Trials@uspto.gov
571-272-7822

Paper No. 62
Filed: September 28, 2017

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HEWLETT-PACKARD ENTERPRISE CO.; HP ENTERPRISE SERVICES, LLC; and TERADATA OPERATIONS, INC.,
Petitioner,

v.

REALTIME DATA LLC d/b/a IXO,
Patent Owner.

Case IPR2016-00783
Patent 6,597,812 B1

Before GEORGIANNA W. BRADEN, JASON J. CHUNG, and SCOTT C. MOORE, *Administrative Patent Judges*.

CHUNG, *Administrative Patent Judge*.

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

I. INTRODUCTION

Hewlett-Packard Enterprise Company, HP Enterprise Services, LLC, and Teradata Operations, Inc. (collectively, "Petitioner"), filed a Petition to institute an *inter partes* review of claims 1–4, 8, 14–17, 21, and 28 of U.S. Patent No. 6,597,812 B1 ("the '812 patent"). Paper 1 ("Pet."). Realtime Data LLC ("Patent Owner"), filed a Preliminary Response pursuant to 35 U.S.C. § 313. Paper 12 ("Prelim. Resp.").

Upon consideration of the Petition and the Preliminary Response, on October 5, 2016, we instituted *inter partes* review of claims 1–4, 8, 14–17, 21, and 28 ("instituted claims"), pursuant to 35 U.S.C. § 314. Paper 19 ("Dec.").

Subsequent to institution, Patent Owner filed a Patent Owner Response. Paper 29 ("PO Resp."). Petitioner filed a Reply to Patent Owner's Response. Paper 37 ("Reply"). An oral hearing was held on June 30, 2017 and a transcript of the oral hearing is available in the record. Paper 59 ("Tr.").

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, Petitioner has shown by a preponderance of the evidence that claims 1–4, 8, 14–17, 21, and 28 of the '812 patent are unpatentable. *See* 35 U.S.C. § 316(e).

A. Related Matters

Petitioner and Patent Owner inform us that the '812 patent is involved in multiple suits in the U.S. District Court for the Eastern District of Texas. Pet. 1; Paper 9, 1–2; Paper 10, 2–3; Paper 58, 4–5. Patent Owner also informs us that the '812 patent is involved in a suit in the U.S. District Court

for the Northern District of California. Paper 9, 2; Paper 10, 2–3; Paper 58, 4–5.

B. The Instituted Grounds

We instituted the following grounds of unpatentability:

References[1]	Basis	Instituted Claims
O'Brien[2] and Nelson[3]	§ 103(a)[4]	1–4, 8, and 28
O'Brien, Nelson, and Welch[5]	§ 103(a)	14–17 and 21

C. The '812 Patent

The '812 patent describes systems and methods "for providing lossless data compression and decompression." Ex. 1001, Abs. The '812 patent further describes "characteristics of run-length encoding, parametric dictionary encoding, and bit packing to comprise an encoding/decoding process." *Id.* Figure 1 of the '812 patent is reproduced below.

[1] Petitioner also relies upon the Declarations of Dr. Charles D. Creusere. Ex. 1005
[2] U.S. Patent No. 4,929,946; issued May 29, 1990, (Ex. 1002, "O'Brien")
[3] MARK NELSON, THE DATA COMPRESSION BOOK (1992), (Ex. 1003, "Nelson")
[4] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), revised 35 U.S.C. § 103, effective March 16, 2013. The '812 patent was issued prior to the effective date of the AIA. Thus, we apply the pre-AIA version of § 103.
[5] U.S. Patent No. 4,558,302; issued Dec. 10, 1985, (Ex. 1004, "Welch")

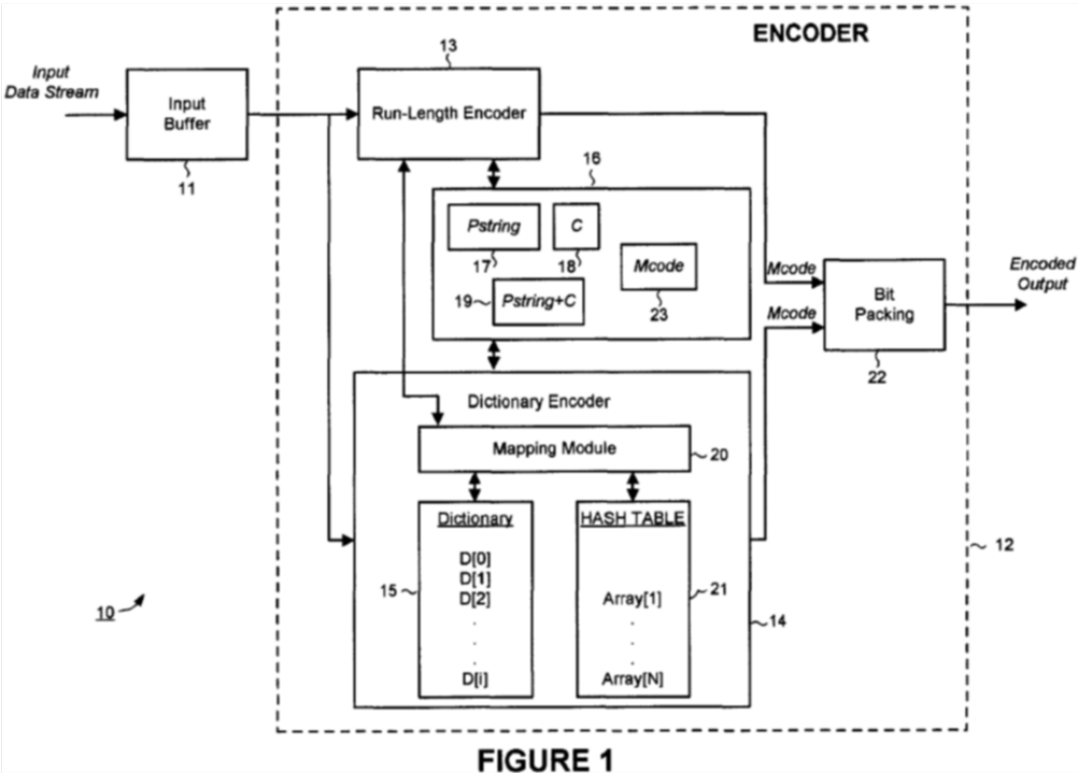

FIGURE 1

Figure 1 of the ’812 patent, reproduced above, is a detailed block diagram of a system for combining run-length encoding with dictionary encoding. Ex. 1001, 5:14–23. Input buffer 11 temporarily buffers an input data stream, and encoder 12 compresses the input data stream. *Id.* at 4:66–5:2. Encoder 12 implements a combination of run-length encoder 13 and dictionary encoder 14. *Id.* at 5:14–22. More specifically, encoder 12 identifies any run-length sequence in the data stream and outputs one or more code words from dictionary 15 to represent the run-length sequence. *Id.* at 5:31–37. Dictionary encoder 14 builds a character string comprising two or more characters that does not comprise a run-length sequence, searches dictionary 15 for a code word corresponding to the character string, and then outputs the code word representing the character string. *Id.* at 5:38–42.

D. The Instituted Claims

We instituted *inter partes* review of claims 1–4, 8, 14–17, 21, and 28. Claim 1 is illustrative and reproduced below:

> 1. A method for compressing input data comprising a plurality of data blocks, the method comprising the steps of:
>
> detecting if the input data comprises a run-length sequence of data blocks;
>
> outputting an encoded run-length sequence, if a run-length sequence of data blocks is detected;
>
> maintaining a dictionary comprising a plurality of code words, wherein each code word in the dictionary is associated with a unique data block string;
>
> building a data block string from at least one data block in the input data that is not part of a run-length sequence;
>
> searching for a code word in the dictionary having a unique data block string associated therewith that matches the built data block string; and
>
> outputting the code word representing the built data block string.

Ex. 1001, 16:53–17:2.

II. ANALYSIS

A. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). 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 skill in the art; and (4) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

A determination of whether a patent claim is invalid as obvious under § 103 requires consideration of all four *Graham* factors, and it is error to reach a conclusion of obviousness until all those factors are considered." *Apple v. Samsung Elecs. Co., Ltd.*, 839 F.3d 1034, 1048 (Fed. Cir. 2016) (en banc) (citations omitted). "This requirement is in recognition of the fact that each of the *Graham* factors helps inform the ultimate obviousness determination." *Id.*

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review). Furthermore, Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Thus, to prevail in an *inter partes* review, Petitioner must explain how the proposed combinations of prior art would have rendered the challenged claims unpatentable. At this final stage, we determine whether a preponderance of the evidence of record shows that the challenged claims

would have been obvious over the proposed combinations of prior art.

We analyze the instituted grounds of unpatentability in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

The parties do not disagree as to the level of skill in the art. *See generally* Pet., PO Resp., Reply. We find that the level of ordinary skill in the art is reflected by the prior art of record. *See 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).

