

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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ELECTION SYSTEMS & SOFTWARE, LLC,  
Petitioner,

v.

HART INTERCIVIC, INC.,  
Patent Owner.

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PGR2020-00031  
Patent 10,445,966 B1

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Before CHARLES J. BOUDREAU, AMANDA F. WIEKER, and  
JASON M. REPKO, *Administrative Patent Judges*.

REPKO, *Administrative Patent Judge*.

JUDGMENT  
Final Written Decision  
Determining All Challenged Claims Unpatentable  
35 U.S.C. § 328(a)

## I. INTRODUCTION

Election Systems & Software, LLC (“Petitioner”) filed a petition to institute a post-grant review of claims 1–30 of U.S. Patent No. 10,445,966 B1 (Ex. 1001, “the ’966 patent”). Paper 2 (“Pet.”). Hart InterCivic, Inc. (“Patent Owner”) did not file a Preliminary Response.

On September 2, 2020, we instituted an *inter partes* review of all challenged claims based on all grounds in the Petition. Paper 6 (“Inst. Dec.”). Patent Owner filed a Response. Paper 14 (“PO Resp.”). Petitioner filed a Reply. Paper 19 (“Pet. Reply”). Patent Owner filed a Sur-reply. Paper 20 (“Sur-reply”). An oral hearing was held on July 6, 2021. A transcript of that hearing has been entered into the record. Paper 28 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued under 35 U.S.C. § 328(a). For the reasons that follow, Petitioner has shown by a preponderance of the evidence that claims 1–30 are unpatentable.

### A. *Related Matters*

Neither party identifies any related matters. Pet. 1; Paper 4, 2 (Mandatory Notice).

### B. *The ’966 Patent*

The ’966 patent describes an electronic voting system that uses printed vote records (PVRs). Ex. 1001, 1:54–57. PVRs create an official record for later auditing. *Id.* at 1:29–31, 36. Electronic voting systems that create a paper record are called “hybrid voting” systems because they are a cross between hand-marked paper ballots and electronic systems. *Id.* at 1:31–34. In these hybrid systems, PVRs typically contain a bar code that encodes the voter’s selections. *Id.* at 1:40–42. The hybrid voting system then digitally scans the PVR’s bar code to create an electronic cast vote

record. *Id.* at 1:42–43. But, according to the patent, voters find that this system lacks transparency because they cannot read the bar code to confirm that their votes match the printed record and their intended vote selections. *Id.* at 1:43–47.

To improve transparency, the '966 patent's PVRs record the voter's selections using voter-readable characters. *See id.* at 1:48–57. For example, the top of a PVR generated by a ballot-marking device is shown below. *See id.*, Fig. 3.

Figure 3 shows a sample PVR (Printed Voter Record) with the following components:

- Header Region 310:** Contains instructions and metadata.
  - OFFICIAL VOTE RECORD
  - Additional custom header text
  - For Title
  - Joint General and Special Election
  - Sample County, USA
  - November 2, 2026
  - #1234567
  - To cast your ballot, you must take this record to the separate scanning station and scan it.
  - Precinct: Anderson 1201-B
  - PROVISIONAL
  - 046408-12-0000
  - 23
  - 001 010-00000000
  - Page 1 of 2
- QR Code 320:** A square QR code used for verification.
- Selection Section 340:** A table listing candidates and their order.

| CHOICE           | ORDER  |
|------------------|--------|
| QUINLAN PHILLIPS | 3 DEN  |
| CAJ KLEMENTS     | 1 DEN  |
| NITIN STEVENS    | 5 DEN  |
| VIMAL ORIOL      | 22 DEN |
| KELEMEN ANGIOLI  | 2 DEN  |
| SALLIE UTKIN     | 4 DEN  |
| SEBASTIJAN KAMAU | 6 DEN  |
| TEKLA ALFARSI    | 1 DEN  |
- Other Text:** President and Vice President, Senator, House of Representative District 6, Secretary of State, Railroad Commissioner, State Senator, State Legislator, District 124, Governor.

**Figure 3 shows the PVR's header region 310 with instructions to the voter, voter selection section 340, which is readable by the voter, and bar code 320. *Id.* at 6:25–40.**

The system scans the PVR using optical character recognition (OCR) to record the votes. *Id.* at 1:57–59. That is, the voter can read the same data from which the system generates the cast vote record. *Id.* at 1:60–65. This allows the voter to confirm that the PVR matches the selections entered into the ballot-marking device. *Id.* at 6:40–43.

The system uses a bar code to detect counterfeit or altered PVRs. *Id.* at 2:31–32. The bar code includes a digitally signed hash. *Id.* at 2:33–36. During scanning, the system generates the OCR results and verifies them

with another hash. *Id.* at 2:36–38. In particular, the system produces a hash from the OCR-generated characters and compares them to the hash provided in the bar code. *Id.* at 2:38–40. According to the patent, this technique confirms that a known source printed the PVR and detects post-printing alterations. *Id.* at 2:40–44.

The system’s OCR process uses several techniques to improve recognition accuracy. *See id.* at 1:66–2:30. In one embodiment, the OCR process uses a dictionary of potential vote choices (such as candidate names) for pattern matching. *Id.* at 1:67–2:4. The OCR process may also use a Levenshtein distance algorithm for error detection. *Id.* at 2:20–22. This algorithm calculates a distance between the OCR data and each key in the dictionary. *Id.* at 2:22–24. If the distance is below a threshold, the data is matched to the dictionary entry. *Id.* at 2:24–26.

### C. Claims

Claims 1, 6, 11, 15, 20, 23, 28, and 29 are independent. Claim 1 is reproduced below.

1. A method for electronic voting using printed vote records, comprising:
  - recording a voter’s vote selections;
  - generating a printed vote record of the voter’s vote selections, the printed vote record containing voter readable text indicating the voter’s vote selections;
  - scanning the printed vote record, the scanning including scanning the voter readable text;
  - utilizing optical character recognition (OCR) on the scanned voter readable text to create a data set which identifies the voter’s vote selections; and

generating a cast vote record from the data set so that voter selections in the cast vote record are based on the voter readable text,

wherein identifying the voter's vote selection includes comparing the data set to an election dictionary, the election dictionary containing potential vote choices,

wherein the comparing the data set to the election dictionary is utilized to confirm an accuracy of the OCR to limit potential OCR errors.

Ex. 1001, 8:43–62.

*D. Evidence*

| <b>Name</b> | <b>Reference</b>                                | <b>Exhibit</b>                               |
|-------------|-------------------------------------------------|----------------------------------------------|
| Brockhouse  | US 2014/0231513 A1, published Aug. 21, 2014     | 1004                                         |
| Heilper     | US 7,406,201 B2, issued July 29, 2008           | 1005                                         |
| Nadaf       | BR 10 2013 018558-2 A2, published Sept. 2, 2014 | 1006<br>(original),<br>1007<br>(translation) |
| Backert     | US 9,401,059 B2, issued July 26, 2016           | 1008                                         |
| Herskowitz  | US 6,971,574 B1, issued Dec. 6, 2005            | 1009                                         |

Petitioner also relies on the declarations of Michael I. Shamos, Ph.D., J.D. Ex. 1003 (“Shamos Decl.”); Ex. 1055 (“Shamos Suppl. Decl.”). Patent Owner relies on the declaration of Daniel P. Lopresti, Ph.D. Ex. 2006 (“Lopresti Decl.”).

*E. Asserted Grounds*

Petitioner asserts that claims 1–30 are unpatentable on the following grounds. Pet. 3.

| <b>Claim(s) Challenged</b> | <b>35 U.S.C. §</b> | <b>Reference(s)/Basis</b>           |
|----------------------------|--------------------|-------------------------------------|
| 1–30                       | 101                | Eligibility                         |
| 1–5, 15–19                 | 103                | Brockhouse, Heilper                 |
| 6–10, 23, 24, 29, 30       | 102                | Nadaf                               |
| 6–10, 23, 24, 29, 30       | 103                | Nadaf                               |
| 25                         | 103                | Nadaf, Heilper                      |
| 25                         | 103                | Nadaf                               |
| 11–14, 28                  | 103                | Nadaf, Backert, Herskowitz          |
| 20–22                      | 103                | Nadaf, Heilper, Backert, Herskowitz |
| 4, 5, 26, 27               | 112(b)             | Indefiniteness                      |

**II. ANALYSIS**

*A. Eligibility for Post-Grant Review*

Post-grant review is available only for patents that, at one point, contained at least one claim with an effective filing date, as defined by 35 U.S.C. § 100(i), on or after March 16, 2013. Petitioner asserts that the ’966 patent is available for post-grant review. Pet. 2. We agree. The filing date for the ’966 patent is January 4, 2019, and the patent claims benefit only to a provisional application filed on July 27, 2018. Ex. 1001, codes (22), (60).

*B. Level of Ordinary Skill in the Art*

According to Petitioner,

A person of ordinary skill in the art at the time the ’966 patent was filed (“POSITA”) would have had at least a Bachelor’s degree in electrical engineering or computer science or an equivalent field, or equivalent work experience and, in addition, at least two years’ experience with electronic voting machines, including familiarity with ballot marking devices

(“BMDs”), optical character recognition, bar codes and hash functions.

Pet. 24 (citing Shamos Decl. ¶¶ 50–51).

In the Institution Decision, we applied Petitioner’s proposed definition. Inst. Dec. 6. Patent Owner does not dispute Petitioner’s proposed level of ordinary skill in the art. (PO Resp. 3). We continue to find that the level of ordinary skill identified by Petitioner (Pet. 24) is consistent with the record. *See* Inst. Dec. 6. Thus, we use the same definition here that we used in the Institution Decision.

### C. Claim Construction

We need only construe terms that are in controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

We construed the term “cast vote record” in the Institution Decision. Inst. Dec. 6–8. After considering the full record, we adopt the same construction in this decision. Our reasons follow.

In interpreting the claims of the ’966 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b).

Under that standard, claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and even extrinsic evidence. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc). But extrinsic evidence is “less significant” than the intrinsic record. *Id.* at 1317. The specification is the “single best guide” to a disputed term’s meaning. *Id.* at 1315. It “may reveal

a special definition given to a claim term.” *Id.* at 1316. Or it may reveal “an intentional disclaimer, or disavowal, of claim scope.” *Id.* at 1316. “The patentee’s lexicography must, of course, appear ‘with reasonable clarity, deliberateness, and precision’ before it can affect the claim.” *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The patentee can disavow claim scope with language in the specification or the prosecution history. *Poly-Am., L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016). “In either case, the standard for disavowal is exacting, requiring clear and unequivocal evidence that the claimed invention includes or does not include a particular feature.” *Id.*

In Petitioner’s view, the ’966 patent defines the term “cast vote record.” Pet. 23 (quoting Ex. 1001, 1:23–28). We agree. Here, the patentee’s lexicography appears with “reasonable clarity, deliberateness, and precision.” *Renishaw*, 158 F.3d at 1249. Specifically, the patent states,

*As used herein*, an electronic cast vote record is an electronic record that indicates the determined voter’s choice or selection in a manner determined in accordance with the voting system. Thus, an electronic cast vote record is an electronic record of a voter’s cast voting selections and may be used in the vote tabulation process.

Ex. 1001, 1:23–28 (emphasis added). We emphasize “as used herein” because it indicates the patentee’s intent to define the term as described in the sentence. The claims, however, simply recite a “cast vote record” without the word “electronic.” *See, e.g., id.* at 8:43–62 (claim 1). So our construction of “cast vote record” follows the quoted definition but omits the word “electronic.” *Accord* Pet. 23.

The ’966 patent also notes that the cast vote record “*may* be used in the vote tabulation process.” *Id.* (quoting Ex. 1001, 1:23–28) (emphasis

added). We agree with Petitioner that the term “may” indicates that tabulation is not required. *Id.*

Thus, we construe “cast vote record” as a “record that indicates the determined voter’s choice or selection in a manner determined in accordance with the voting system.” *See* Ex. 1001, 1:23–28; Pet. 23. Because the term “cast vote record” is not required to be electronic or tabulated, we do not include the second part of the quoted definition: “an electronic record of a voter’s cast voting selections and may be used in the vote tabulation process.” *See* Ex. 1001, 1:23–28.

