 10–18. See *id.* at 4–5. Essentially, the proposal is for substitute claims 27–36 to add the limitation “wherein the sound-tubes are not combined by mechanical coupling” to each of issued claims 9–18.

Patent Owner argues proposed substitute claims 27–36 do not enlarge the scope of the claims because “[t]he substitute claims . . . include all of the limitations of the original claims and add an additional limitation.” Mot. to Amend 1–2. Patent Owner further contends the proposed claims do not add new matter because the added limitation “wherein the sound-tubes are not

combined by mechanical coupling” is supported by U.S. Patent Application No. 13/315,610 (“the ’610 application”) to which the ’960 patent claims priority. *Id.* at 3 (citing Ex. 1002 ¶ 67, Fig. 7).

Petitioner argues the ’610 application does not provide written description support for the “wherein the sound-tubes are not combined by mechanical coupling” limitation, and, therefore, that the proposed claims “impermissibly enlarge the scope of the claims and introduce new matter.” Mot. to Amend Opp. 11–13. Petitioner argues the “not adjoined by mechanical coupling” limitation is a negative limitation, and requires written description support that either provides a reason to exclude the limitation, or discloses the limitation as one among a number of excludable alternatives. *See id.* at 11 (citing *Santarus, Inc. v. Par Pharma, Inc.*, 694 F.3d 1344, 1351 (Fed. Cir. 2012); *Inphi Corp. v. Netlist, Inc.*, 805 F.3d 1350, 1356 (Fed. Cir. 2015)). Petitioner asserts the ’610 application “does not describe a reason to exclude ‘mechanical coupling’ as a way to adjoin sound bores,” nor does it “positively recite alternative ways to adjoin the sound bores, of which mechanical coupling is one.” *Id.* at 12. Therefore, Petitioner argues, the ’610 application does not “reasonably convey to a POSA that the inventor was in possession of a system and method wherein the sound bores are adjoined **but not** by mechanical coupling.” *Id.* at 13. Patent Owner contends the “not adjoined by mechanically coupling” limitation is not “a negative limitation, but rather an express clarification of the ‘adjoining . . . to form a single unit’ limitation that is already present” in the disclosure of the ’610 application. Mot. to Amend Reply 6.

We agree with Petitioner that the proposed claims are not supported by the disclosure of the ’610 application, and therefore improperly seek to

add new matter to the '940 patent. First, the added “wherein the sound bores *are not* adjoined by mechanical coupling” limitation is a negative limitation because it excludes sound bores that *are* adjoined by mechanical coupling. *See, e.g., In re Bankowski*, 318 F.2d 778, 783 (CCPA 1963) (describing a negative limitation as one that excludes, for example, a “limitation such as ‘metal, except for nickel’”). Second, the '610 application does not reasonably convey to a person of ordinary skill in the art that the inventor was in possession of an invention in which sound bores *could be* but were purposefully *not* adjoined by mechanical coupling. For example, the '610 application does not disclose a reason to exclude adjoining sound bores by mechanical coupling. *See Santarus*, 694 F.3d at 1351 (“Negative claim limitations are adequately supported when the specification describes a reason to exclude the relevant limitation.”). Nor does the '610 application disclose adjoining by mechanical coupling to be one of a number of excludable alternatives for adjoining sound bores. *See Inphi*, 805 F.3d at 1357 (“[A]lternative features are sufficient to satisfy the written description standard of § 112, paragraph 1 for negative claim limitations.”). Indeed, as Patent Owner admits, the '610 application does not discuss adjoining sound bores by mechanical coupling. *See Mot. to Amend Reply 5* (“nothing in the . . . original disclosures teaches two sound bores being mechanically adjoined together”). Nor does it disclose a reason why a person of ordinary skill would not want to adjoin sound bores by mechanical coupling.

Accordingly, for the reasons discussed above, we find the proposed amended claims lack written description support under 35 U.S.C. § 112 ¶ 1, and that the Motion to Amend improperly seeks to add new matter to the

'960 patent in contravention of 35 U.S.C. § 316(d)(3). For this reason, we deny the Motion to Amend as to substitute claims 27–36.

*J. Petitioner's Motion to Exclude*

Petitioner argues that “lines 57:4-9 and 62:2-14 of Exhibit 2004,” “[l]ines 200:23-201:21 and 225:2-19 of Exhibit 2004,” and “Patent Owner’s cross-examination of Mr. Young on ‘P.O. #8’” 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 36, 3–7. Because we do not rely on this material in reaching our decision, we dismiss these objections as moot.

Petitioner also argues that Ex. 2005, which on its face appears to be a color version of Fig. 7 of the '960 patent, should be excluded because (a) “Patent Owner did not produce any evidence to support a finding that Exhibit 2005 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 2005 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 2005 is a phase corrected response between 90 degrees and -90 degrees from 31.5Hz to 16kHz.” Paper 36, 7–8. 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 36, 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.

*K. Patent Owner’s Motion to Exclude*

Patent Owner seeks to exclude Exhibits 1050, 1051, 1052, 1053, 1054 and 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 64, 1. Because, as explained above, we conclude that Petitioner may respond to the Institution Decision even if Patent Owner does not (*see* Section II.H), these exhibits are not improper, and Patent Owner’s motion is denied.

### III. CONCLUSION

Petitioner has shown, by a preponderance of the evidence, that claims 1–11 and 13–18 of the ’960 patent are unpatentable. Petitioner has not shown, by a preponderance of the evidence, that claim 12 of the ’960 patent is unpatentable.

#### IV. ORDER

For the reasons given, it is:

ORDERED that claims 1–11 and 13–18 of U.S. Patent 9,197,960 B2 have been shown to be unpatentable;

ORDERED that claim 12 of U.S. Patent 9,197,960 B2 has 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.

IPR2017-01092  
Patent 9,197,960 B2

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