C. Claim Construction

In the Decision to Institute, we did not construe any terms. Dec. 5. Patent Owner argues a construction for "maintaining a dictionary" (claims 1 and 14) and "consecutively outputting a first control word indicating a run-length sequence, a code word in the dictionary . . . that corresponds to the input data block, and a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3 and 16). PO Resp. 23–33. In response, Petitioner argues for a construction of "maintaining a dictionary" (claims 1 and 14) and "consecutively" (claims 3 and 16). Reply 1–9.

1. Consecutively (Claims 3 and 16)

Patent Owner argues "consecutively outputting a first control word indicating a run-length sequence, a code word in the dictionary . . . that corresponds to the input data block, and a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3

and 16) should be construed as "the control word indicating a run-length sequence is outputted before the other two words in the run-length sequence." PO Resp. 27–32. At the outset, Patent Owner mischaracterizes Petitioner's argument to construe "consecutively" (*see* Pet. 31) as a request to construe "consecutively outputting a first control word indicating a run-length sequence, a code word in the dictionary . . . that corresponds to the input data block, and a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3 and 16) to mean "following one another in uninterrupted order; successive." PO Resp. 27. We note, however, that Petitioner did not argue for a construction of "consecutively outputting a first control word indicating a run-length sequence, a code word in the dictionary . . . that corresponds to the input data block, and a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3 and 16). Pet. 31; Reply 8. Rather, Petitioner argues for a construction of just the term "consecutively" (claims 3 and 16). Pet. 31; Reply 8.

Regarding the construction of the phrase "consecutively outputting a first control word indicating a run-length sequence, a code word in the dictionary . . . that corresponds to the input data block, and a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3 and 16), Patent Owner argues the use of the term "first" recited in claims 3 and 16 necessitates a particular chronological order – i.e., the control word is output first. PO Resp. 28–30 (citing Ex. 2007 ¶¶ 101–107, 152). In addition, Patent Owner argues Petitioner is attempting to read out "first" from claims 3 and 16, thereby rendering the term "first" superfluous. PO Resp. 29.

Patent Owner also argues its proposed construction is supported by a preferred embodiment discussed in the Specification of the ’812 patent that describes the control code being output first from the dictionary, followed by the code word for the character that is stored, which is then followed by the number of consecutive characters that were found in the input stream. PO Resp. 29–32 (citing Ex. 1001, 8:33–39, Fig. 4A).

We disagree with Patent Owner. In particular, we disagree with Patent Owner that the word “first” necessitates a particular chronological order in which “a first control code word indicating a run-length sequence” (claims 3 and 16) is output before both “a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block” (claims 3 and 16) and “a word corresponding to the number of successive data blocks that are similar to the input data block” (claims 3 and 16) are output. More specifically, we disagree with Patent Owner because the word “first” recited in claims 3 and 16 modifies the claimed “control word” rather than modifying the claimed “outputting,” while “consecutively” modifies “outputting.” Ex. 1001, 17:9–15, 18:40–48. That is, claims 3 and 16 recite “first control code word” and “consecutively outputting.” *Id.* Because “first” modifies “control word” rather than modifying “outputting,” we are not persuaded by Patent Owner that “first” has any bearing on an alleged chronological order of outputs in claims 3 and 16.

Moreover, we disagree with Patent Owner’s argument that the Specification of the ’812 patent limits claims 3 and 16 to the chronological order of “words” described in the “preferred embodiment.” Ex. 1001, 6:14–33. Limiting a claim to what is described in a preferred embodiment is

seldom correct. *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1372 (Fed. Cir. 2014) ("Even when the specification describes only a single embodiment, the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction.'").

We instead adopt Petitioner's definition of "consecutively" to mean "following one another in uninterrupted order; successive" (Pet. 31; Reply 8) because it is consistent with the plain and ordinary meaning and the Specification.

2. Remaining Terms

We determine that no other terms require express construction for purposes of this Decision. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (only those claim terms or phrases that are in controversy need to be construed, and only to the extent necessary to resolve the controversy).

D. Alleged Obviousness of Independent Claims 1 and 14

1. Overview of O'Brien (Ex. 1002)

O'Brien teaches adaptive data compression to compress efficiently a user data file. Ex. 1002, Abs. O'Brien teaches that "[r]uns of three or more repeated bytes are encoded using a predetermined set of reserved reference values to indicate that the preceding character was repeated the number of times specified by the repeat code." *Id.* at 3:67–4:2. O'Brien further teaches the adaptive data compression operates in a way such that strings are built a character at a time, which means "a previously defined string plus the next

user data byte shall define a new string and is assigned the next previously undefined reference value." *Id.* at 12:23–31. As a result, strings become longer and data compression becomes more efficient as more data bytes are examined. *Id.* at 12:31–33. String definition occurs by combining the last used reference value with the next user data byte; this resultant string is then used to search the string table to determine if this string was defined previously. *Id.* at 12:34–36. If the string was defined previously, the next subsequent data byte is concatenated to the reference value of the string that has been found to form a new string table search pattern. *Id.* at 12:36–41. The search is repeated iteratively until a string is found that has not been defined previously. *Id.* at 12:43–44. Once the undefined string is found, the last used defined string reference is placed in the output compressed data stream and the next consecutive unused reference value is assigned to this undefined string. *Id.* at 12:44–48.

2. Overview of Nelson (Ex. 1003)

Nelson teaches source code for a complete version of Lempel-Ziv-Welch ("LZW") compression and decompression. Ex. 1003, 306. Nelson teaches using a dictionary to include definitions of symbols, code, characters, etc. *Id*. at 308. In addition, Nelson teaches adding definitions to the dictionary if a definition is not present in the dictionary. *Id.*

3. O'Brien Teaches Maintaining a Dictionary (Claims 1 and 14)

The parties' dispute focuses on whether O'Brien teaches "maintaining a dictionary" as recited in claims 1 and 14. Pet. 40–42, 55–57; PO Resp. 35–40. Because Petitioner has the burden of proof (*see* 35 U.S.C. § 316(e), 37 C.F.R. § 42.20(c)), we begin with Petitioner's arguments.

Petitioner argues O'Brien teaches string compression, which is a dictionary algorithm. Pet. 41 (citing Ex. 1005 ¶ 84). Petitioner further argues that a person having ordinary skill in the art would have considered O'Brien's "reference values" to be dictionary indices. *Id.* And, Petitioner argues "[t]he combination of character reference values mapped to characters and string reference values mapped to character strings stored in the string table is an example of a 'dictionary.' (Run length reference values are also part of the 'dictionary,' as control code words.)" *Id.* Petitioner argues O'Brien creates, populates, and uses the data structures and logic associated with its reference values and string table, and therefore that O'Brien teaches "maintaining a dictionary" as recited in claim 1 and 14. *Id.* at 41–42, 55–57.

In response, Patent Owner argues that O'Brien's segmentation approach fails to teach maintaining a dictionary because O'Brien generates a new dictionary for each new segment. PO Resp. 33–40. In particular, Patent Owner argues O'Brien divides its input data into segments of a pre-determined size; O'Brien then encodes each segment independently from the other segments and discards the dictionary after each segment is encoded and assigns new reference values for each segment. *Id.* at 34 (citing Ex. 1002, Abstract; Ex. 2009, 43:14–20).

Patent Owner argues because O'Brien discards the dictionary and assigns new reference values for each segment, O'Brien fails to teach "maintaining a dictionary" pursuant to Patent Owner's proposed construction. PO Resp. 34–35. Moreover, Patent Owner also argues O'Brien's BEGIN and END variables teaches the generating and discarding

of dictionaries, which Dr. Creusere acknowledges. *Id.* at 35–37 (citing Ex. 2009, 55:4–9).

Patent Owner further argues O'Brien's adaptive algorithm builds a dictionary by matching input strings to strings that were defined previously in the dictionary until a match is not found; then, O'Brien's algorithm adds the unmatched string to an unused reference value in the dictionary. PO Resp. 38–39. Patent Owner argues O'Brien's adaptive dictionary compression algorithm fails to teach "maintaining a dictionary" because it never makes a determination of whether to retain the dictionary during the course of compression of the input data stream and instead, discards its dictionary after encoding each segment and generates a new dictionary. *Id.* at 39–40 (citing Ex. 2007 ¶¶ 117–119; Ex. 2009, 55:4–9). We disagree with Patent Owner.

At the outset, we note that Petitioner, Patent Owner, and their respective declarants all agree that O'Brien's encoder is a type of dictionary encoder. *See e.g.*, Pet. 41; PO Resp. 16–18; Ex. 1005 ¶¶ 32, 84; Ex. 2007 ¶¶ 74, 79, 80, 82, 85. Because O'Brien teaches a "dictionary," we now turn to whether O'Brien teaches the larger phrase, "maintaining a dictionary" as recited in claims 1 and 14. To determine whether O'Brien teaches "maintaining a dictionary," we turn to dependent claims 4 and 17 (Ex. 1001, 17:16–22, 18:48–55), which depend from claims 1 and 14, respectively.