Petitioner cites a definition for “cast vote record” from the *Electronic Voting Glossary*: “permanent record of all votes produced by a single voter whether in electronic, paper or other form. Also referred to as BALLOT IMAGE when used to refer to electronic ballots. ... An ‘archival record of all votes produced by a single voter.’” Pet. 23–24 (quoting Ex. 1045, 7) (alteration in original). Petitioner, however, does not appear to rely on this definition in its unpatentability analysis. *See generally Id.* In particular, Petitioner’s rationale does not depend on the permanence of the record. *Id.*

In contrast with Petitioner, Patent Owner argues that the cast vote record must be permanent. PO Resp. 4. Patent Owner argues that the definition in the patent is consistent with the definition in the *Electronic Voting Glossary*. *Id.* In Patent Owner’s view, the glossary defines the cast vote record as a “permanent record” or “archival record” of a voter’s vote selections. Sur-reply 18 (citing Ex. 1045, 7–8). According to Patent Owner, the claim excludes transient records. *Id.*

But, here, the patentee created a special and particular definition for “cast vote record.” Ex. 1001, 1:23–28. That definition does not include any requirement that the record be permanently stored. *See id.* “[A] common

meaning, such as one expressed in a relevant dictionary, that flies in the face of the patent disclosure is undeserving of fealty.” *Renishaw*, 158 F.3d at 1249. Because the definition in the ’966 patent disclosure does not require a permanent record or even a record of tabulation, the construction of “cast vote record” in this decision does not require the record to be permanently stored.

Apart from cast vote record, neither party offers or argues for any additional constructions. Because no other terms are in controversy, we do not construe any other claim terms in this decision.

#### *D. Principles of Law*

In this decision, we must determine whether Petitioner has established by a preponderance of the evidence that the specified claims are unpatentable over the cited prior art. 35 U.S.C. § 326(e). 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). This burden never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We previously instructed Patent Owner that “any arguments for patentability not raised in the [Patent Owner Response] may be deemed waived.” Paper 7, 8; *see also In re NuVasive, Inc.*, 842 F.3d 1376, 1381 (Fed. Cir. 2016) (holding that patent owner’s failure to make arguments at trial as instructed in the scheduling order constitutes waiver). Also, the Board’s Trial Practice Guide states that the Patent Owner Response “should identify all the involved claims that are believed to be patentable and state the basis for that belief.” Patent Trial and Appeal Board Consolidated Trial

Practice Guide 66 (Nov. 20, 2019), *available at* <http://www.uspto.gov/TrialPracticeGuideConsolidated> (“CTPG”).

*E. Obviousness over Brockhouse and Heilper*

*1. Claims 1 and 15*

Petitioner asserts that the subject matter of independent claims 1 and 15 would have been obvious over Brockhouse and Heilper. Pet. 49–56. As discussed in the following sections, Petitioner asserts that Brockhouse teaches all limitations of claims 1 and 15, except for using a dictionary to improve the accuracy of the OCR process. *Id.* For that remaining limitation, Petitioner asserts that one of ordinary skill in the art would have used a dictionary, as taught by Heilper, for error correction. *Id.* at 56.

*a. Brockhouse*

Brockhouse describes a voting system that prints a voter’s selections on a card. *See generally* Ex. 1004, Abstract, Fig. 6. In one embodiment, the voter selects candidates on a touch-screen device. *Id.* ¶¶ 41–42. After the voter finishes selecting the candidates, the voting system prints those selections on an activation card. *Id.* ¶ 53. The activation card includes other information, such as a bar code. *Id.* In one mode, the tabulation device decodes voter selections on the activation card using OCR and generates the cast vote record from the resulting data set. *Id.* ¶¶ 130, 134.

*b. Heilper*

Heilper generally relates to OCR error correction. Ex. 1005, 1:6–9. Heilper explains that an OCR process is typically followed by an error-correction step. *Id.* at 1:20–21. For example, Heilper describes an algorithm for dictionary-based OCR error correction. *Id.* at 1:26–41.

*c. Preamble*

The preamble of claim 1 recites “A method for electronic voting using printed vote records.” Ex. 1001, 8:43–44. Claim 15 recites the same preamble. *Id.* at 9:64–65.

To the extent that the preamble is limiting, Brockhouse teaches the subject matter recited in the preamble. Pet. 49 (citing Ex. 1004, Abstract; Shamos Decl. ¶¶ 208–209). In particular, the cited evidence shows that Brockhouse’s electronic voting station uses a printed activation card. Ex. 1004, Abstract. Brockhouse’s printed activation card shows the voter’s selections. *Id.* Thus, Petitioner shows that Brockhouse teaches a method for electronic voting using printed vote records, as recited in claims 1 and 15.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.

*d. Recording Vote Selections*

Claim 1 recites, in part, “recording a voter’s vote selections.” Ex. 1001, 8:45. Claim 15 recites a similar step but adds that the selection is “with a ballot marking device.” *Id.* at 9:66–67. The ’966 patent discloses that a “wide range” of BMDs may be used. *Id.* at 4:27–30. In one example, the voter enters selections via the BMD’s touch screen, and the BMD prints a PVR with an internal printer. *Id.* at 4:39–45.

Petitioner asserts that Brockhouse’s voting apparatus performs the recited recording. See Pet. 50 (citing Ex. 1004 ¶¶ 16, 41–42, 53, 104–106, 117, 134). Like the BMD disclosed in the ’966 patent, Brockhouse’s voting apparatus records a voter’s selections via a touch-screen display or a keypad. Ex. 1004 ¶¶ 41–42, *cited in* Pet. 50. After these selections, Brockhouse’s

voting apparatus prints a PVR, i.e., an activation card, to create the cast vote record. *Id.* ¶ 53, *cited in* Pet. 50. Thus, Petitioner shows that Brockhouse records a voter's vote selections with a BMD.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner's cited evidence and analysis, which Patent Owner does not contest.

*e. Generating a Printed Vote Record*

Claim 1 recites, in part, "generating a printed vote record of the voter's vote selections, the printed vote record containing voter readable text indicating the voter's vote selections." Ex. 1001, 8:46–48. Claim 15 recites a similar limitation but adds "a candidate name of a voter's vote selection." *Id.* at 10:1–4.

Petitioner asserts that Brockhouse prints the recited PVR. Pet. 52. Brockhouse states that "after a voter has made his/her voting selections with universal voting station 12, printer 72 prints a master bar code 110, vote selection bar codes 112, and vote selections 114 on activation card 20." Ex. 1004 ¶ 53, *quoted in* Pet. 52. One embodiment of Brockhouse's activation card is shown below with Petitioner's annotations. Pet. 52.

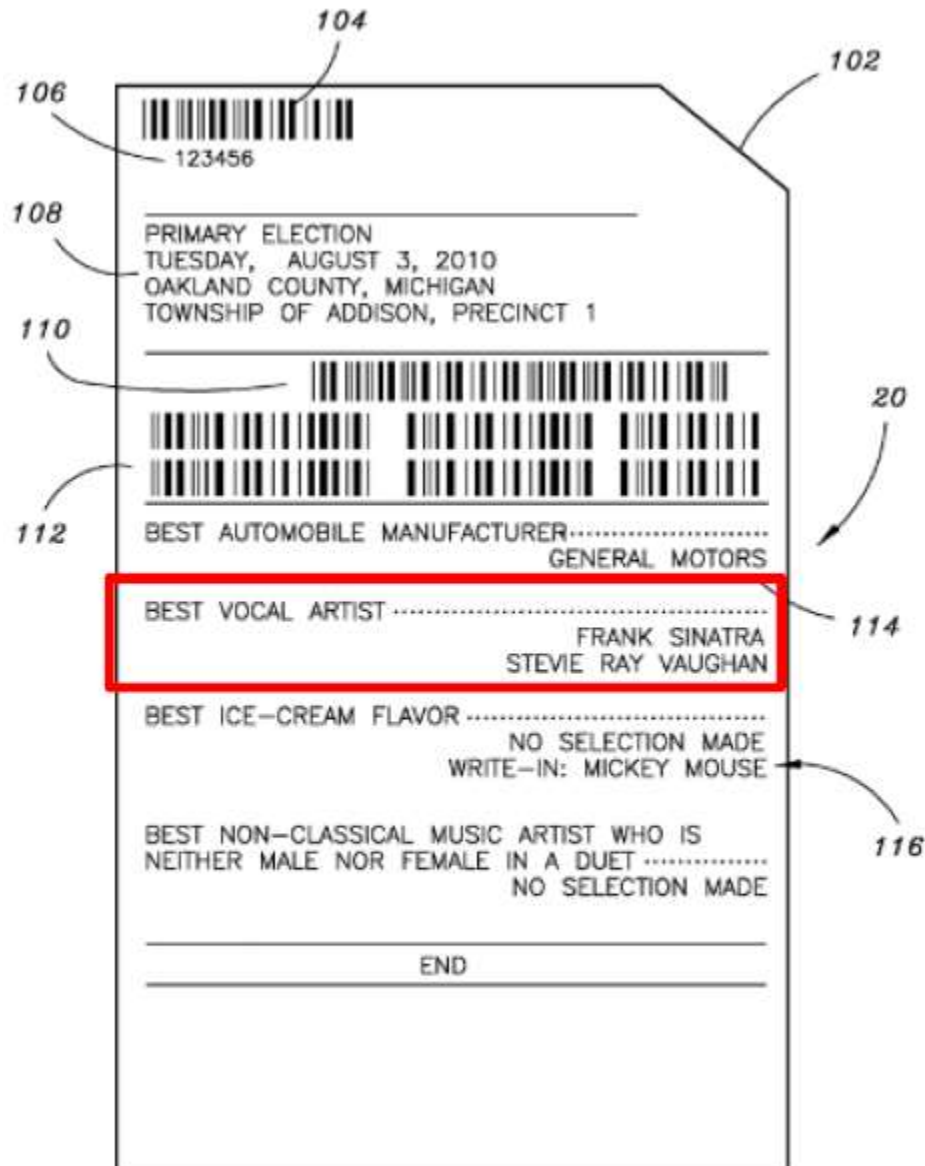


FIG. 6

**The figure above shows Brockhouse’s activation card with Petitioner’s annotations. Pet. 52 (citing Ex. 1004, Fig. 6, ¶ 16).**

Figure 6 shows, among other things, the names “FRANK SINATRA” and “STEVIE RAY VAUGHAN.” Ex. 1004, Fig. 6. Brockhouse explains that the voter chose these candidates for the “BEST VOCAL ARTIST” contest. *Id.* ¶ 56. On this record, Petitioner shows that Brockhouse teaches a

PVR containing voter-readable text indicating the voter's vote selections: candidates Frank Sinatra and Stevie Ray Vaughn, among others. Pet. 52 (citing Ex. 1004, Fig. 6, ¶¶ 16, 53, 106; Shamos Decl. ¶¶ 216–218).

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner's cited evidence and analysis, which Patent Owner does not contest.

*f. Scanning the Printed Vote Record*

Claim 1 recites, in part, “scanning the printed vote record, the scanning including scanning the voter readable text.” Ex. 1001, 8:49–50. Claim 15 recites, in part, “electronically scanning the printed vote record, the scanning including scanning the candidate name.” *Id.* at 10:5–6.

Petitioner asserts that Brockhouse teaches these limitations. Pet. 53 (citing Ex. 1004 ¶¶ 106, 130, 134; Shamos Decl. ¶¶ 219–221). In one of the cited paragraphs, Brockhouse teaches that, after tabulation device 14 receives an activation card, ballot-scanner assembly 194 scans the card and sends the result to a processor. Ex. 1004 ¶ 130. Considering Brockhouse's description of ballot-scanner assembly 194 here, Petitioner shows that Brockhouse teaches the limitations about scanning the PVR.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner's cited evidence and analysis, which Patent Owner does not contest.

*g. Optical Character Recognition*

Claim 1 recites, in part, “utilizing optical character recognition (OCR) on the scanned voter readable text to create a data set which identifies the voter's vote selections.” Ex. 1001, 8:51–53. Claim 15 has a similar

limitation but recites candidate name instead of voter-readable text:

“utilizing optical character recognition (OCR) on the scanned *candidate name to create a first data set.*” *Id.* at 10:7–8 (emphasis added).