Dependent claim 4 recites "*maintaining a dictionary* comprises the step of: dynamically generating a new code word corresponding to a built data block string, if the built data block string does not match a unique data block string in the dictionary; and adding the new code word in the

dictionary" (emphasis added). *Id.* at 17:16–22. Dependent claim 17 recites similar features. *Id.* at 18:48–55.

We are persuaded that a person having ordinary skill in the art would have considered O'Brien's "reference values" to be dictionary indices, because O'Brien's string compression includes the signature features of LZ78 (i.e., Lempel and Ziv's paper in 1978) and LZW, which are dictionary algorithms. Pet. 41. Moreover, O'Brien teaches an adaptive algorithm that builds a dictionary by combining strings and matching these combined strings to strings that were defined previously in the dictionary until a match is not found. *Id.* at 49 (citing Ex. 1004, 12:43–48; Ex. 1005 ¶ 101); *see id.* at 55. At that juncture, O'Brien's algorithm adds the unmatched combined string to an unused reference value in the dictionary, which we find to teach "*maintaining a dictionary* comprises the step of: dynamically generating a new code word corresponding to a built data block string, if the built data block string does not match a unique data block string in the dictionary; and adding the new code word in the dictionary" (emphasis added) as recited in claim 4 (and similarly recited in claim 17). Pet. 49 (citing Ex. 1004, 12:43–48; Ex. 1005 ¶ 101); *see id.* at 55.

Accordingly, because O'Brien teaches "dynamically generating a new code word corresponding to a built data block string, if the built data block string does not match a unique data block string in the dictionary; and adding the new code word in the dictionary" recited in dependent claims 4 and 17, we are persuaded that Petitioner has established by a preponderance of the evidence that O'Brien teaches "maintaining a dictionary" (claims 1 and 14).

4. O'Brien's Dictionary Encoder is Similar to a LZ78 and LZW Dictionary Encoder

Petitioner argues O'Brien combines run-length encoding with LZ78 or LZW dictionary encoding. Pet. 10–11 (citing Ex. 1005 ¶¶ 32–40). In particular, Petitioner argues that O'Brien teaches "an example of an LZW variation of the LZ78 dictionary encoder." *Id.* at 13 (citing Ex. 1005 ¶¶ 35–40). That is, O'Brien first initializes a dictionary with code words for all possible characters such that, at the beginning of each data segment, reference value encoder 304 is provided with two variables, END and BEGIN that correspond to the largest and smallest individual character codes in the data segment. *Id.* at 13–14 (citing Ex. 1002, 10:19–25). According to Petitioner, O'Brien's END and BEGIN variables define the range of reference values, or code words that represent single characters and are referred to as character reference values. Pet. 14 (citing Ex. 1002, 10:22–28). Petitioner also argues that O'Brien's setting a range of character reference values and associated single characters "is analogous to the initialization of the LZW dictionary with all possible single characters." *Id.* (citing Ex. 1005 ¶ 36).

Petitioner then explains that O'Brien compression technique uses signature features of an LZ78 dictionary encoder. Pet. 13–15. In particular, Petitioner explains that

> O'Brien's reference value encoder *uses the signature LZ78 features* of 1) reading the next input character; 2) adding the next input character to the current prefix string to build a new, combined string; 3) searching the dictionary to see if the new string is found; 4) if so, continuing by updating the prefix string, building the new string by adding one character at a time, and continuing to search the dictionary until the new string is not

> found; 5) when the new string is not found in the dictionary, outputting the reference value for the prefix string and adding the new string to the dictionary. As in LZW, O'Brien's encoder also includes features of initialization of code words (character reference values) for individual characters and setting the prefix string (referenced by last RV) to be the last input character when a combined string is not found in the string table. As such, *it is a classic LZW dictionary encoder*.

Pet. 15–16 (citing Ex. 1005 ¶ 40) (emphases added).

Moreover, Petitioner presents a table comparing the similarities between LZ78 compression, LZW compression, O'Brien's compression, and that of the '812 patent, and contrasting LZ77 (i.e., Lempel and Ziv's paper in 1977) compression with the aforementioned compression techniques. Reply 14. Petitioner's table is reproduced below.

Characteristic	LZ77	LZ78	LZW	O'Brien	'812
Sliding window dictionary	Yes	No	No	No	No
Initializes with all possible single character strings	No	No	Yes	Yes	Yes
Builds dictionary by adding new strings	No	Yes	Yes	Yes	Yes

Petitioner's table, above, illustrates three characteristics: "sliding window dictionary"; "initializes with all possible single character strings"; and "builds dictionary by adding new strings." Petitioner argues its table illustrates that LZ77 is unlike O'Brien in that LZ77 has a sliding window

dictionary, whereas O'Brien does not. Reply 14–15, 17. In addition, Petitioner explains the table illustrates that LZ77 does not initialize its dictionary with all possible single character strings, whereas O'Brien does. *Id.* at 15–17. Petitioner also points out that its table illustrates LZ77 does not build its dictionary by adding new strings, whereas O'Brien builds its dictionary by adding new strings. *Id.* at 16–17.

Furthermore, Petitioner argues its table illustrates that LZ77 is unlike the '812 patent in that LZ77 has a sliding window dictionary, whereas the '812 patent does not. *Id.* at 14–15, 17. In addition, Petitioner explains the table illustrates that LZ77 does not initialize its dictionary with all possible single character strings, whereas the '812 patent does. *Id.* at 15–18. Petitioner also points out that its table illustrates LZ77 does not build its dictionary by adding new strings, whereas the '812 patent does build its dictionary by adding new strings. *Id.* at 16–17.

Patent Owner argues that O'Brien's dictionary encoder is "more akin to an LZ77 dictionary encoder." PO Resp. 16 (citing Ex. 2007 ¶¶ 82–83, 85–86). In particular, Patent Owner argues that rather than reinitializing the dictionary when the dictionary is full and maintaining a dictionary when the dictionary is not full, O'Brien's system, instead, partitions the input data into segments and uses a separate dictionary for each segment, which is similar to the functioning of an LZ77 dictionary encoder. *Id.* at 17 (citing Ex. 2007 ¶¶ 74–75). According to Patent Owner, O'Brien's segmenting is a basic principle of its operation and can prevent its dictionary from becoming full, which ensures the dictionary does not impact negatively the encoding speed that data compression requires. *Id.* at 17–18.

Moreover, Patent Owner argues its declarant, Mr. Laub, states that Dr. Creusere's classification of O'Brien's dictionary encoder as both an LZ78 and an LZW dictionary encoder is flawed for several reasons. PO Resp. 18–21. First, Patent Owner argues that Petitioner is conflating LZ78 and LZW because LZW initializes the dictionary with all 256 possible single characters, whereas LZ78 starts with an essentially empty dictionary and builds the dictionary out of previously seen symbols in the input data. *Id.* at 14–15, 19 (citing Ex. 2007 ¶ 78).

Second, Patent Owner argues that O'Brien is neither an LZ78 dictionary encoder nor an LZW dictionary encoder. PO Resp. 19. Patent Owner argues O'Brien is not an LZ78 dictionary encoder because O'Brien does not use a single dictionary for the entire input data, whereas an LZ78 dictionary encoder can use the dictionary for an entire input data stream. *Id.* at 14, 19–20. Patent Owner further argues that O'Brien is not an LZ78 dictionary encoder because O'Brien segments its data similar to a text window, whereas the LZ78 dictionary encoder abandons the text window. *Id.* at 14, 19.

Patent Owner also argues O'Brien is not an LZW dictionary encoder because O'Brien does not initialize a dictionary to include all 256 possible single characters, whereas an LZW dictionary encoder does initialize a dictionary. *Id.* at 15, 20. And, Patent Owner argues O'Brien is not an LZW dictionary encoder because O'Brien does not use a single dictionary for the entire input data, whereas an LZW encoder can use the dictionary for the entire input data stream. *Id.* at 14, 20.

Third, Patent Owner argues that Petitioner's interpretation of O'Brien is wrong because O'Brien looks at short pieces of input data; much like an

LZ77 dictionary encoder's sliding window. *Id.* at 13–14, 20–21. According to Patent Owner, both O'Brien and an LZ77 dictionary encoder limit their dictionaries to the contents of those short pieces. *Id.* at 20–21.

Patent Owner also argues that third parties having no interest in the present proceeding and Mr. Laub's opinion characterize O'Brien's encoder as an LZ77 dictionary encoder rather than as an LZ78 or an LZW dictionary encoder. PO Resp. 21–22 (citing Ex. 2010, 2; Ex. 2011, 1). These third parties and Mr. Laub characterize U.S. Patent No. 4,988,998 ("the '998 patent"), which is also issued to O'Brien, as an LZ77 compression technique. *Id.* at 21–22 (citing Ex. 2007 ¶ 84). We disagree with Patent Owner.

At the outset, the instituted claims of the '812 patent lack any implicit or explicit recitation of the type of dictionary compression. Instead, the instituted claims set forth the particular actions the claimed compressor requires. That said, whether O'Brien is more akin to LZ77, LZ78, or LZW is irrelevant and not dispositive to the present case. The important factor is whether O'Brien's actions to compress the input data are the same as the actions required by claim 1. We believe the Petition shows that O'Brien's actions are the same actions required by claim 1.

Nonetheless, we analyze the parties' argument regarding what type of compression is most similar to O'Brien's type of compression because resolving the parties' issue is helpful in determining whether O'Brien's compression type is similar to Nelson's compression type, as we will discuss *infra* in §§ II.D.5., II.D.6., II.D.7., and II.D.8.

Although both an LZ77 dictionary encoder and O'Brien look at short pieces of input data (*see* PO Resp. 20–21), we agree with Petitioner that

there are numerous significant departures between an LZ77 dictionary encoder and O'Brien (*see* Reply 14). First, LZ77 is unlike O'Brien in that LZ77 has a sliding window dictionary, whereas O'Brien does not. Reply 14–15, 17. Second, LZ77 does not initialize its dictionary with all possible single character strings, whereas O'Brien does. *Id.* at 15–17. Third, LZ77 does not build its dictionary by adding new strings, whereas O'Brien builds its dictionary by adding new strings. *Id.* at 16–17. Fourth, an LZ77 dictionary encoder has a fixed size dictionary, whereas O'Brien does not. *Id.* at 18. Fifth, LZ77 does not process fixed sized segments of input data, whereas O'Brien processes mostly fixed sized segments. *Id.*

Moreover, Mr. Laub's statement that O'Brien is more akin to an LZ77 dictionary encoder rather than an LZ78 or LZW dictionary encoder because both an LZ77 dictionary encoder and O'Brien look at short pieces of data is flawed. This flaw exists because the sliding window of an LZ77 dictionary encoder is a window of *already processed* input data that operates as a dictionary, whereas O'Brien's segments are *unprocessed* chunks of input data. *Id.*

Patent Owner and Mr. Laub's reliance on Exhibit 2010 and 2011 (*see* PO Resp. 21–22; Ex. 2007 ¶¶ 83–84) is misplaced because those Exhibits discuss a different patent rather than the '812 patent at issue in this proceeding. Exhibit 2010 is a PCT application and Exhibit 2011 is a blog, and both state that the '998 patent issued to O'Brien uses LZ77 compression (*see* Ex. 2010, 2; Ex. 2011, 1); however, the O'Brien patent at issue in this proceeding is the '812 patent – a different patent than the '998 patent.

In addition, Mr. Laub's opinion that the compression schemes in the '998 patent and the '812 patent both disclose LZ77 compression is not

persuasive because, as discussed *supra* in § II.D.4., we agree with Petitioner that there are numerous significant departures between an LZ77 dictionary encoder and O'Brien. Also, Mr. Laub does not know who wrote either statement in Exhibits 2010 and 2011 or what their qualifications were (Ex. 1025, 113:12–21, 120:18–121:20) so, he is not in a good position to evaluate the veracity or weight that should be given to those statements.

More significantly, both statements in Exhibits 2010 and 2011 are contradicted by the '998 patent itself, which states "The basic textual substitution algorithm is based on one described in the article: 'A Technique for High-Performance Data Compression' by Terry A. Welch, Computer, June 1984, pp 8–19." Ex. 1009, 13:1–3. More specifically, the cited Welch article, which was filed with the Petition as Exhibit 1014, is a paper credited with describing the LZW compression algorithm. Ex. 1003, 237 (The Welch article "was a practical description of [Welch's] implementation of the LZ78 algorithm, which he called LZW."); *see id*. at 295.

Accordingly, we are persuaded that Petitioner has established by a preponderance of the evidence that O'Brien's actions are the same actions required by claim 1 and O'Brien's compression is more akin to LZW and LZ78 compression.

5. The Petition Discusses why a Person Having Ordinary Skill in the Art Would Have Combined O'Brien and Nelson

In order to demonstrate that the challenged claims are obvious, petitioner must articulate a *reason why* a person of ordinary skill in the art would combine the prior art references. *In re Nuvasive*, 842 F.3d 1376, 1382 (Fed. 2016); *see also In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017) ("it

is insufficient to simply conclude the [prior art] combination would have been obvious without identifying any reason why a person of skill in the art would have made the combination."). Therefore, the parties' argument with respect to ordinary skill focuses on the rationale a person having ordinary skill in the art would have had to turn to Nelson after reading O'Brien when O'Brien allegedly teaches all the limitations of all claims challenged in Ground 1. Pet. 10–17, 33–35. PO Resp. 40–45.

Petitioner argues that O'Brien's compression is akin to LZW and LZ78 compression as discussed *supra* in § II.D.4. Petitioner further argues that Nelson teaches "variations of LZ78-based dictionary compression, including LZW." Pet. 17 (citing Ex. 1005 ¶¶ 41–42). Petitioner also argues Nelson's "LZW compression algorithm starts with a dictionary initialized to contain indices corresponding to all single characters." *Id.* (citing Ex. 1003, 302–304).

In addition, Petitioner argues that each of Nelson's LZ78 and LZW compression techniques share important features with each other and with O'Brien. Pet. 33–35. Petitioner recognizes that LZ77 uses a sliding window while none of Nelson's LZ78 and LZW and O'Brien's compression technique use a sliding window. *See id.* at 7–10, 12–18, 33–35; Reply 14. And, Petitioner recognizes that Nelson's LZ78 and LZW compression techniques each builds its dictionary by adding new strings, which is similar to O'Brien's compression technique. Pet. 7–10, 12–18, 33–35; Reply 14. Petitioner also explains that O'Brien and Nelson's LZW initializes its dictionary with all possible single character strings. Pet. 13–14, 17 (citing Ex. 1002, 10:19–28; Ex. 1003, 302–304; Ex. 1005 ¶ 36); Reply 14.

Moreover, Petitioner argues O'Brien teaches an adaptive data compression algorithm and that the

> [a]daptive data compression algorithms are well known and the exact details of the present algorithm are not relevant for an understanding of the present apparatus. Therefore, the adaptive data compression algorithm is not disclosed in any further detail herein.

Pet. 33–34 (quoting Ex. 1002, 12:50–54). Petitioner reasons O'Brien's statement suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system. *Id.* at 34 (citing Ex. 1005 ¶¶ 72–73). Petitioner explains that Nelson discusses most well-known dictionary algorithms are adaptive; adaptive dictionaries start out with either no dictionary or with a default baseline dictionary and, as compression proceeds, add new phrases to be used later as encoded tokens. *Id.* (citing Ex. 1003, 232). Petitioner argues a person having ordinary skill in the art "reading O'Brien's statement that the particular adaptive compression was unimportant, would have been motivated to look to Nelson for additional disclosure and features of adaptive compression algorithms, such as LZW encoders." *Id.* at 34–35 (citing Ex. 1005 ¶ 74).

In addition, Petitioner argues O'Brien's "run length encoding and LZW encoding, were well known and well-understood, as evidenced, in part, by Nelson" and, consequently, "it would have been within the level of ordinary skill in the art to combine such techniques, and the results would have been predictable." Pet. 35 (citing Ex. 1005 ¶ 75). Furthermore, Petitioner argues substituting one of Nelson's LZW encoders or one or more

of Nelsons features (e.g., operations to build strings, operations to maintain a dictionary, operations to search for string in the dictionary, and/or operations to output code words) into O'Brien's string encoder "would have been a simple substitution of one well-known element for another since both were well-known and, in this case, nearly identical." *Id.* (citing Ex. 1005 ¶ 76).

And, Petitioner argues that Nelson teaches several LZW implementations and that it would have been obvious to a person having ordinary skill in the art to modify O'Brien's reference value encoder to include Nelson's single dictionary structure for the reasons described in the preceding paragraph. Pet. 42 (citing Ex. 1005 ¶ 85).

In response, Patent Owner argues that Petitioner fails to establish why a person having ordinary skill in the art would have been motivated to turn to Nelson after reading O'Brien pursuant to the Federal Circuit decision in *In re NuVasive*, 842 F.3d at 1382. PO Resp. 40. Moreover, Patent Owner argues Petitioner cites to large portions of Nelson without explaining how Nelson is used within the combination of O'Brien and Nelson. *Id.* at 41. According to Patent Owner, because Petitioner fails to show why and how O'Brien and Nelson are to be combined, Petitioner fails to establish its *prima facie* case of obviousness. *Id.*

Patent Owner also explains Petitioner's argument that the multiple prior-art references disclosed devices that are "quite similar" is insufficient to show obviousness pursuant to *CaptionCall LLC v. Ultratec, Inc.*, Case IPR2015-01359 ("CaptionCall"). PO Resp. 43–44. Patent Owner argues that in *CaptionCall*, the Board did not find support for the key factual underpinning of petitioner's obviousness theory – that the secondary reference described a device that was "quite similar" to the other references

and, as a result, failed "'a critical inquiry in a proper obviousness analysis under *Graham* and *KSR*.'" PO Resp. 43–44 (citing *CaptionCall*, slip op. at 13–14 (P.T.A.B. Dec. 14, 2016) (Paper 75)).