Petitioner asserts that Brockhouse teaches these limitations. Pet. 54 (citing Ex. 1004 ¶ 134; Shamos Decl. ¶¶ 222–224). In the paragraph cited by Petitioner, Brockhouse discloses that devices 12 or 14 use OCR to “decode the voter selections 114 on the printed activation cards.” Ex. 1004 ¶ 134. As discussed above, Petitioner sufficiently shows that Brockhouse’s activation card has candidate names. *Supra* § II.E.1.e. Thus, Petitioner shows that Brockhouse teaches using the OCR process recited in claims 1 and 15.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.

#### *h. Generating a Cast Vote Record*

Claim 1 recites, in part, “generating a cast vote record from the data set so that voter selections in the cast vote record are based on the voter readable text.” Ex. 1001, 8:54–56. Claim 15 recites, in part, “generating a cast vote record based on the comparing of the first data set with the election dictionary so that voter selections in the cast vote record are based on the scanned candidate name.” *Id.* at 10:15–18.

We construe “cast vote record” as “a record that indicates the determined voter’s choice or selection in a manner determined in accordance with the voting system.” *See supra* § II.C.

Petitioner asserts that Brockhouse teaches generating the cast vote record, as recited. Pet. 54 (citing Ex. 1004 ¶¶ 117, 130, 134). In the cited paragraphs, Brockhouse teaches that the tabulation device uses OCR to

decode voter selections on the card and generates the cast vote record from the resulting data set. Ex. 1004 ¶¶ 130, 134. Because the OCR data comes from the voter’s selections, Petitioner sufficiently shows that Brockhouse’s record indicates the determined voter’s choice—as required by the construction of cast vote record above. *See supra* § II.C. Petitioner shows that Brockhouse generates the cast vote record, as recited in claims 1 and 15.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.

*i. The Election Dictionary*

Claim 1 recites, in part,

wherein identifying the voter’s vote selection includes  
comparing the data set to an election dictionary, the  
election dictionary containing potential vote  
choices,

wherein the comparing the data set to the election  
dictionary is utilized to confirm an accuracy of the  
OCR to limit potential OCR errors.

Ex. 1001, 8:57–62. Claim 15 recites a similar limitation. *See id.* at 10:9–14.

*(1) Petitioner’s Obviousness Rationale*

Petitioner asserts that, because of “the importance of ensuring that a cast vote record is accurate in an official election,” it would have been obvious “to incorporate the known error correction safeguards disclosed in Heilper, such as the use of a dictionary, with the common OCR procedures utilized in Brockhouse.” Pet. 56 (citing Shamos Decl. ¶¶ 231–235).

Petitioner asserts that OCR processes are error prone. *Id.* (citing Ex. 1005, 1:13–41). According to Petitioner, “One of ordinary skill in the art would

have further known that the cast vote record should be based on the error-corrected OCR data set—a data set that as established above includes candidate name(s).” *Id.* (citing Shamos Decl. ¶ 234).

Patent Owner argues that Petitioner has not shown that it would have been obvious to combine Heilper’s dictionary with Brockhouse’s voting system. PO Resp. 31–34. Patent Owner argues that Petitioner’s reasoning is “too generic and conclusory to support a finding of obviousness.” *Id.* at 32 (quoting Pet. 56). We disagree.

The record supports Petitioner’s rationale that Heilper would have provided “correction safeguards” for Brockhouse’s OCR: Heilper teaches that OCR processes typically segment the scanned document into individual characters and then apply a pattern-recognition algorithm to each character to find a match. Ex. 1005, 1:15–20. Heilper teaches that this is typically followed by an error-correction step because OCR processes are error prone. *Id.* at 1:20–21. Heilper’s error correction includes looking up each OCR-generated word in a dictionary and substituting the closest matching word. *Id.* at 1:21–25, *quoted in* Pet. 56.

These teachings echo Dr. Shamos’s assertion that dictionaries “could and should be used to ensure the accuracy of the data set resulting from use of OCR,” which Heilper says is error prone. Shamos Decl. ¶ 231; Ex. 1005, 1:20–21. Thus, we credit Dr. Shamos’s testimony on this point. *See* Shamos Decl. ¶ 231.

Contrary to Patent Owner’s arguments, Petitioner’s assertions here are not “generic” or “conclusory.” PO Resp. 32, 34. Rather, with ample support from Dr. Shamos’s testimony and Heilper’s teachings, Petitioner proposes a specific improvement to Brockhouse: correcting the OCR-generated results by using Heilper’s dictionary. *Id.* Heilper’s teachings and Dr. Shamos’s

testimony also support Petitioner's conclusion that the accuracy of Brockhouse's OCR could be improved. Pet. 56; Ex. 1005, 1:20–21 (disclosing that OCR is error prone); Shamos Decl. ¶ 231.

On this record, Petitioner provides sufficient “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

(2) *Patent Owner's arguments about a “generic dictionary”*

Patent Owner argues that Heilper's dictionary is not an “election dictionary,” as recited in the claim. PO Resp. 28–31; *see also id.* at 34 (arguing that the combination does not teach this limitation). Patent Owner argues that the recited election dictionary's purpose is to “provide reliable matching of the OCR results with the proper ballot choice.” *Id.* at 29 (citing Ex. 1001, 8:19–23). According to Patent Owner, Petitioner only argues that Heilper discloses a generic dictionary, which does not contain potential voter choices. *Id.* Patent Owner argues that Heilper's generic dictionary does not fulfill the purpose of an election dictionary because most voter selections will be proper nouns, which do not appear in an ordinary dictionary. *Id.* at 29–30.

The record, though, does not support Patent Owner's narrow characterization of Heilper's teachings as only applying to a particular type of OCR-generated content. *Id.* at 28–31, 34. Specifically, Heilper explains that the computer looks up the OCR-generated word in the dictionary to obtain the corrected word. Ex. 1005, 1:13–41, *quoted in* Pet. 56. This means that Heilper's dictionary is an appropriate dictionary that is expected to contain the correct words. *Id.*

The correct words are not limited to generic English words. Rather, the correct words are determined by the content to be corrected. For

example, the appropriate dictionary and correct words could represent DNA sequences, as taught by Heilper, if DNA sequences were at issue. *See* Pet. Reply 15; *see also* PO Resp. 27 (discussing Ex. 1005, 3:10–13, 7:50–53). According to Dr. Lopresti, one would not expect to find DNA sequences in a generic English dictionary. Ex. 1053, 125:20–22 (Dr. Lopresti’s Deposition). Likewise, in the deposition, Dr. Lopresti acknowledged that Heilper could be used for non-English words. *Id.* at 113:19–114:19.

In fact, Dr. Lopresti’s testimony indicates that the dictionary would be used for every OCR-generated word:

[Y]ou would assume that if you’re going to do dictionary comparison, that every word that you would want to recognize in the document would be compared to that dictionary[’s] terms.

*Id.* at 81:16–82:3, *cited in* Pet. Reply 16–17. Here, Brockhouse’s OCR-generated words include the candidate names. *See* Ex. 1004 ¶ 134; *supra* § II.E.1.e. A person of ordinary skill in the art would understand that the “correct” words in the context of the combination would be candidates’ names. *See* Ex. 1053, 81:16–82:3 (explaining that dictionaries contain the words that you want to recognize); Ex. 1005, 1:13–41 (explaining that dictionaries are used for correcting OCR-generated words). “A person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 389, 421 (2007). Thus, the record supports Petitioner’s position that, in the proposed combination, Heilper’s dictionary would contain the correct candidate names when applied to Brockhouse’s OCR-generated candidate names. *See* Pet. 56 (citing Shamos Decl. ¶ 234).

Using a dictionary that does not contain the words that you would expect to find, as described in Patent Owner’s characterization (PO Resp. 28–31), would be pointless and contradicts Heilper’s express teaching that the dictionary contains the corrected words. Ex. 1005, 1:13–41. If a dictionary did not contain the words that could be substituted for the OCR-generated words, then the dictionary would be unable to make the “correction” that Heilper describes. *See id.*; *accord* Ex. 1053, 81:16–82:3.

Thus, the record does not support Patent Owner’s characterization of Heilper’s dictionary as generic. PO Resp. 28–31. Because Dr. Lopresti’s testimony on this issue relies on Patent Owner’s narrow characterization of Heilper, we give the testimony little weight. Lopresti Decl. ¶¶ 55–59.

We disagree with Patent Owner that Petitioner’s Reply introduces a new theory about a “specialized dictionary.” Sur-reply 8–13. Rather, the Reply responds to Patent Owner’s mischaracterization of Heilper’s dictionary as generic. *See* PO Resp. 28–31. In the Reply, Petitioner reiterates that Heilper’s dictionary has the “correct words for use in string matching.” *Compare* Pet. Reply 15 (citing Ex. 1005, 2:50–3:9), *with* Pet. 56 (quoting Ex. 1005, 1:13–41 about correcting words).

### (3) *The Genus-Species Argument*

For similar reasons, Patent Owner’s genus-species argument is unclear and without a basis in the claim language. *See* PO Resp. 30; Sur-reply 10–11. Specifically, Patent Owner argues that Heilper teaches “a generic ‘dictionary’ genus,” and that the recited election dictionary is a species of a generic dictionary. PO Resp. 30; Sur-reply 10–11. But it is unclear what defines the purported genus and each species. For example, does the dictionary’s content—e.g., the potential vote choices—define the species?

Notably, Patent Owner does not persuasively explain why the claim precludes the election dictionary from containing additional content. *See* PO Resp. 30; Sur-reply 10–11. By definition, a genus encompasses a species. This could mean that a genus dictionary includes the content of each species. If so, the genus dictionary could also be an election dictionary because it also contains the potential vote choices from the species dictionary, as required by the claim. Patent Owner’s genus-species argument is simply unclear on this point. PO Resp. 30; Sur-reply 10–11.

Generally, Patent Owner’s arguments about a dictionary that uses context-specific entries to limit OCR errors does not align with the claim language. Sur-reply 11. For example, Patent Owner argues, “An election dictionary uses a context-specific set of entries—e.g., ‘potential vote choices’—to limit OCR errors in that context.” *Id.* (emphasis omitted). But apart from the limitation “the election dictionary containing potential vote choices,” Patent Owner does not explain why the claimed dictionary has only context-specific terms. *See generally id.*

Nevertheless, we need not construe the term “election dictionary” because the Brockhouse-Heilper combination addresses Patent Owner’s narrow reading. *See* Pet. 56. Here, Petitioner is not proposing to use the content from any particular embodiment of Heilper’s dictionary, e.g., words from a general-purpose dictionary or DNA sequences. *See, e.g.,* Ex. 1005, 3:10–13, 7:50–53, *discussed in* PO Resp. 27. Instead, Petitioner asserts that “the cast vote record should be based on the error-corrected OCR data set—a data set that . . . includes *candidate name(s)*.” Pet. 56 (emphasis added). That is, Heilper’s dictionary contains the words to be substituted as the “correct” words. Ex. 1005, 1:13–41, *quoted in* Pet. 56. And Petitioner has shown that the correct words are the potential vote choices. *See supra*

§ II.E.1.e. So Petitioner’s rationale is based on a dictionary with the potential vote choices, not a generic one. Pet. 56.

Thus, we disagree with Patent Owner’s genus-species arguments. *See* PO Resp. 30; Sur-reply 10–11.

(4) *Expectation of Success*

Patent Owner’s mischaracterization of Heilper is also a basis for its expectation-of-success argument: In Patent Owner’s view, “There are reasons to doubt whether a POSITA would expect that adding Heilper’s generic dictionary to Brockhouse would result in the claimed invention, which specifically requires an ‘election dictionary containing potential vote choices.’” PO Resp. 35 (emphasis omitted). According to Patent Owner, “Without modification, a generic dictionary would not be tailored to a particular election and would therefore not contain potential vote choices—which would almost exclusively be proper nouns.” *Id.* Patent Owner argues that Petitioner failed to address expectation of success in its obviousness analysis, which alone is a basis for denial. *Id.* at 34–36. Patent Owner argues that Petitioner did not argue that it would have been obvious to modify Heilper or Brockhouse to satisfy the election dictionary limitation. *Id.* at 30–31.