Patent Owner further explains that Petitioner's arguments and Dr. Creusere's testimony that O'Brien teaches all of the limitations of all claims challenged in Ground 1 and then turning to Nelson in the alternative rather than explaining the difference between "maintaining a dictionary" (claim 1) and O'Brien is flawed. PO Resp. 44–45 (citing Pet. 42, 52; Ex. 2009, 33:2–34:3, 34:15–20, 72:3–10). That is, Patent Owner contends Petitioner provides improper vague analysis by ambiguously vacillating between asserting that O'Brien teaches everything and asserting that Nelson teaches several features. *Id.* (citing Pet. 42, 52; Ex. 2009, 33:2–34:3, 34:15–20, 72:3–10). We disagree with Patent Owner.

At the outset, although Petitioner alleges these claims are unpatentable as obvious, but appears to present a case of anticipation, we determine that such a presentation is not a basis for dismissing the petition. It is axiomatic patent law that a disclosure that anticipates under 35 U.S.C. § 102 also may render the claim unpatentable under 35 U.S.C. § 103, because anticipation is the epitome of obviousness. *See In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002) ("It is well settled that 'anticipation is the epitome of obviousness.'") (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)); Tr. 21:1–23:15.

As explained *supra* in § II.D.4., we agree with Petitioner that O'Brien's compression is akin to LZW and LZ78 compression. We also note that Nelson discusses LZ78 compression, including LZW compression, in an entire chapter (i.e., chapter 9) spanning pages 300 to 321. We,

therefore, agree with Petitioner's argument that Nelson teaches "variations of LZ78-based dictionary compression, including LZW." Pet. 17 (citing Ex. 1005 ¶¶ 41–42). We also agree with Petitioner that a passage of Nelson's chapter 9 discusses "LZW compression algorithm starts with a dictionary initialized to contain indices corresponding to all single characters." *Id.* (citing Ex. 1003, 302–304).

Petitioner's argument that LZ77 uses a sliding window while none of Nelson's LZ78 and LZW and O'Brien's compression technique use a sliding window is also persuasive. *See id.* at 7–10, 12–18, 33–35; Reply 14. And, so is Petitioner's argument that Nelson's LZ78 and LZW compression builds its dictionary by adding new strings, which is similar to O'Brien's compression technique. Pet. 7–10, 12–18, 33–35; Reply 14. In addition, we agree with Petitioner's explanation that O'Brien and Nelson's LZW initializes its dictionary with all possible single character strings. Pet. 13–14, 17 (citing Ex. 1002, 10:19–28; Ex. 1003, 302–304; Ex. 1005 ¶ 36); Reply 14. In summary, O'Brien's compression techniques and Nelson's compression techniques share striking similarities.

Patent Owner's reliance on *CaptionCall* is misplaced. That is, the present case is distinguishable from *CaptionCall* because, in the present case, there is support for Petitioner's key factual underpinning. In particular, we note that Petitioner's obviousness theory is not to be understood as only: O'Brien and Nelson are similar; therefore, O'Brien and Nelson are combinable. Rather, we understand Petitioner's argument and Dr. Creusere's declaration to be based on two factors: (1) the striking similarities between O'Brien and Nelson's compression techniques (*supra*, §§ II.D.4. and II.D.5.); and (2) O'Brien's statement about adaptive data compression

algorithms (Ex. 1002, 12:50–54) which suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system, which would be a simple substitution yielding predictable results (*see* Pet. 34–35 (citing Ex. 1005 ¶¶ 72–73); *see* Pet. 42).

Furthermore, Petitioner does provide an adequate rationale for combining the two references. In particular, Petitioner asserts that O'Brien's "run length encoding and LZW encoding, were well known and well-understood, as evidenced, in part, by Nelson" and, consequently, "it would have been within the level of ordinary skill in the art to combine such techniques, and the results would have been predictable." Pet. 35 (citing Ex. 1005 ¶ 75).

And, Petitioner proffers that substituting one of Nelson's LZW encoders or one or more of Nelson's features (e.g., operations to build strings, operations to maintain a dictionary, operations to search for string in the dictionary, and/or operations to output code words) into O'Brien's string encoder "would have been a simple substitution of one well-known element for another since both were well-known and, in this case, nearly identical" and would lead to predictable results. Pet. 35 (citing Ex. 1005 ¶ 76).

Accordingly, Petitioner has established by a preponderance of the evidence that a person having ordinary skill in the art would have been motivated to turn to Nelson after reading O'Brien even though O'Brien teaches all the limitations of all claims challenged in Ground 1.

6. Petition's Reliance on Nelson's Different Compression Techniques Are Arguments in the Alternative

In order to demonstrate that the challenged claims are obvious, petitioner must articulate sufficiently *how* and *why* a person having ordinary skill in the art would have been able to use Nelson's multiple different compression techniques in combination. *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1327 (Fed. Cir. 2012). Therefore, the parties' argument focuses on whether it was proper for Petitioner to combine O'Brien with Nelson's four compression techniques. Pet. 33–35; PO Resp. 45–48.

Petitioner argues O'Brien teaches the limitations of claim 1, but does not refer expressly to its string encoding as "dictionary encoding" and turns to Nelson's compression techniques that expressly refer to dictionary encoding. Pet. 33. In particular, Petitioner further explains that "Nelson makes clear that O'Brien's string encoding, which uses an LZW algorithm, is dictionary-based encoding." *Id.* Petitioner argues, alternatively, it would have been obvious to one having ordinary skill in the art to use other data structures for a dictionary, such as Nelson's compression techniques for O'Brien's string compression. *Id.* (citing Ex. 1005 ¶ 70).

Petitioner submits a chart to highlight some of the similarities that LZ78 and LZW compression techniques share with O'Brien's compression techniques and the '812 patent's compression technique. *Supra*, § II.D.4; Reply 14. Petitioner also points out the similarities between Nelson's LZ78 and LZW compression techniques and O'Brien's compression techniques. *Supra*, § II.D.5. In addition, Petitioner recognizes that LZ77 uses a sliding window while none of Nelson's LZ78, LZW, LZW12.C, and LZW15V.C

(LZW12.C and LZW15V.C are variations of LZW variations) and O'Brien use a sliding window. *See* Pet. 7–10, 12–18, 33–35; Reply 14.

Patent Owner argues that Petitioner improperly relies on Nelson's four disparate LZ78, LZW, LZW12.C, and LZW15V.C compression techniques without explaining what specific combination a person having ordinary skill in the art would have been motivated to make and *why* a person having ordinary skill in the art would have combined these disparate compression techniques. PO Resp. 45–47. In addition, Patent Owner argues that Petitioner relies on both of Nelson's LZ78 and LZW while failing to explain *how* their differing features would work together and that Petitioner's argument has the same flaw while relying on both of Nelson's LZW12.C and LZW15V.C. *Id.* at 47.

Patent Owner further argues that because these four disparate compression techniques are fundamentally different, Petitioner had to articulate reasons why a person having ordinary skill in the art would have combined LZ78 with LZW, combined an LZ78-LZW combination with LZW12.C, and combined an LZ78-LZW-LZW12.C combination with LZW15V.C. *Id.* at 47–48. According to Patent Owner, Petitioner, instead, conflates these four compression techniques and Dr. Creusere acknowledges that he does not explain how the combination would work. *Id.* at 48 (citing Ex. 2009, 73:2–4). We disagree with Patent Owner.

We understand Petitioner's arguments to be arguments in the alternative; that is, it would have been obvious to combine one of Nelson's four compression techniques and O'Brien's compression technique. Moreover, Petitioner brings in Nelson to provide a more explicit teaching of "dictionary." Pet. 33–35, 42. In summary, we determine that Petitioner sets

forth a sufficient rationale in its Petition to combine O'Brien and Nelson (*see supra*, §§ II.D.5. and II.D.6.).

In addition to Petitioner's chart highlighting some similarities that LZ78 and LZW compression techniques share with O'Brien's compression techniques (*supra*, § II.D.4.) and Petitioner pointing out similarities between Nelson's LZ78 and LZW compression techniques and O'Brien's compression techniques (*supra*, § II.D.5.), Petitioner articulates sufficiently that each of Nelson's LZ78, LZW, LZW12.C, and LZW15V.C compression techniques share important features with both each other and with O'Brien (Pet. 17–18, 33–35). For instance, Petitioner articulates sufficiently that LZ78, LZW, LZW12.C, and LZW15V.C builds its dictionary, which Patent Owner acknowledges. Pet. 7–10, 13–18, 35 (citing Ex. 1003, 303); PO Resp. 14–16; Reply 14. Another example is Petitioner articulating sufficiently that LZW, LZW12.C, and LZW15V.C initializes its dictionary, which Patent Owner acknowledges. Pet. 13–18; PO Resp. 15–16; Reply 14.