Petitioner, however, need not show an expectation of success for using a generic dictionary to correct candidate names because Petitioner’s challenge is not based on a generic dictionary. “It is well-established that a determination of obviousness based on teachings from multiple references does not require an actual, physical substitution of elements.” *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012). Yet Patent Owner’s expectation-of-success argument assumes that a generic dictionary would be substituted without modification to correct the OCR-generated words in Brockhouse.

See PO Resp. 34–36. Doing so, however, would contradict Heilper’s express teaching that a dictionary with the “correct” words should be used. Ex. 1005, 1:13–41, *quoted in* Pet. 56. In sum, the expectation-of-success argument mischaracterizes Petitioner’s combination and Heilper’s teachings. PO Resp. 34–36.

(5) *Objective Indicia of Non-Obviousness*

Patent Owner also argues that the claimed election dictionary solves a known problem that others failed to solve. PO Resp. 36–38. According to Patent Owner, a specialized election dictionary would “appropriately narrow the potential word choices for the OCR process,” and as a result, “the system will be less likely to misread a vote choice.” *Id.* at 37. This is a “critical obstacle,” in Patent Owner’s view, to OCR’s adoption in voting. *Id.* According to Patent Owner, “substantial secondary considerations of non-obviousness weigh against finding any of the challenged claims obvious.” *Id.* at 36.

In particular, Patent Owner asserts that, “[u]ntil at least April 2019, [Election Systems & Software] maintained publicly that OCR could not be relied on in voting machines, in part because of situations where two candidates have the same or similar names.” *Id.* (citing Ex. 2008, 6). In Patent Owner’s view, this indicates that even a “sophisticated supplier of voting machines,” like Election Systems & Software (ES&S), did not find it obvious to use teachings from Heilper to arrive at the claimed invention. *Id.* (citing Lopresti Decl. ¶ 67).

There are two main reasons why we disagree with Patent Owner that there is any objective evidence of non-obviousness, such as skepticism or long-felt need.

First, Patent Owner's arguments (*id.* at 36–38) ignore Brockhouse's teachings about using OCR in the voting process. *See* Pet. 54 (citing Ex. 1004 ¶ 134; Shamos Decl. ¶¶ 222–224). In particular, Brockhouse uses OCR to decode voter selections 114 on the printed activation cards. Ex. 1004 ¶ 134. And the cover of the Brockhouse patent shows ES&S as the assignee. *Id.* at code (73). For at least the reason that ES&S's patent application proposes using OCR to decode voter selections and is prior art here, we disagree with Patent Owner's assertion that the record shows that ES&S was skeptical about using OCR in the voting process. *See* PO Resp. 36–38.

Second, we disagree with Patent Owner's characterization of ES&S's comments in its letter. *Id.* (citing Lopresti Decl. ¶ 68; Ex. 2008, 5–6; Ex. 2009, 10; Ex. 2013, 1). For instance, Patent Owner argues that ES&S states that “OCR could not be relied on in voting machines.” *Id.* (citing Ex. 2008, 6). We see little support for this assertion. Rather, the quoted passage was ES&S's response to a question about using barcodes, not OCR:

Experts have raised significant concerns about the risks of ballot marking machines that store voter choice information in *non-transparent forms that cannot be reviewed by voters (i.e., such as barcodes or QR codes)*, noting that errors in the printed vote record could potentially evade detection by voters. Do you currently sell any machines whose paper records do not permit voters to review the same information that the voting system uses for tabulation? If so, do you believe this practice is secure enough to be used in the 2020 election cycle?

Ex. 2008, 5 (emphasis added). ES&S's response explains that barcodes can be used to determine how to count the vote after a name is recognized by OCR, not to help recognize the printed name itself:

It is possible that there could be two separate and distinct candidates, both named Jane Doe, who are running for different

offices on the same ballot. The system cannot use OCR to read “Jane Doe” and record a vote reliably because it would have to know for what race the vote for “Jane Doe” should be counted. Thus, the barcode is used to tell the tabulation machine for what race Jane Doe should receive a vote.

*Id.* at 6. Here, ES&S’s comment indicates that the name “Jane Doe” has been generated by OCR, and the bar code tells the system how to use the OCR-generated result. *Id.* ES&S’s response, however, does not express skepticism whether OCR could be used to accurately recognize the name “Jane Doe.” *Id.*

Nor does Patent Owner explain how an election dictionary is relevant to the issues discussed in ES&S’s letter. *See* PO Resp. 36–38. If an election dictionary were used in the letter’s hypothetical election, then presumably Jane Doe would be included in the dictionary as a potential vote choice for both races. Although the dictionary could help in accurately recognizing the name Jane Doe, an accurate recognition of the name Jane Doe would not solve the problem of determining for what race Jane Doe should receive a vote. Thus, we disagree with Patent Owner that ES&S’s comments in the letter express skepticism that OCR could be relied on in voting machines. *Id.* at 36 (citing Ex. 2008, 6). Contrary to Patent Owner’s arguments, ES&S’s response assumes that the name Jane Doe has been accurately recognized. Ex. 2008, 6.

In sum, Patent Owner has not produced evidence of skepticism or that the claimed election dictionary solves a known problem that others failed to solve. *See* PO Resp. 36–38. Generally, “[f]or objective [evidence of secondary considerations] to be accorded substantial weight, its proponent must establish a nexus between the evidence and the merits of the claimed invention.” *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1246 (Fed. Cir.

2010). But, regardless whether Patent Owner has established a nexus here, the proffered evidence does not carry “substantial weight” for at least the reason that it shows that the industry, or at least ES&S, used OCR in the voting process.

(6) *Patent Owner’s Teaching-Away Arguments*

Patent Owner also argues that Dr. Shamos authored a paper where “he emphasized that one way to improve the reliability and security of an electronic voting machine was to omit any list of the candidates or parties from the software.” PO Resp. 37 (emphasis omitted). In Patent Owner’s view, this is “evidence of teaching away in the prior art.” *Id.*

Patent Owner, though, does not sufficiently explain how the paragraph quoted from Dr. Shamos’s paper is relevant to the Brockhouse-Heilper combination. *Id.* at 37–38. In particular, Patent Owner’s comments and Dr. Lopresti’s declaration suggest that one way to use Heilper’s dictionary in Brockhouse would be to include an “election dictionary listing candidate names and additional information in the software for an electronic voting machine.” *Id.* at 38. Yet the quoted paragraph from Dr. Shamos’s paper says nothing about dictionaries, let alone the specific teachings of Brockhouse or Heilper. Ex. 2003, 12–13.

Rather, the paragraph quoted from Dr. Shamos’s paper describes a system that is unlike either Brockhouse or Heilper. *See id.* Specifically, the quoted paragraph describes a compromised machine that has been programmed to move votes from one party to another. *Id.* To prevent this from happening, a system can be designed to present the candidate and party names as images. *Id.* But even this countermeasure can be defeated by software containing “a complete optical character recognition algorithm.” *Id.* That is, the quoted paragraph assumes that the system lacks such an OCR

algorithm. *See id.* But both Brockhouse and Heilper disclose systems that use OCR algorithms. *See supra* § II.E.1.e. So the quoted paragraph has little relevance to whether one of ordinary skill in the art would have combined the teachings of Brockhouse or Heilper, which rely on OCR technology.

Thus, we find scant support in the paragraph for a conclusion that this paper teaches away from using OCR dictionaries, generally, or teaches away from combining Brockhouse and Heilper, in particular. PO Resp. 37–38. For this reason, we disagree with Patent Owner’s teaching-away argument (*id.*), and we accord minimal weight to Dr. Lopresti’s testimony on this issue (Lopresti Decl. ¶ 71).

#### (7) Conclusion

From the entirety of the record, we find that Petitioner has shown that a person of ordinary skill in the art would have combined Brockhouse and Heilper, that this combination would have been within the level of ordinary skill in the art, and that the combination teaches all limitations of claims 1 and 15. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 1 and 15 would have been obvious over Brockhouse and Heilper.

#### 2. Claims 2, 3, and 16

Claim 2 recites, “The method of claim 1, wherein the comparing the data set to an election dictionary includes using a long string matching algorithm.” Ex. 1001, 8:43–62. Claim 16 depends from claim 15 and recites a similar limitation. *Id.* at 9:64–10:21. Claim 3 further limits the matching algorithm by reciting that it “uses a Levenshtein distance value.” *Id.* at 8:66–67.

Petitioner asserts that Heilper teaches the recited matching algorithm. Pet. 57 (quoting Ex. 1005, 1:13–41). According to the quoted paragraph,

dictionary-based error correction typically uses a string-matching algorithm, and these algorithms are based on the Levenshtein distance. Ex. 1005, 1:26–41. Thus, Petitioner shows that Heilper teaches the recited long-string matching algorithm and Levenshtein-distance value.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. Upon review of the entirety of the record, we are persuaded by Petitioner’s cited evidence and analysis, and we credit the undisputed testimony of Dr. Shamos. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter recited in claims 2, 3, and 16 would have been obvious.

3. *Claims 4, 5, 18, and 19*

Claim 4 depends from claim 1 and recites, in part, “wherein the data set includes a candidate’s name, the data set combined with additional information related to the voter’s vote selection to assist in identifying the voter’s vote selection.” Ex. 1001, 9:1–4. Claim 18 recites a similar limitation and “scanning additional information related to the voter’s vote selection to assist in identifying the voter’s vote selection.” *Id.* at 10:24–28.

a. *Claim Construction*

Petitioner asserts that claim 4 is indefinite because it is “ungrammatical and meaningless as written.” Pet. 85–86. For the purpose of the obviousness ground, Petitioner interprets claim 4 to require that the data set combined with additional information is used to assist in identifying the voter’s vote selection. *See id.* at 60. For example, Petitioner explains that “[a] POSITA would have also recognized that this additional information—contest name(s)—could be used to assist in identifying the voter’s vote selection.” *Id.* at 59–60.

Petitioner’s interpretation is supported by the embodiments disclosed in the patent. *See id.* For instance, the ’966 patent discloses that the additional data can be information other than the candidate’s name, such as “sequence number data,” “line number data affiliated with a contest,” “the contest name itself,” or “data related to the candidate.” Ex. 1001, 5:14–22. In one embodiment, the OCRed name and the additional data are used together as a key into the election dictionary. *Id.* at 5:14–16.

Patent Owner does not rebut Petitioner’s interpretation here. *See generally* PO Resp., Sur-reply. Rather, by arguing that Petitioner does not explain why a skilled artisan “would use the information,” Patent Owner’s arguments appear to be consistent with Petitioner’s interpretation. PO Resp. 39; *see also* Sur-reply 13 (arguing that the claims require “using” the information). Thus, we are persuaded that Petitioner’s interpretation of claim 4 should be applied here. Pet. 60.

*b. Analysis of Petitioner’s Obviousness-based Challenge to Claims 4 and 18*

As for the prior art, Petitioner asserts that Brockhouse’s PVR has additional information, including the contest name. *Id.* at 59. To show this, Petitioner annotates Brockhouse’s Figure 6, below. *Id.*

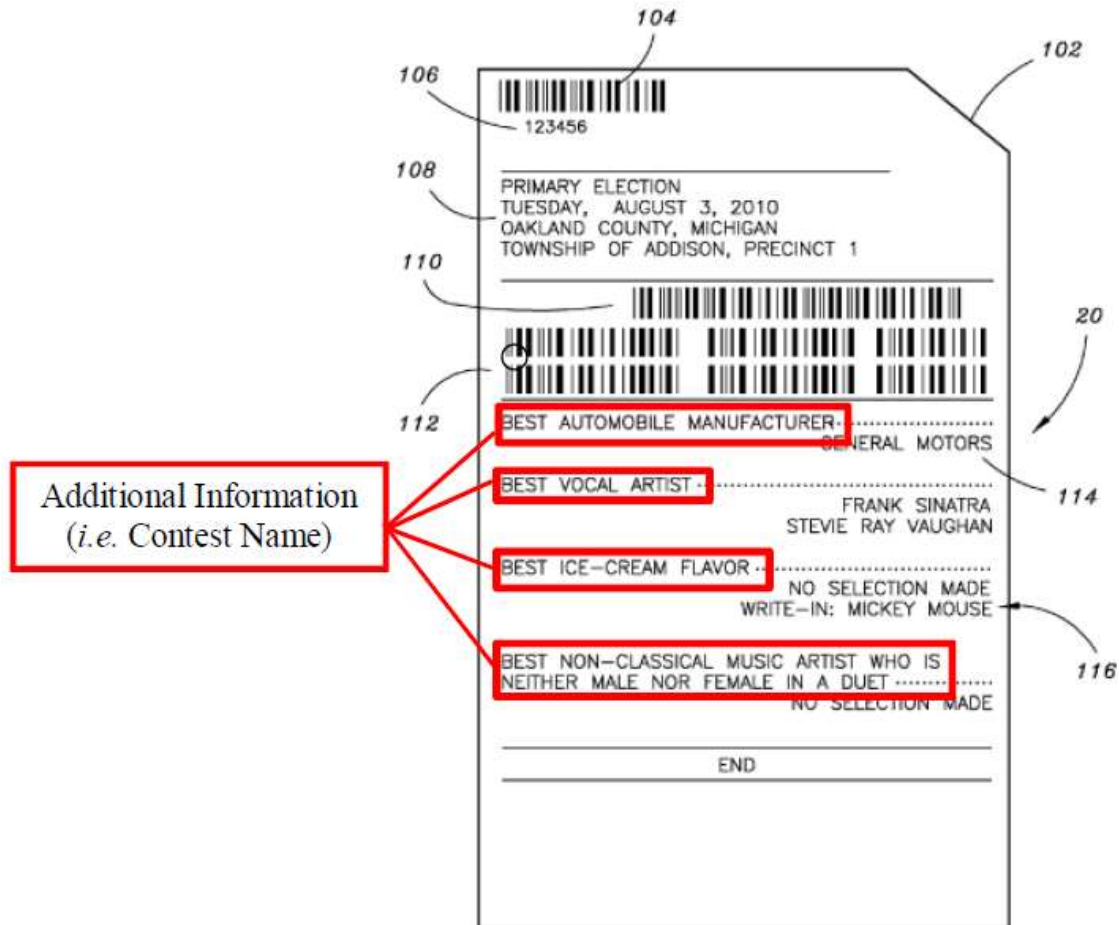


FIG. 6

**Figure 6, above, shows Brockhouse’s PVR with Petitioner’s annotation on the contest name. Pet. 59.**

Figure 6 shows a PVR with “BEST VOCAL ARTIST,” among other contests. Ex. 1004, Fig. 6. Brockhouse uses OCR to decode the vote selections. *Id.* ¶ 134. Petitioner asserts that it would have been obvious to use the contest name to help identify the vote selection. Pet. 59–60 (citing Shamos Decl. ¶¶ 241–250).

Patent Owner disagrees and argues that Petitioner does not explain why a person of ordinary skill in the art would use the information in this way. PO Resp. 39 (Lopresti Decl. ¶¶ 72–73; Ex. 1001, 9:2–4, 10:26–28); *see also* Sur-reply 13 (“Even if ‘vote total reports’ include the contest name,

ES&S has not explained why this would lead a POSITA to use the contest name in the OCR process for a single PVR, as claimed.”). Patent Owner also argues that Petitioner’s assertions are unsupported. PO Resp. 39. Patent Owner accuses Petitioner of engaging in impermissible hindsight. *Id.* at 40. We disagree with all these arguments.

Petitioner’s assertions are supported through its corresponding citations to Brockhouse: As discussed above with respect to independent claims 1 and 15 (*supra* § II.E.1.g), Brockhouse uses OCR to recognize vote selections 114. Pet. 54 (citing Ex. 1004 ¶ 134; Shamos Decl. ¶¶ 222–224). Brockhouse’s “vote selections 114 are human readable text identifying each voting selection made by the voter (e.g., ‘General Motors’) *and* a brief description of the contest and/or candidate (e.g., ‘BEST AUTOMOBILE MANUFACTURER’).” Ex. 1004 ¶ 56 (emphasis added). Brockhouse uses OCR to “decode the voter selections 114 on the printed activation cards as an alternative to decoding the vote selection barcodes 112 to determine the corresponding vote selections.” *Id.* ¶ 134, *cited in* Pet. 54 (addressing the independent claims).

Because Brockhouse uses OCR to decode the contest name in 114 to determine to vote selections, Petitioner’s assertion that the additional contest information in 114 is used to assist in identifying the voter’s vote selection, and Dr. Shamos’s testimony about this issue, are adequately supported by the record. *See* Pet. 54, 59. Thus, we credit Dr. Shamos’s testimony on this point. Shamos Decl. ¶¶ 241–250.

Patent Owner argues that “ES&S (which is both the Petitioner and the assignee of Brockhouse) publicly recognized that one challenge for using OCR in voting systems is handling situations where candidates have similar names.” PO Resp. 40 (citing Ex. 2008, 6). Patent Owner argues that ES&S

“previously expressed complete ignorance about how to solve this same problem.” *Id.* at 41; *see also* Sur-reply 13–14. In Patent Owner’s view, ES&S’s prior public statements are objective indicia of non-obviousness, or “secondary considerations,” in the obviousness analysis. PO Resp. 41–40. We disagree.

Patent Owner quotes a letter from ES&S about using OCR in tabulation systems:

Even tabulation systems that utilize Optical Character Recognition (OCR) incorporate the use of a barcode to count the vote. Here’s why: It is possible that there could be two separate and distinct candidates, both named Jane Doe, who are running for different offices on the same ballot. The system cannot use OCR to read “Jane Doe” and record a vote reliably because it would have to know for what race the vote for “Jane Doe” should be counted. Thus, the barcode is used to tell the tabulation machine for what race Jane Doe should receive a vote.

Ex. 2008, 6. This paragraph does not state that every OCR-based tabulation system must use a barcode. *Id.* Nor does it express “complete ignorance” about how to use OCR technology for voting. *Id.* Rather, ES&S’s response to the question here relates to the security of using barcodes. *See supra* § II.E.1.i(5)(discussing how Patent Owner mischaracterizes ES&S’s letter). When considered in context with the question about barcode security, ES&S’s response indicates that bar codes are trusted enough to be used in OCR-based tabulation systems. *Id.*

Even so, the quoted paragraph has little relevance to the Brockhouse patent application publication, assigned to ES&S, because Brockhouse expressly states that OCR is used on the contest name and candidate name (voter selections 114) “*as an alternative* to decoding the vote selection barcodes 112 to determine the corresponding vote selections.”

Ex. 1004 ¶ 134 (emphasis added), *cited in* Pet. 54 (addressing the independent claims). Thus, we disagree with Patent Owner that ES&S’s response in the letter indicates skepticism or any other kind of objective indicia of non-obviousness. PO Resp. 40–41.

Considering all evidence of record, we find that Petitioner has shown that a person of ordinary skill in the art would have combined Brockhouse and Heilper, that this combination would have been within the level of ordinary skill in the art, and that the subject matter of claims 4 and 18 would have been obvious over the combination.

c. *Analysis of Petitioner’s Obviousness-based Challenge to Claims 5 and 19*

Claim 5 depends from claim 4 and recites “wherein the additional information includes information affiliated with a candidate and/or information affiliated with a contest.” Ex. 1001, 9:5–7. Claim 19 depends from claim 18 and recites a similar limitation. *Id.* at 10:29–31. Here, Petitioner identifies the contest name “BEST VOCAL ARTIST,” which is at least affiliated with the candidate “FRANK SINATRA.” Pet. 59 (citing Ex. 1004, Fig. 6). Thus, Petitioner has shown by a preponderance of the evidence that Brockhouse teaches or suggests the subject matter recited in claim 5 and 19, and that the claims are unpatentable. Upon review of the entirety of the record, we are persuaded by Petitioner’s cited evidence and analysis regarding claims 5 and 19 (*id.* at 58–60), which Patent Owner does not contest. *See generally* PO Resp.; Sur-reply.

4. *Claim 17*

Claim 17 depends from claim 15 and further recites “providing a bar code on the printed vote record.” Ex. 1001, 10:22–23. Petitioner asserts that Brockhouse teaches this limitation. Pet 60 (citing Ex. 1004 ¶ 134, Fig. 6).

Because the PVR in Figure 6 of Brockhouse has a bar code printed on it, Petitioner shows that Brockhouse teaches the recited bar code. *See* Ex. 1004 ¶ 134 (discussing bar codes).

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. Upon review of the entirety of the record, we are persuaded by Petitioner’s cited evidence and analysis. We credit the undisputed testimony of Dr. Shamos. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter recited in claim 17 would have been obvious over the combination of Brockhouse and Heilper.

*F. Nadaf, Anticipation or Obviousness*

*1. Independent Claims 6, 23, and 29, Anticipation*

Petitioner asserts that the subject matter of independent claims 6, 23, and 29 is unpatentable as anticipated “and/or” obvious over Nadaf. Pet. 60–69. In this section, we analyze the anticipation-based rationale.

*a. Nadaf*

Nadaf describes an electronic voting device that prints a “verification ballot.” Ex. 1007, 14:7–14. The verification ballot has the voter’s selections “stated in sufficiently legible text.” *Id.* at 14:11–12. The ballot also contains a bar code that encodes “the complete vote by the voter.” *Id.* at 14:12–14. Nadaf’s optical reader compares the text to the bar-code information. *Id.* at 19:7–9. According to Nadaf, the voting device allows “the voter to leave the polling station after comparing the two printed records of their vote, one in text and the other in a two-dimensional bar code.” *Id.* at 13:6–9.

*b. Preamble*

The preambles of claims 6, 23, and 29 each recite “A method for electronic voting using printed vote records.” Ex. 1001, 9:8–9 (claim 6), 10:62–63 (claim 23), 12:13–14 (claim 29).

Petitioner asserts that Nadaf’s electronic voting machine generates printed records. Pet. 61 (quoting Ex. 1007, 10:13–11:1). In the quoted paragraph, Nadaf explains that the printed vote assures the voter about the vote’s integrity and prevents digital tampering. See Ex. 1007, 10:13–11:1. Thus, we determine that Petitioner shows that Nadaf’s method is for electronic voting using PVRs, as recited in the preamble.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.

*c. Recording Vote Selections*

Claims 6, 23, and 29 recite, in part, “recording a voter’s vote selections.” Ex. 1001, 9:10 (claim 9), 10:64 (claim 23), 12:15 (claim 29).

Petitioner asserts that, in Nadaf, the voter uses the voting machine to record selections. Pet. 62 (citing Ex. 1007, 14:3–9; Ex. 1003 ¶¶ 261–262). In the cited paragraph, Nadaf describes that, using a keyboard or touchscreen, the voter chooses the candidates then authorizes the ballot to be printed. Ex. 1007, 14:3–9, *quoted in* Pet. 62. Thus, Petitioner shows that Nadaf discloses the recited recording.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.



election. Ex. 1007, 14:7–14, *quoted in* Pet. 63. Nadaf adds that the choices are “stated in sufficiently legible text.” *Id.* at 14:11–12. Petitioner shows that Nadaf’s PVR contains voter-readable text “indicating the voter’s vote selections,” as recited.

Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest.

*e. Scanning the PVR*

Claims 6 and 29 recite, in part, “scanning the printed vote record, the scanning including scanning the voter readable text.” Ex. 1001, 9:15–16 (claim 6), 12:19–20 (claim 29). Claim 23 recites a similar limitation but adds electronic bar-code scanning: “*electronically* scanning the printed vote record, the *electronical* scanning including scanning the voter readable text and scanning the bar code.” *Id.* at 11:4–6 (emphasis added).

Petitioner asserts that Nadaf discloses an optical reader that performs these operations. Pet. 64–65 (citing Ex. 1007, 13:6–9, 19:7–9). The Petition explains that, after voting, the voter submits the printed ballot to optical reader 25 for scanning. *Id.* (citing Ex. 1007, 19:7–9). In the cited paragraph, Nadaf describes that optical reader 25 compares the text-vote information to the vote information encoded by the bar code. Ex. 1007, 19:7–9, *quoted in* Pet 65.

Patent Owner argues that the Petition incorrectly states that Nadaf’s voter inserts the ballot in an optical reader. PO Resp. 52. Nadaf’s optical reader 25 is in equipment 19. Ex. 1007, Fig. 6. In a deposition, Dr. Shamos later explained that Nadaf’s “voter does not insert the ballot into equipment 19.” Ex. 2005 131:17–18.