Accordingly, Petitioner has established by a preponderance of the evidence that a person having ordinary skill in the art would have found that Nelson's compression techniques and O'Brien's compression technique were obvious simple substitutions yielding predictable results. *See* Pet. 33–35.

7. Combining O'Brien's Segmented Approach and Nelson's Non-Segmented Approach

The parties' argument focuses on whether a person having ordinary skill in the art would have combined O'Brien's segmented approach and Nelson's non-segmented approach. Pet. 10–18, 33–35; PO Resp. 48–53.

Petitioner argues: (1) there are similarities between O'Brien and Nelson's compression techniques (*supra*, §§ II.D.4., II.D.5., and II.D.6.); and (2) O'Brien's statement about adaptive data compression algorithms suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system, which would be a simple substitution yielding predictable results (*supra*, §§ II.D.5. and II.D.6.).

Patent Owner argues Petitioner provides conclusory testimony and fails to provide an articulated reasoning with some rational underpinning for the Board to make an obviousness determination. PO Resp. 48–50. Patent Owner also argues that Petitioner and Dr. Creusere, instead, state in a conclusory nature that a person having ordinary skill in the art would have combined O'Brien and Nelson to maintain a dictionary because the change would have been allegedly a simple substitution of well-known elements that would have yielded predicable results. *Id.* at 50–51 (citing Ex. 2009, 105:19–106:1).

Moreover, Patent Owner argues that the Petition and Dr. Creusere's declaration is circular at best and is not based on underlying factual findings. PO Resp. 51–52 (citing Pet. 33–35; Ex. 1005 ¶ 76). According to Patent Owner, Dr. Creusere explained that the modification is not trivial, but would change the fundamental structure of O'Brien. PO Resp. 52 (citing Ex. 2009, 30:19–31:9).

In particular, Patent Owner argues that Mr. Laub opined that O'Brien's segmented approach has fundamental differences with the '812

patent. PO Resp. 52 (citing Ex. 2007 ¶ 130). That is, Patent Owner argues O'Brien divides the input data into many small segments and thus prevents the dictionary from reaching a size that would impact negatively the encoding speed required for real-time data compression, but limits the compression ratio, whereas the '812 patent sets a dictionary size and maintains the dictionary to balance the encoding ratio. PO Resp. 52–53 (citing Ex. 2007 ¶¶ 123, 128–131; Ex. 1002, 3:8–13). Patent Owner argues that Petitioner's approach of modifying O'Brien with an approach that maintains a dictionary destroys O'Brien's basic principle of operation of segmenting data into predetermined-sized segments. PO Resp. 53. According to Patent Owner, Petitioner fails to establish why a person of ordinary skill in the art would have combined O'Brien and Nelson, which is the requisite threshold to prove obviousness. *Id.* We disagree with Patent Owner.

As discussed *supra* in §§ II.D.4.,II.D.5., and II.D.6., we agree with Petitioner's arguments and rationale, which we find to be sufficient. In particular, we agree with Petitioner's explanation that: (1) there are striking similarities between O'Brien and Nelson's compression techniques (*supra*, §§ II.D.4., II.D.5., and II.D.6.); and (2) O'Brien's statement about adaptive data compression algorithms suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system, which would be a simple substitution yielding predictable results (*supra*, §§ II.D.5. and II.D.6.).

Accordingly, Petitioner has established by a preponderance of the evidence that a person having ordinary skill in the art would have combined O'Brien's segmented approach and Nelson's non-segmented approach.

8. O'Brien and Nelson Teach the "Dictionary" Recited in Claim 28

The parties' argument focuses on whether the combination of O'Brien and Nelson teaches "a dictionary comprising a plurality of code words, wherein the code words comprise control code words and code words that are each mapped to a unique data block string" as recited in claim 28. Pet. 51–55; PO Resp. 53–56.

Petitioner argues that O'Brien's Table A reference values teach claim 28's "control code words." Pet. 51–52 (citing Ex. 1002, 3:67–4:2; Ex. 1005 ¶ 106). Petitioner argues that O'Brien's character reference values and string reference values teach "code words." Pet. 53 (citing Ex. 1002, 10:22–31; Ex. 1005 ¶ 107–108).

Moreover, the analysis for claim 28 in the Petition states "[a]ccordingly, the substitution would have been simple and would have produced predictable results." Pet. 52 (citing Ex. 1005 ¶ 109). The Petition also states "*See also* section VII.A.1. ('Motivation to Combine'), *supra*.)" Pet. 52; *see supra* §§ II.D.5., II.D.6., II.D.7. In the Petition, "Section VII.A.1. ('Motivation to Combine')" includes Petitioner's rationale that articulates the combination of O'Brien and Nelson is a simple substitution yielding predictable results. Pet. 33–35; *see supra* §§ II.D.5., II.D.6., II.D.7.

In the "Prior Art" section of the Petition (Pet. 10–18) and the "Motivation to Combine" section of the Petition (Pet. 33–35), Petitioner argues: (1) there are similarities between O'Brien and Nelson's

compression techniques; and (2) O'Brien's statement about adaptive data compression algorithms suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system, which would be a simple substitution yielding predictable results. *See supra* §§ II.D.4., II.D.5., II.D.6., II.D.7.

Patent Owner argues O'Brien's reference values do not teach the claimed dictionary comprising control code words and code words that are mapped to a unique data block string because O'Brien's character reference values and string reference values originate from and are stored in two separate regions of O'Brien's system. PO Resp. 53–54 (citing Ex. 2007 ¶¶ 160–162). That is, Patent Owner argues O'Brien's character reference value adder 408 encodes the character reference values in reference value encoder 304. PO Resp. at 54 (citing Ex. 1002, 10:44–50, Fig. 3); Ex. 2007 ¶ 161). In addition, Patent Owner argues O'Brien's string reference values originate from compression string table 306. PO Resp. 54 (citing Ex. 1002, 9:48–51, 11:6–14, Fig. 3; Ex. 2007 ¶ 161). Patent Owner further argues Petitioner, Dr. Creusere, and O'Brien fail to show where the reference values in O'Brien's Table A originate. PO Resp. 54 (citing Ex. 2007 ¶ 161).

According to Patent Owner, because O'Brien's character reference values and string reference values originate from separate regions of O'Brien's compression circuit, and the Petition is silent pertaining to the reference values shown in Table A, Petitioner has failed to show that O'Brien teaches a dictionary that comprises both control code words and

code words that are each mapped to a data block string. PO Resp. 54–55 (citing Ex. 2007 ¶ 162).

Patent Owner also argues that Petitioner's reliance on Nelson in the alternative does not remedy the shortcomings of O'Brien because Petitioner falls short of proving a person having ordinary skill in the art would have found it obvious to modify O'Brien to include the claimed dictionary. PO Resp. 55. That is, Patent Owner argues Petitioner fails to ascertain the differences between O'Brien and the '812 patent and, instead, argues that O'Brien teaches the claim 28 element and then states that Nelson's encoders have dictionaries that operate in a very similar manner to O'Brien's encoder. *Id.* (citing Pet. 52). According to Patent Owner, pursuant to *CaptionCall*, Petitioner's assertion that O'Brien and Nelson teach devices that are "quite similar" indicates a failure to ascertain the differences between the prior-art references and the claimed invention. *Id.*

Patent Owner further argues that Petitioner fails to provide any reason as to why a person having ordinary skill in the art would have combined O'Brien and Nelson to create a system that includes a dictionary with both control code words and code words that are each mapped to a unique data block string. *Id.* at 56 (citing Ex. 2007 ¶¶ 163–171). Moreover, Patent Owner argues unlike claims 1 and 14 where Petitioner argued that substituting Nelson's LZW15V.C into O'Brien to maintain a dictionary would have been a simple substitution, for claim 28, Petitioner never argues the simple substitution theory yielding predictable results, which is why Petitioner fails to meet its burden to prove obviousness. PO Resp. 56. We disagree with Patent Owner.

At the outset, we note that claim 28 does not require that the "control code words" and "code words" originate from the same location. All claim 28 requires is a "dictionary" that comprises the "control code words" and "code words." Moreover, Patent Owner does not proffer a construction for "dictionary" and, instead, states that the term "dictionary" does "not require a construction to determine patentability of the claims in this proceeding." *Id.* at 33.