Yet who initiates Nadaf's scanning is irrelevant to the claims: Claims 6 and 29 recite "scanning" without specifying an actor. *See* Ex. 1001, 9:15–16 (claim 6), 12:19–20 (claim 29). Claim 23 recites a similar limitation, only adding that scanning is performed "electronically." *Id.* at 11:4–6.

Patent Owner does not explain how Petitioner's mistake shows that Nadaf does not disclose the recited scanning. *See* PO Resp. 52. Petitioner's analysis simply does not depend on whether the voter inserts the ballot into the equipment. *See* Pet. 64–65. Thus, we determine that whether a voter uses equipment 19 is irrelevant in our analysis of Petitioner's assertion that Nadaf discloses the scanning step recited in claims 6, 29, and 23.

Patent Owner argues that Dr. Shamos, in the deposition, admitted that equipment 13 does not compare the text vote to the bar code. PO Resp. 53 (citing Ex. 2005, 137:5–11). Patent Owner argues that Dr. Shamos "confirmed that the intent was to point to equipment 13 (not equipment 19) as performing this claim step" and "disavowed any reliance on equipment 19 for this element." *Id.* at 52–53 (citing Ex. 2005, 117:20–118:8, 131:7–22; 135:11–22), 53 n.5 (citing Ex. 2005 131:7–22, 135:11–22). According to Patent Owner, Petitioner's reliance on equipment 13 is "incompatible with" the theory that equipment 19 OCRs the scanned voter-readable text to create the data set that identifies the voter's vote selections. *Id.* at 54.

In its Reply, Petitioner reiterates that it is relying on equipment 19. *See* Pet. Reply 20–21. In response, Patent Owner argues that Petitioner "now switches to a further modified theory on reply, relying on the page 19 citation (contrary to Shamos's testimony) but now arguing equipment 19 performs this step without human involvement (contrary to the Petition)." Sur-reply 14. We disagree with Patent Owner's view of the record.

Dr. Shamos testified that “[the Petition] says 19, 7 to 9 [of Exhibit 1007]; the citation part is where the scanning occurs to create the cast vote record.” Ex. 2005, 135:21–22. This part of Nadaf describes equipment 19, not equipment 13. Ex. 1007, 19:7–9. Thus, we disagree that Dr. Shamos “disavowed any reliance on equipment 19” for the scanning step. PO Resp. 53.

To the extent that Dr. Shamos’s deposition testimony may be unclear in other regards, the deposition does not change Petitioner’s express reliance on equipment 19 in the Petition. Pet. 64–65. In particular, the Petition cites Nadaf’s description of equipment 19 and refers to the “optical reader.” *Id.* (citing Ex. 1007, 19:7–9).

Consistent with the Petition, the Institution Decision states that “Nadaf’s Figure 6 shows that optical reader 25 is part of the electronic voting equipment.” Inst. Dec. 21 (citing Ex. 1007, Fig. 6, 11:14–15). Indeed, Nadaf’s Figure 6 shows that equipment 19 has optical reader 25. Ex. 1007, Fig. 6. Thus, we based our Institution Decision on Petitioner’s unambiguous citation to equipment 19, not equipment 13. Inst. Dec. 21; *accord* PO Resp. 53 n.5 (“Without the benefit of Dr. Shamos’s deposition, the Board appears to have relied on ES&S misplaced citation to optical scanner 25 in equipment 19.”). Our analysis here also focuses on equipment 19.

As for the subject of the recited scanning, i.e., the “voter readable text,” the Petition asserts that Nadaf’s ballot contains text and barcodes. Pet. 64. As discussed above, Petitioner sufficiently shows that Nadaf’s text-vote information contains voter-readable text. *Supra* § II.E.1.d. Thus, Petitioner shows that Nadaf’s optical reader 25 in equipment 19 is electronic and scans the voter-readable text and bar code. Pet. 64–65. Petitioner’s

assertions about these teachings are unrebutted. *See generally* PO Resp.; Sur-reply.

For the reasons in this section, weighing all the evidence of record, we find that Petitioner has shown by a preponderance of the evidence that Nadaf discloses “scanning the printed vote record, the scanning including scanning the voter readable text,” as recited in claims 6 and 29, and similar limitations recited in claim 23.

*f. Optical Character Recognition*

Claims 6, 23, and 29 recite, in part, “utilizing optical character recognition (OCR) on the scanned voter readable text to create a data set which identifies the voter’s vote selections.” Ex. 1001, 9:17–19 (claim 6), 11:7–9 (claim 23), 12:21–23 (claim 29).

Petitioner asserts that Nadaf’s optical reader 25 applies OCR to the scanned image to create a data set identifying the voter’s selections. Pet. 65 (citing Ex. 1007, 18:9, 19:7–13; Shamos Decl. ¶¶ 270–273). In particular, Petitioner asserts that Nadaf’s optical reader 25 is an optical OCR and QR-code reader. *Id.* (citing Ex. 1007, 18:9). According to the cited paragraphs, Nadaf’s reader 25 reads the bar codes and compares the “text vote information” to the vote information from the bar code. Ex. 1007, 19:7–9, *cited in* Pet. 65.

Because Patent Owner’s arguments about this step and Nadaf’s OCR implicate the other recited steps, we address those arguments the sections that follow.

*g. Generating a Cast Vote Record (CVR)*

Claims 6, 23, and 29 recite, in part, “generating a cast vote record from the data set so that voter selections in the cast vote record are based on the voter readable text.” Ex. 1001, 9:20–22 (claim 6), 11:10–12 (claim 23),

12:24–26 (claim 29). We refer to this limitation as the “the CVR-generation step.”

(1) *Nadaf’s Equipment 1*

Patent Owner argues that, in analyzing the recited scanning step, Petitioner cites the functions of Nadaf’s equipment 1 and 19. *See supra* § II.E.1.f. Nadaf uses equipment 1 for collecting ballots from the voter, and equipment 19 for audit, ballot, and vote aggregation. *See* Ex. 1007, 12:10–14 (describing equipment 1), 17:13–18:9 (describing equipment 19). But we note that, in analyzing the CVR-generation step, all the Petition’s citations pertain to equipment 19. Pet. 66 (citing Ex. 1007, 6:7–10, 17:13–18:9, 19:10–13). Dr. Shamos also asserted in his testimony that equipment 19 performs the CVR-generation step. *See also* Ex. 2005, 135:21–22 (“It says 19, 7 to 9 [of Exhibit 1007]; the citation part is where the scanning occurs to create the cast vote record.”). So Patent Owner’s arguments about equipment 1 are moot. *See* PO Resp. 55–56. Our analysis focuses on Nadaf’s equipment 19.

(2) *Nadaf’s Equipment 19*

Petitioner asserts that Nadaf’s equipment 19 generates the cast vote record from the OCR-generated data set. Pet. 66 (citing Ex. 1007, 6:7–10,

17:13–18:9, 19:10–13; Shamos Decl. ¶¶ 274–276). Nadaf’s equipment 19, is reproduced below. Ex. 1007, Fig. 6.

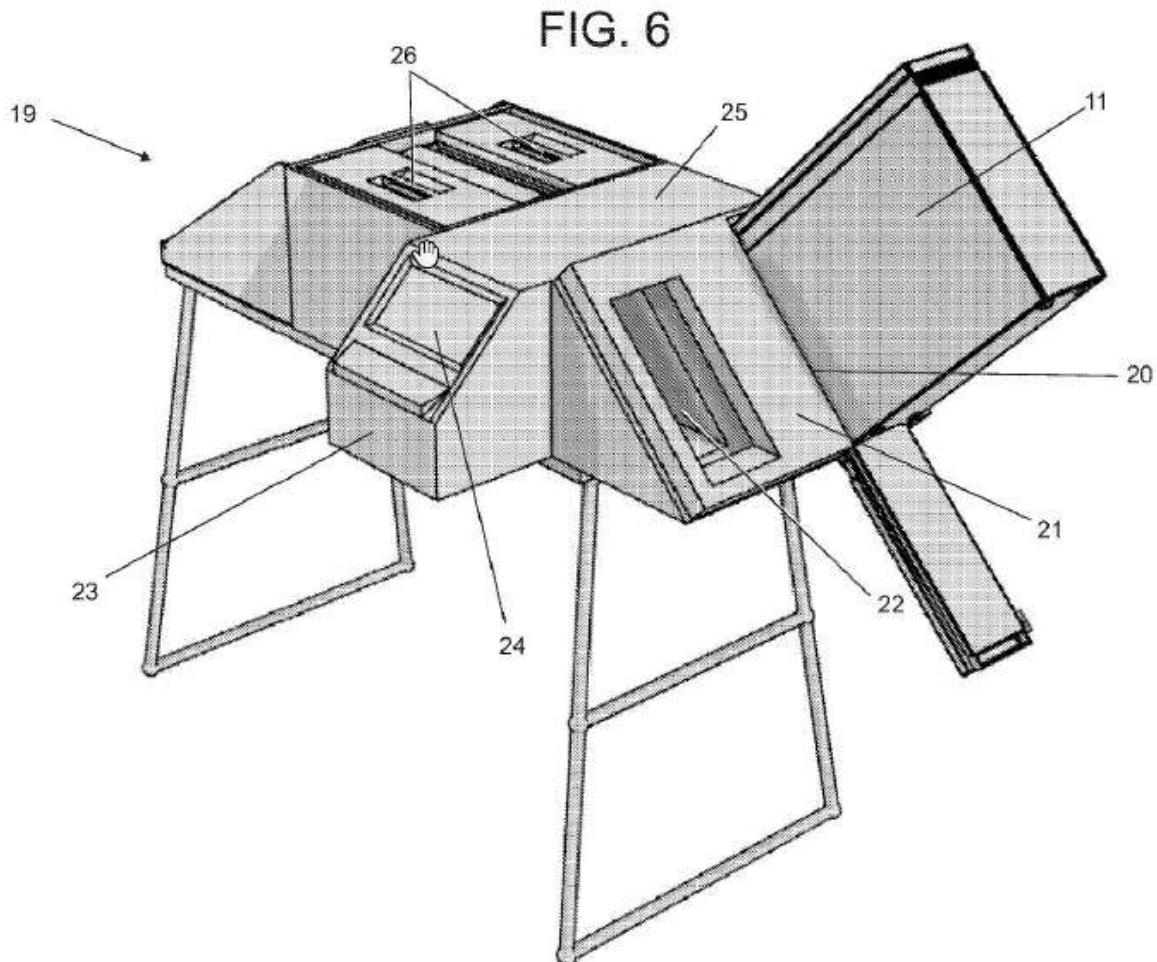


Figure 6, above, shows Nadaf’s equipment for auditing and counting ballots. *Id.* at 11:14–15. As shown in Figure 6, equipment 19 has input 20 for independent collection urn 11, RFID read/record device 21, input for audited ballots 22, printer 23, and LCD monitor 24. *Id.* at 18:4–8. Equipment 19 also has optical OCR and QR code reader 25, as well as devices 26 for the packaged ballots. *Id.* at 18:9–11.

(3) “cast vote record”

In this decision, we construe “cast vote record” as a “record that indicates the determined voter’s choice or selection in a manner determined in accordance with the voting system.” *Supra* § II.C.

Patent Owner disputes whether Nadaf generates a cast vote record, as recited. PO Resp. 47–51. Patent Owner argues that equipment 19 audits and counts paper records, but equipment 1 exclusively handles the actual voting. *Id.* at 47–51, 65–66. In Patent Owner’s view, “[t]he actual voting in Nadaf is all electronic.” *Id.* at 47.<sup>1</sup> Patent Owner argues that equipment 19, on the other hand, has two functions: auditing and counting verification ballots 14. *Id.* at 50 (citing Ex. 1007, 5:16–6:14, Lopresti Decl. ¶ 88). Patent Owner calls equipment 19’s process a “crosscheck.” *Id.* at 51.

Petitioner asserts, and we agree, that the auditing and counting performed by equipment 19 is part of the actual voting process and produces a cast vote record (“CVR”). *See* Pet. 66. In particular, Petitioner asserts that, in Nadaf, “each confirmed printed ballot is scanned and OCR’d, with the resulting data set compared to the decoded bar code.” *Id.* (citing Ex. 1007, 17:16–18:9).

Nadaf supports Petitioner’s assertion: In equipment 19, ballots are fed through optical reader 25.<sup>2</sup> Ex. 1007, 19:7–9, *quoted in* Pet. 65. Optical

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<sup>1</sup> In the Oral Hearing, though, Patent Owner’s counsel argued “Backert has this whole idea for purely electronic voting, when *the entire purpose of Nadaf is to get away from purely electronic voting.*” Tr. 72:4–6 (emphasis added).

<sup>2</sup> As discussed in Section II.E.1.f, the Petition asserts that voters perform this step. Pet. 64–65 (citing Ex. 1007, 13:6–9, 19:7–9). In later testimony, Dr. Shamos stated that this assertion was incorrect. Ex. 2005, 137:5–11. But Patent Owner has not explained how who performs this step affects the

reader 25 reads the bar codes. *Id.* The digital signatures are extracted and verified. *Id.* And “the text vote information” is compared to “the vote information encoded into the bar code.” *Id.* Here, “the text vote information” is the OCR-created data set. *See also supra* § II.E.1.g (discussing Nadaf’s OCR process).

It is undisputed that Nadaf’s equipment 19 compares the “the text vote information” to “the vote information encoded into the bar code.” Ex. 1007, 19:7–9, *quoted in* Pet. 65; *see* PO Resp. 50–51. The issue, though, is whether that comparison generates a CVR. *See* PO Resp. 51. We agree with Petitioner that it does. Pet. 66.

Patent Owner argues that Nadaf’s audit produces “reports, alerts, and the total count bulletin,” which are not CVRs. PO Resp. 56–58. But the Petition does not say that the reports, alerts, and bulletins are CVRs. *See* Pet. 66.

Rather, in addressing the CVR-generation step (*id.*), Petitioner quotes part of the emphasized sentence below from the English translation of Nadaf:

*After a comparative audit, the printed vote is then recorded electronically and sent to a module (26) where, along with the other ballots (14) from the polling station being tabulated, they will be stored. Once the counting of all the votes is completed, the ballots will be sealed in plastic and sent to the output (27), forming a paper block (29), as is shown in Figure 8, which will receive a radio frequency chip in the labeler (28), thus completing the auditing and electronic tabulating 15 of the printed ballots.*

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obviousness analysis. *See generally* PO Resp.; Sur-reply. Neither party argues that the challenge here turns on who is feeding the ballots into the device. Nor do we see anything in the claim that implicates this issue. So we deem Petitioner’s statement in the Petition a harmless error. Pet. 64–65.

Ex. 1007, 19:10–13 (emphasis added). That is, after the comparative audit, the voter’s choices have been determined such that they are ready to be recorded or counted in this step. *See id.* Thus, after the comparative audit, the vote must exist in some form, as a CVR, so that the vote can be included in a count or tabulation. *Id.*

Patent Owner disagrees with Petitioner’s translation of “recorded electronically” in the quoted sentence. PO Resp. 51, 58–62. According to Patent Owner, the original phrase in Portuguese is “o voto impresso é então contabilizado electronicamente.” *Id.* at 59 (citing Ex. 1006, 17:12–13) (emphasis omitted). Patent Owner argues that “the proper definition of ‘conta’ (the root of ‘contabilizado’) is a ‘sum,’ or ‘account.’” *Id.* (citing Ex. 2014, 3). Patent Owner asserts that the correct translation of Nadaf is “the printed vote is then *counted* electronically,” not “the printed vote is then *recorded* electronically.” *Id.* (citing Ex. 2010, 18:9; Ex. 1007, 20:6–7). In Patent Owner’s view, this translation is consistent with Nadaf’s disclosure that equipment 19’s produces a “total count bulletin.” *Id.*

Even so, the claim only requires generating a CVR. *See supra* § II.C. That is, although Nadaf is silent with respect to the CVR’s form and storage, the claim does not impose any requirement on how the CVR is maintained or for how long. *See id.* So we see no reason to exclude the result of Nadaf’s comparative audit on the basis of how it is stored.

In sum, Nadaf’s *contabilizado* step causes equipment 19 to either count or record the vote, depending on the translation. Ex. 1007, 19:10–13; PO Resp. 50–51, 58–62 (discussing its translation). Under either translation, we agree with Petitioner that Nadaf at least discloses “generating” a CVR. Thus, whether that CVR is “transient” or “permanent” is immaterial to our

analysis here, as the claim does not require either type of storage. Sur-reply 18; *see supra* § II.C.

Of greater relevance to our analysis of whether Nadaf anticipates, the construction of “cast vote record” requires that a CVR “indicates the determined voter’s choice or selection.” *See supra* § II.C. Nadaf’s CVR meets this requirement. To count or record the votes in Nadaf’s *contabilizado* step, some record must indicate the voter’s choice because the computer determines how the voter’s choice contributes to the final tabulation. *See* Ex. 1007, 19:10–13. In other words, Petitioner has shown that the determined vote exists in some form that allows the computer to use the vote in the tabulation that occurs after the “comparative audit.” *See* Pet. 66 (citing 6:7–10).

Patent Owner argues that Petitioner never identified the CVR in the Petition, and Petitioner’s Reply puts forth a new theory not found in the Petition. PO Resp. 56; Sur-reply 15–19. In Patent Owner’s view, Petitioner’s Reply presents a theory based on inherent operations that happen during the comparative audit, but the Petition focused on activities before the audit. Sur-reply 15–16. We disagree. The Petition’s analysis of the generating step analyzes the activities that happen “[a]fter [the] comparative audit” before concluding that Nadaf discloses the CVR-generation step. Pet. 66.

On this record, Petitioner has shown by a preponderance of the evidence that Nadaf’s comparative audit generates “a cast vote record,” as recited in claims 6, 23, and 29.

(4) “*generating a cast vote record from the data set*”

Claims 6, 23, and 29 recite, in part, “generating a cast vote record *from the data set* so that voter selections in the cast vote record are based on the voter readable text.” Ex. 1001, 9:20–22 (claim 6), 11:10–12 (claim 23),

12:24–26 (claim 29) (emphasis added). The antecedent basis for “the data set” appears in the OCR step: “utilizing optical character recognition (OCR) on the scanned voter readable text *to create a data set* which identifies the voter’s vote selections.” *Id.* at 9:16–19 (claim 6) (emphasis added); *see also id.* at 11:8–10 (claim 23), 12:21–23 (claim 29).

Patent Owner argues that Nadaf’s equipment 19 does not generate the CVR based on the OCR-created data set. PO Resp. 56–64; Sur-reply 17–18. Dr. Lopresti testified that some OCR systems work on a character-by-character basis:

So you literally could recognize one character at a time, do something with that character and throw it away. And then recognize the second character and throw it away, recognize the third and throw it away. So you’ve got characters but you wouldn’t have a dataset.

Ex. 1053, 163:13–164:18, *discussed in* Sur-reply 17–18. Patent Owner argues that “if the OCR check in Nadaf is subdivided at all (e.g., character-by-character, word-by-word), then equipment 19 would not generate a complete record of the voter’s vote selection (a CVR) from the voter readable text.” Sur-reply 17–18 (emphasis omitted).

But it is not clear how or why the described subdividing would be used in Nadaf’s system to accomplish the *constabilizado* step. For example, Dr. Lopresti did not explain what would be done with the character before it was thrown away. *See* Ex. 1053, 163:13–164:18. Rather, Dr. Lopresti explained that “some early OCR systems worked exactly that way back in the days when computers had a very small memory.” *Id.* at 164:10–13. Yet Nadaf was filed on July 19, 2013. Ex. 1007, code (22). Dr. Lopresti does not explain which years are considered “back in the days,” or why Nadaf’s system, in 2013, would be equipped with a memory that could only store one

character at a time. Ex. 1053, 163:13–164:18. Because the OCR technology described by Dr. Lopresti does not appear to be similar to Nadaf’s system, we assign Dr. Lopresti’s testimony on this issue minimal weight. *Id.*

Patent Owner also argues that the recited CVR must be separate from the data set that is used to generate it. Sur-reply 18–19. In Patent Owner’s view, the OCR-scan results used in the audit cannot be both the claimed data set and the CVR generated from the data set. *Id.* at 19.

Nadaf, though, discloses two distinct data sets: unaudited data (the OCR-scan results) and audited data (the result of the comparative audit). See Ex. 1007, 19:10–13. Nadaf is silent about how the data is handled or formatted. See *id.* at 19. It is possible that Nadaf reformats that OCR-generated information or simply reuses it. In any case, Petitioner has shown that the result of the comparative audit “indicates the determined voter’s choice or selection” for at least the reason Nadaf uses it to tabulate the vote. See Pet. 66 (citing Ex. 1007, 17:13–18:9, 19:10–13). Specifically, Nadaf discloses that (1) the OCR scanning generates data, (2) equipment 19 uses the OCR-scan results in a comparative audit, and (3) the *constabilizado* step uses the data generated by the comparative audit—i.e., the CVR. Ex. 1007, 17:13–18:9, 19:10–13. We are persuaded that, in this way, the result of Nadaf’s comparative audit—the CVR—is “generated from the” OCR-scan results, as claimed. Pet. 66.

#### (5) *Electronic Voting*

In Patent Owner’s view, Nadaf’s equipment 1 is a direct recording electronic (DRE) voting machine, and equipment 19 merely audits the ballots. PO Resp. 63 (citing Lopresti Decl. ¶¶ 107–108; Ex. 1007, 15:13–15, 10:13–16). Patent Owner argues that equipment 1 records the voter’s electronic vote and sends it to an “electoral system.” *Id.* According to Patent

Owner, “When the Nadaf reference was filed, Brazilian elections all used electronic voting.” *Id.* at 62 (citing Ex. 1007, 7:5–6). Patent Owner argues that, “shortly before Nadaf’s filing date, the Supremo Tribunal Federal for Brazil struck down a law that would reintroduce paper records into Brazil’s electronic voting process.” *Id.* (citing Ex. 2011, 11, 28). Patent Owner argues that Nadaf uses verification ballot 14 only for voter verification at equipment 1, not for determining the election winner. *Id.* at 63–64 (citing Lopresti Decl. ¶ 108). Thus, Patent Owner argues that Nadaf’s equipment 19 does not generate a CVR. *Id.* at 64.

We disagree with Patent Owner’s arguments about Brazilian DREs and voting laws because these arguments assume that there can be only one CVR. *See id.* at 62–64.

First, we note that Patent Owner’s argument that Nadaf discloses all-electronic voting (*id.* at 62) is in tension with the argument that its counsel made at the Oral Hearing: “Backert has this whole idea for purely electronic voting, when the entire purpose of Nadaf is to get away from purely electronic voting.” Tr. 72:4–6.

Second, the record indicates that a CVR created by a DRE machine does not preclude another CVR from being created after an audit. For example, Dr. Shamos testifies that it is possible to have multiple CVRs:

An electronic CVR is simply a record of all votes produced by a single voter. Such a record is created when the voter’s selections are captured. In addition, the data may be stored on one or more storage devices, and may be transmitted electronically to another device for remote tabulation. At each stage, a new cast vote record is created . . . .

Shamos Suppl. Decl. ¶ 65.

Dr. Shamos’s testimony is consistent with the ’966 patent’s description of “a hybrid voting device.” Ex. 1001, 4:54–64, *cited in* Pet. Reply. 22. Specifically, the patent describes an embodiment with both “electronic voting features” and a printed voting record (PVR). *Id.* The patent explains that the PVR is used in an “audit,” which requires a record to audit. *See id.* That is, as Dr. Shamos testifies (Shamos Suppl. Decl. ¶ 65), the record that undergoes OCR is not the only CVR in this embodiment. Ex. 1001, 4:54–64. Thus, we credit Dr. Shamos’s testimony on this point. Shamos Suppl. Decl. ¶ 65. Because Dr. Lopresti’s testimony is inconsistent with the record in this way, we assign it little weight. Lopresti Decl. ¶¶ 107–108.

For the reasons in this section, weighing all the evidence of record, we find that Petitioner has shown that Nadaf discloses the CVR-generation step.

*h. Bar code / Encoded Data*

Claim 6 recites, in part,

providing a bar code on the printed vote record, the bar code including information indicative of the voter’s vote selections, wherein the bar code is utilized to confirm that results of the OCR match the voter’s original selections by comparing data in the bar code to the data set created by the OCR.