In addition, Patent Owner does not rebut Petitioner's argument that O'Brien's Table A reference values teach claim 28's "control code words." *See generally* PO Resp. 53–55. Nor does Patent Owner rebut Petitioner's argument that O'Brien's character reference values and string reference values teach "code words." *See generally id.*

We agree with Petitioner's unrebutted argument that O'Brien's Table A reference values teach claim 28's "control code words." Pet. 51–52 (citing Ex. 1002, 3:67–4:2; Ex. 1005 ¶ 106). In addition, we agree with Petitioner's unrebutted argument that O'Brien's character reference values and string reference values teach "code words." *Id.* at 53 (citing Ex. 1002, 10:22–31; Ex. 1005 ¶ 107–108).

Regarding Patent Owner's argument that Petitioner did not proffer a simple substitution yielding predictable results theory for claim 28, we note that the Petition explicitly states "[a]ccordingly, the substitution would have been simple and would have produced predictable results." Pet. 52 (citing Ex. 1005 ¶ 109). We also note that the Petition references "*See also* section VII.A.1. ('Motivation to Combine'), *supra*.)" in its Petition. Pet. 52. Turning to the "Prior Art" section of the Petition (*id.* at 10–18) and the "Motivation to Combine" section of the Petition (*id.* at 33–35), we see that

Petitioner argues: (1) there are similarities between O'Brien and Nelson's compression techniques; and (2) O'Brien's statement about adaptive data compression algorithms suggests that a wide variety of adaptive compression algorithms could be used and encourages a person having ordinary skill in the art to turn to "well known" algorithms such as Nelson's algorithms for techniques of performing string compression in O'Brien's system, which would be a simple substitution yielding predictable results. *See supra* §§ II.D.4., II.D.5., II.D.6., II.D.7. Because of Petitioner's citation to the "Motivation to Combine" section, we ascertain this citation as Petitioner citing to a simple substitution yielding predictable results theory for claim 28.

Accordingly, we are persuaded that Petitioner has established by a preponderance of the evidence that O'Brien and Nelson teaches "a dictionary comprising a plurality of code words, wherein the code words comprise control code words and code words that are each mapped to a unique data block string" as recited in claim 28.

9. Conclusion

In conclusion, and having performed the factual inquiries required by *Graham*, for the reasons given above and based on our review of the arguments and evidence of record, Petitioner has shown by a preponderance of the evidence that O'Brien and Nelson render obvious the subject matter of claims 1–4, 8, and 28 of the '812 patent.[6]

[6] We note that Patent Owner did not proffer a substantive argument regarding objective indicia of non-obviousness. *See generally* PO Resp.

E. Alleged Obviousness of Claims 14–17, and 21

1. Overview of Welch (Ex. 1004)

Welch relates to data compression. Ex. 1004, Abs. Welch's data compression implements software for loading into a stored program digital computer. *Id.* at 39:23–34.

2. Petitioner Articulates How And Why To Add Welch's Well-Known Software to O'Brien/Nelson's Hardware System

In order to demonstrate that the challenged claims are obvious, petitioner must articulate a *reason why* a person of ordinary skill in the art would combine the prior art references. *In re Nuvasive*, 842 F.3d at 1382. Therefore, the parties' argument focuses on whether Petitioner articulates how or why to add Welch's well-known software to O'Brien/Nelson's hardware system. Pet. 55–58; PO Resp. 65–67.

Petitioner argues the only difference between claims 1 and 14 is the preamble. Pet. 55. Petitioner states claim 14, therefore, is obvious for the same reasons described in connection with claim 1. *Id.* at 56 (citing sections VIII.A.1–2).

In addition, Petitioner argues it would have been obvious to a person having ordinary skill in the art that O'Brien's instructions for causing a processor to perform compression "could have been stored on a 'program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine.'" *Id.* (citing Ex. 1005 ¶ 118). Petitioner additionally argues "[s]uch a person having ordinary skill in the art would have been well aware that operations implemented in hardware could typically be implemented in software." *Id.* (citing Ex. 1005 ¶ 118).

And, Petitioner explains deciding between a hardware or software implementation "was a matter of design choice depending on the circumstances and requirements of any particular implementation." Pet. 56 (citing Ex. 1005 ¶ 118).

Moreover, Petitioner rationalizes that Welch is evidence that a software implementation was applicable in LZW data compression, which is the same type of data compression used in O'Brien and the '812 patent. *Id.* at 56–57 (citing Ex. 1004, Figs. 2–4, 6–9, 39:23–34; Ex. 1005 ¶ 119). Petitioner argues, therefore, a person having ordinary skill in the art "would have considered it obvious to create a software implementation of the O'Brien encoder." *Id.* at 57 (citing Ex. 1005 ¶ 119).

Patent Owner explains the only difference between claims 1 and 14 is the preamble. PO Resp. 65. Patent Owner argues because Petitioner's theory of unpatentability fails for claim 1, its theory also fails regarding claim 14 for similar reasons. *Id.* In addition, Patent Owner argues Petitioner and its declarant merely state a person having ordinary skill in the art would have been well aware of the operations implemented hardware, which *typically* could be implemented in software rather than Petitioner showing *why* or *how* O'Brien could have been implemented in software. *Id.* (citing Pet. 56; Ex. 1005 ¶ 118).

Patent Owner further explains that O'Brien stores compressed data on a magnetic tape while Nelson's data compression encompasses software and hardware compression techniques that can be dissimilar to one another with the exception of their shared data compression feature. PO Resp. 66 (citing Ex. 1002, Abstract, 3:3–8; Ex. 1003, 17). Patent Owner argues that because of the dissimilarity that Nelson recognizes, merely stating that *typically*

hardware embodiments can be implemented in software fails to explain *why* or *how* a person having ordinary skill in the art would have implemented O'Brien in software. PO Resp. 66 (citing Ex. 2007 ¶¶ 175–176).

Patent Owner argues Petitioner's argument of having a hardware or software implementation also fails because Petitioner fails to provide reasoning as to why implementing O'Brien and Nelson into software would have been a matter of design choice. *Id.* (citing Pet. 56; Ex. 1005 ¶ 118; Ex. 2007 ¶ 176). Patent Owner argues Petitioner's theory that Welch and O'Brien both teach LZW compression techniques also fails because while Welch did invent LZW dictionary encoding, O'Brien is more akin to a LZ77 dictionary encoder. *Id.* at 66–67 (citing Pet. 56–57; Ex. 1003, 242, 321, 523; Ex. 1005 ¶ 119; Ex. 2007 ¶ 177). We disagree with Patent Owner.

At the outset, the parties agree that the only difference between claims 1 and 14 is the preamble. Pet. 55; PO Resp. 65. Regarding Patent Owner's argument that O'Brien is more akin to LZ77 compression, we disagree because as we discussed *supra* in § II.D.4., O'Brien is more akin to LZW compression and LZ78 compression. Moreover, as discussed *supra* in § II.D.5., Nelson also teaches LZW and LZ78 compression in chapter 9.

As for Patent Owner's argument that Petitioner fails to explain *why* or *how* a person having ordinary skill in the art would have combined O'Brien, Nelson, and Welch, we disagree because Petitioner did point us to important factual similarities between O'Brien, Nelson, Welch, and the '812 patent's compression techniques to provide sufficient support for its obviousness rationale. *Supra*, §§ II.D.4., II.D.5., II.E.2.

Because we agree with Petitioner's argument that there are similarities between O'Brien, Nelson, Welch, and the '812 patent's compression

techniques to provide sufficient support for its obviousness rationale (*supra*, §§ II.D.4., II.D.5., II.D.6., and II.E.2.), we, therefore, agree with Petitioner that: (1) it would have been obvious to a person having ordinary skill in the art that O'Brien's instructions for causing a processor to perform compression "could have been stored on a 'program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine'" (Pet. 56 (citing Ex. 1005 ¶ 118)); (2) "[s]uch a person having ordinary skill in the art would have been well aware that operations implemented in hardware could typically be implemented in software" (*id.* (citing Ex. 1005 ¶ 118)); and (3) deciding between a hardware or software implementation "was a matter of design choice depending on the circumstances and requirements of any particular implementation." (*id.* (citing Ex. 1005 ¶ 118)).

Accordingly, we are persuaded that Petitioner has established by a preponderance of the evidence how and why a person having ordinary skill in the art would have added Welch's well-known software to O'Brien/Nelson's hardware system.

3. Conclusion

In conclusion, and having performed the factual inquiries required by *Graham*, for the reasons given above and based on our review of the arguments and evidence of record, Petitioner has shown by a preponderance of the evidence that O'Brien, Nelson, and Welch render obvious the subject matter of claims 14–17, and 21 of the '812 patent.[7]

[7] We note that Patent Owner did not proffer a substantive argument regarding objective indicia of non-obviousness. *See generally* PO Resp.

F. Alleged Obviousness of Claim 3 and 16

1. O'Brien Outputs Three Values in its Run-Length Sequence

The parties' argument focuses on whether O'Brien outputs three values in its run-length sequence. Pet. 47–49; PO Resp. 56–62.

Petitioner argues "O'Brien's compression system encodes a run length sequence by outputting three things: (1) the character being repeated; (2) a reference value selected from Table A; and (3) the repeat count for the run." Pet. 47 (citing Ex. 1005 ¶ 95).

In particular, Petitioner argues O'Brien's run-length encoder first outputs a character that is repeated, which teaches "a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block" recited in claims 3 and 16. *Id.* (citing Ex. 1002, 5:45–40, 12:55–58). Petitioner argues O'Brien then outputs a reference value denoted by O'Brien's Table A in the first column, which teaches the "a first control code word indicating a run length sequence" recited in claims 3 and 16. Pet. 47–48 (citing Ex. 1002, 5:45–50, 12:55–13:17; Ex. 1005 ¶ 97). Petitioner argues O'Brien's third output is a repeat count corresponding to the number of times a character is to be repeated, which teaches the "a word corresponding to the number of successive data blocks that are similar to the input data block." *Id.* at 48 (citing Ex. 1002, 12:55–13:17; Ex. 1005 ¶ 98).

Patent Owner argues Petitioner fails to prove claims 3 and 16 would have been obvious to one of ordinary skill in the art because O'Brien outputs only two values when encoding a run-length sequence. PO Resp. 56–58. In particular, Patent Owner argues O'Brien's two values when encoding a run-

length sequence are: a reference value and a repeat code. *Id.* at 57 (citing Ex. 1002, 12:55–56; Ex. 2007 ¶¶ 133–135; Ex. 2009, 84:13–85:1).

Patent Owner explains that the reference value identifies the last character of a string or the only character of a string, while the repeat code identifies the number of times that the last or only character of the string repeats. PO Resp. 57–58 (citing Ex. 1002, 12:56–58; Ex. 2007 ¶ 135). Patent Owner describes this two-value output as being consistent with a typical run-length encoder. *Id.* at 58.

According to Patent Owner, Petitioner's reliance on O'Brien's Table A is misguided because Table A merely shows ranges of repeat codes an embodiment utilizing 2048-byte segments could use in a run-length sequence. PO Resp. 58 (citing Pet. 47–49; Ex. 1005 ¶¶ 97–98). Moreover, Patent Owner argues O'Brien's Table A does not contradict O'Brien's explicit teaching that O'Brien outputs two values, which are a repeat code and a reference value. *Id.* at 58–59 (citing Ex. 2007 ¶¶ 136, 138–143).

Patent Owner explains that O'Brien's circuit monitors three bytes on leads 313, 312, and 129 such that, when the bytes monitored on the leads match, a run-length detect signal is sent to reference value encoder. PO Resp. 59–60 (citing Ex. 1002, 9:22–29, Fig. 3). Patent Owner further explains the first output of O'Brien's run-length sequence is a reference value encoded by reference value encoder 304 and O'Brien's repeat code (i.e., the number of times the data byte is repeated) is the second output of the run-length sequence. *Id.* at 60–61 (citing Ex. 1002, 9:41–45, 12:56–58; Ex. 2007 ¶¶ 139, 141).

Patent Owner characterizes O'Brien as outputting only two values when encoding a run-length sequence and no other reference values are

needed. PO Resp. 61 (citing Ex. 2007 ¶ 145). Patent Owner further argues O'Brien's two output values fails to teach claims 3 and 16's requirement of *consecutively* outputting three words: (1) a first control code word indicating a run-length sequence; (2) a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block; and (3) a word corresponding to the number of successive data blocks that are similar to the input data block. *Id.* at 61–62.

Moreover, Patent Owner argues even if O'Brien's compression system outputs three values: (1) the character being repeated; (2) a reference value selected from Table A; and (3) the repeat count for the run, O'Brien still fails to teach the correct chronological order of outputs claims 3 and 16 require. PO Resp. 62. In particular, Patent Owner argues O'Brien does not *first* output a control code word indicating a run-length sequence according to its proper construction. *Id.* Patent Owner further argues Petitioner and Dr. Creusere acknowledge O'Brien's system *first* outputs the character being repeated instead of a code word indicating a run-length sequence. *Id.* (citing Pet. 47; Ex. 1005 ¶ 95; Ex. 2009, 83:4–8). We disagree with Patent Owner.

At the outset, as explained *supra* in § II.C.1., we construed "consecutively" (claims 3 and 16) as "following one another in uninterrupted order; successive." And, as we articulated *supra* in § II.C.1., we declined to import a chronological modifier into "consecutively" that would require it to mean that "a first control code word indicating a run length sequence" (claims 3 and 16) is output prior to "a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block" (claims 3 and 16) being output.

Nor is Patent Owner's argument persuasive that "first," as recited in claims 3 and 16, necessitates a chronological ordering of "a first control code word indicating a run length sequence" (claims 3 and 16) being output before "a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block" (claims 3 and 16) and "a word corresponding to the number of successive data blocks that are similar to the input data block" (claims 3 and 16). PO Resp. 62; *supra*, § II.C.1. Claims 3 and 16 require "first" to modify a "control code word" rather than the order of output because claims 3 and 16 recite "first control code word." *Supra*, § II.C.1. Moreover, claims 3 and 16 recite "consecutively outputting," which means that "consecutively" modifies the order of output. *Id.*

Moving onto the outputs of O'Brien, Patent Owner appears to overlook the nature of O'Brien's teachings. A closer look at the cited passage of O'Brien that Petitioner relies on demonstrates that O'Brien's run-length encoder first outputs a character that is repeated; we are persuaded that this passage sufficiently teaches "a code word in the dictionary having a unique data block string associated therewith that corresponds to the input data block" recited in claims 3 and 16. Pet. 47 (citing Ex. 1002, 5:45–40, 12:55–58).

Regarding O'Brien's next output, we note that Patent Owner acknowledges that O'Brien's reference value (shown in O'Brien's Table A) "identifies the last character of a string or the only character of a string." PO Resp. 57 (citing Ex. 1002, 12:58–62; Ex. 2007 ¶ 135). Because we did not construe "consecutively" or "first" (claims 3 and 16) to import a chronological order, as discussed *supra* in § II.C.1, we agree with

Petitioner's argument that O'Brien's reference value sufficiently teaches "a first control code word indicating a run length sequence" as recited in claims 3 and 16. Pet. 47 (citing Ex. 1002, 5:45–50, 12:55–58). And, we, therefore, agree with Petitioner that O'Brien's repeat count corresponding to the number of times a character is to be repeated is a sufficient teaching of "a word corresponding to the number of successive data blocks that are similar to the input data block" as recited in claims 3 and 16. *Id.* at 48 (citing Ex. 1002, 12:55–13:17; Ex. 1005 ¶ 98).

Accordingly, we are persuaded that Petitioner has established by a preponderance of the evidence that O'Brien's three output values in its run-length sequence teaches the limitations of claims 3 and 16.

2. Design Choice

Because we did not construe "consecutively" or "first" (claims 3 and 16) to import a chronological order, as discussed *supra* in §§ II.C.1. and II.F.1., we need not reach the merits of the parties' arguments regarding whether shuffling the words in a run-length sequence is merely a matter of design choice. Pet. 48–49; PO Resp. 63–65.

As explained *supra* in § II.F.1., we are persuaded that Petitioner has established by a preponderance of the evidence that O'Brien's three output values in its run-length sequence teaches the limitations of claims 3 and 16.

3. Conclusion

In conclusion, and having performed the factual inquiries required by *Graham*, for the reasons given above and based on our review of the arguments and evidence of record, Petitioner has shown by a preponderance

of the evidence that O'Brien and Nelson render obvious the subject matter of claims 3 and 16 of the '812 patent.[8]

III. MOTIONS

We dismiss the parties' Motions and Responses (*see* Papers 45, 47, 49–51, 54, 56, 57) as moot because we do not rely on any of the arguments, testimony, and demonstratives raised in the Motions and Reponses.

IV. CONCLUSION

In conclusion, Petitioner has shown by a preponderance of the evidence that claims 1–4, 8, and 28 are unpatentable under 35 U.S.C. § 103(a) in view of O'Brien and Nelson; and claims 14–17 and 21 are unpatentable under 35 U.S.C. § 103(a) in view of O'Brien, Nelson, and Welch.

V. ORDER

Accordingly, it is

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1–4, 8, 14–17, 21, and 28 of the '812 patent are unpatentable; 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.

[8] We note that Patent Owner did not proffer a substantive argument regarding objective indicia of non-obviousness. *See generally* PO Resp.

PETITIONER:

Jamie Lynn
jamie.lynn@bakerbotts.com

Garth Winn
garth.winn@klarquist.com

J. Christopher Carraway
chris.carraway@klarquist.com

Derrick Toddy
derrick.toddy@klarquist.com

John Vandenberg
john.vandenberg@klarquist.com

Eliot Williams
eliot.williams@bakerbotts.com

PATENT OWNER:

William Rothwell
william@noroozipc.com

Kayvan Noroozi
kayvan@noroozipc.com

Donald Featherstone
donf-PTAB@skgf.com