Ex. 1001, 9:23–29. Claim 29 contains a similar limitation but recites “encoded data” instead of “bar code.”<sup>3</sup> *See id.* at 12:27–33.

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<sup>3</sup> Petitioner asserts that “the bar code” lacks antecedent basis in claim 29. Pet. 67. Claim 29 recited, as originally issued, “by comparing data in *the bar code* to the data set created by the OCR.” Ex. 1001, 12:32–34. But a Certificate of Correction dated October 15, 2019, deleted “the bar code” and inserted “a bar code.” Ex. 1002, 2. Thus, we are not persuaded by Petitioner’s assertion.

Petitioner asserts that Nadaf's PVR has a bar code encoding the voter's selections. Pet. 68 (citing Ex. 1007, 14:10–13, Fig. 4). According to Nadaf, the bar code encodes the voter's "complete vote." Ex. 1007, 14:10–13. Petitioner shows that Nadaf discloses the recited bar code.

Petitioner also asserts that Nadaf uses the bar code to confirm that the OCR results match the voter's original selections. Pet. 68–69 (citing Ex. 1007, 13:6–9, 19:7–9). For example, Nadaf's optical reader 25 compares the text vote information to the vote information from the bar code. Ex. 1007, 19:7–9. Also, Nadaf discloses that the system uses the bar code to verify the printed vote. *See id.* at 13:6–9. Thus, Petitioner sufficiently shows that Nadaf compares the bar code to the OCR data set, as recited in claims 6 and 29.

Similarly, claim 23 recites, in part, "the printed vote record further including a bar code, the bar code including information indicative of the voter's vote selections" (Ex. 1001, 11:1–3) and recites the same "wherein" clause as claim 6 about how the bar code is used (*see id.* at 11:14–17). So for same reasons as discussed for claims 6 and 29, Petitioner shows that Nadaf also discloses this limitation. Pet. 68–69.

Apart from the arguments discussed above (*see supra* §§ II.E.1.h and i), Patent Owner does not substantively address these assertions or otherwise contend that the art lacks any of the features. Thus, we are persuaded by Petitioner's cited evidence and analysis for the reasons discussed here and in Sections II.E.1.h and i.

*i. Conclusion*

From the entirety of the record, we determine that Petitioner has shown by a preponderance of the evidence that Nadaf anticipates claims 6, 23, and 29.

2. *Independent Claims 6, 23, and 29, Obviousness*

Because we determine that Petitioner has shown by a preponderance of the evidence that Nadaf anticipates claims 6, 23, and 29, we need not reach the Petitioner’s alternative rationale under obviousness. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App’x 984, 990 (Fed. Cir. 2020) (non-precedential) (recognizing that the “Board need not address issues that are not necessary to the resolution of the proceeding” and, thus, agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

3. *Claim 8, Obviousness*

Claim 8 recites, “The method of claim 6, wherein the bar code is a one dimensional bar code.” Ex. 1001, 9:32–33.

Petitioner asserts that Nadaf discloses a QR code, which is a two-dimensional barcode. Pet. 71 (citing Shamos Decl. ¶ 296). Petitioner asserts that the one-dimensional barcode recited in claim 8 would have been obvious. *Id.* (“The barcodes of claims 6, 8-10, 23, and 29-30 serve this known purpose, and their inclusion in the claims is not novel nor non-obvious.”). The Petition shows that the type of barcode used depends on the amount of data to be stored:

Barcodes encode data into a visual, machine-readable format that can be read by an optical scanner. One-dimensional barcodes encode data in a series of parallel lines with varying widths and spacing. Exh. 1003 at ¶ 74.

Two-dimensional, or matrix, barcodes provide information storage on both horizontal and vertical axes. Exh.

1003 at ¶ 75. Such barcodes can store considerably more data than one-dimensional barcodes. *Id.*; Exh. 1029 (U.S. 5,726,435) at 1:15-28.

*Id.* at 8.

Patent Owner argues that Nadaf does not anticipate claim 8 because Nadaf only uses two-dimensional bar codes. PO Resp. 66–67 (citing 1006, Fig. 4, 26; Lopresti Decl. ¶ 113). Patent Owner also argues that Petitioner has not argued or shown that the recited one-dimensional bar code would have been obvious in view of Nadaf:

ES&S only addresses claim 8 grouped together with claims 9, 10, and 30. Petition at 70-71. These other claims, however, require *two* dimensional bar codes or QR codes. Given this significant difference, ES&S cannot satisfy its burden on claim 8 by citing to the same vague assertions it relied on for claims reciting a different kind of barcode. *Id.*, 71 (“The barcodes of claims 6, 8-10, 23, and 29-30 serve this known purpose, and their inclusion in the claims is not novel nor non-obvious.”). Such a conclusory approach—which ignores basic requirements like a motivation to modify Nadaf and an expectation of success—is insufficient to show claim 8 would have been obvious.

*Id.* at 67–68 (emphasis in original).

In reply, Petitioner asserts that “[t]he only difference is that a 2-D barcode can store more data per unit of area than a 1-D bar code.” Pet. Reply 23 (citing Shamos Decl. ¶ 75). Petitioner explains that “[t]he choice of bar code would thus depend on the amount of data being encoded and the designer’s preference,” which it asserts would have been obvious.

*Id.*

The evidence of record supports the analysis of bar-code storage capacity in the Petition (Pet. 8), which is largely repeated in the Reply (Pet. Reply 23). For example, Hara, which is cited in the Petition as support for the analysis, states that “a two-dimensional code is generally

advantageous, when it is compared with a bar code, in that a large amount of CD information can be stored in a relatively smaller area.” Ex. 1029, 1:26–29, *cited in* Pet. 8. We note that Hara uses the term “bar code” in its disclosure to refer to one-dimensional bar codes. *See, e.g., id.* at 7:49–50 (“FIG. 19 is a view illustrating an invalidation processing of a conventional bar code.”), 13:57–60 (“For a conventional bar code, the reading operation is easily disabled by simply drawing a line 131 across a bar code 130 as shown in FIG. 19.”); *compare id.*, Fig. 19 (showing bar code 130), *with* Shamos Decl. ¶ 74 (“One-dimensional barcodes encode data in a series of parallel lines with varying widths and spacing.”).

In the Sur-reply, Patent Owner does not rebut Petitioner’s obviousness rationale based on the storage capacity of the bar codes or challenge Petitioner’s assertions about storage capacity. *See generally* Sur-reply. Rather, Patent Owner argues that “Shamos presents additional new theories in his supplemental declaration,” citing paragraph 73 of that declaration, among other paragraphs. *Id.* at 1 n.1. In paragraph 73, Dr. Shamos discusses the storage capacities of one- and two-dimensional barcodes. Shamos Suppl. Decl. ¶ 73.

Shifting arguments is foreclosed by statute and legal precedent. *Wasica Fin. GmbH v. Cont’l Auto. Sys.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017) (citing 35 U.S.C. § 312(a)(3); *Intelligent Bio-Sys., Inc. v. Illumina Cambridge, Ltd.*, 821 F.3d 1359 (Fed. Cir. 2016); *Trial Practice Guide*, 77 Fed. Reg. 48,756, 48,767 (Aug. 14, 2012)); *see also* CTPG 73–75. For example, a petitioner cannot proceed in a reply brief in a new direction with a new approach as compared to the positions taken in its petition. *See id.* But here we do not find that Petitioner has proceeded in a new direction. Rather, Petitioner has merely explained why the original Petition was

correct, in response to Patent Owner’s argument. Pet. Reply 23. Despite how the analysis was organized in the Petition, the discussion of the storage capacities of the various barcodes (Pet. 8, 71) provides “some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *Kahn*, 441 F.3d at 988. Specifically, the Petition indicates that it would have been obvious to choose a one-dimensional bar code or two-dimensional bar code depending on the storage requirements (Pet. 8, 71), consistent with Petitioner’s unrebutted responsive argument on this issue (Pet. Reply 23).

From the entirety of the record, we find that Petitioner has shown that a person of ordinary skill in the art would have found it obvious to modify Nadaf (Pet. 8, 71), which would have been within the level of ordinary skill in the art. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 8 would have been obvious over Nadaf.

#### 4. *Claims 7, 9, 10, 24, and 30, Anticipation*

The Petition states that the statutory basis for challenging claims 7, 9, 10, 24, and 30 is “35 U.S.C. §§ 102 and/or 103.” Pet. 3. In this section, we consider anticipation under Section 102. Patent Owner does not contest Petitioner’s analysis. *See generally* PO Resp.; PO Sur-reply. Upon review of the entirety of the record, we credit the undisputed testimony of Dr. Shamos and are persuaded by Petitioner’s uncontested analysis.

In particular, claims 7 and 24 depend from claims 6 and 23, respectively. Both claims 7 and 24 add “wherein the bar code is utilized to confirm the printed vote record is valid.” Ex. 1001, 9:30–31 (claim 7), 11:18–19 (claim 24).

For claims 7 and 24, Petitioner asserts that Nadaf counts the vote only after confirming that the PVR is valid. Pet. 70 (citing Ex. 1007, 6:2–10). In the cited passages, Nadaf refers to the process as “confirming the institutional provenance and integrity of the content of the printed vote.” Ex. 1007, 6:2–6. According to Nadaf, “Only after being audited will the printed vote be validated for counting.” *Id.* at 6:7–10. On this record, Petitioner supports the assertion that Nadaf confirms the printed vote’s validity with the bar code, as recited. *See* Pet. 69–70. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 7 and 24 are anticipated by Nadaf.

Claim 9 recites a “two dimensional bar code.” Ex. 1001, 9:35–36. Claims 10 and 30 recite “a QR code bar code” *Id.* at 12:34–35. As for claims 9, 10, and 30, Petitioner asserts that Nadaf’s PVR contains both voter-readable text and a bar code encoded with voter selections. Pet. 71 (citing Ex. 1006, Fig. 4). Petitioner asserts that (1) Nadaf’s Figure 4 shows an example QR code and (2) a QR code is a two-dimensional bar code. *Id.* (citing Ex. 1007, 18:9; Ex. 1003 ¶ 296). On this record, Petitioner shows that Nadaf discloses the two-dimensional bar code that is a QR code, as recited in claims 9, 10, and 30. Thus, we determine that Petitioner has shown by a preponderance of the evidence that claims 9, 10, and 30 are anticipated by Nadaf.

#### 5. *Claims 7, 9, 10, 24, and 30, Obviousness*

Because we determine that Petitioner has shown by a preponderance of the evidence that Nadaf anticipates claims 7, 9, 10, 24, and 30, we need not reach Petitioner’s alternative rationale under obviousness. *See SAS*, 138 S. Ct. at 1359 (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc.*,

809 F. App'x at 990 (recognizing that the “Board need not address issues that are not necessary to the resolution of the proceeding” and, thus, agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

*G. Obviousness over Nadaf and Heilper*

Claim 25 recites, in part, “The method of claim 23, wherein identifying the voter’s vote selection includes comparing the data set to an election dictionary.” Ex. 1001, 11:20–22.

Petitioner asserts that the subject matter of claim 25 would have been unpatentable as having been obvious over “Nadaf alone or in combination with Heilper.” Pet. 71 (emphasis added). Because we find that the subject matter of this claim would have been obvious over Nadaf in combination with Heilper, for the reasons discussed below, we do not reach the ground based on Nadaf alone.

Petitioner relies on Heilper to teach the recited dictionary and proposes applying the dictionary to Nadaf’s OCR-generated data set. *Id.* at 72.

Patent Owner argues that “for at least the same reasons discussed above with respect to the Ground 3 [based on Nadaf], Nadaf does not anticipate or render obvious dependent claim 25, which incorporates the requirements of claim 23.” PO Resp. 68. For the reasons discussed above in connection with Ground 3 based on Nadaf, we disagree. *See supra* § II.F.1.

Patent Owner also argues that neither reference discloses comparing “the data set to an election dictionary.” PO Resp. 68. In Patent Owner’s view, Heilper “does not disclose or render obvious the use of an election dictionary.” *Id.* But, for reasons similar to those discussed in connection

with the Brockhouse-Heilper combination, we disagree with Patent Owner's argument. *See supra* § II.E.

In particular, Petitioner sufficiently shows that (1) Nadaf teaches the recited OCR process and (2) Heilper teaches a dictionary for OCR-error correction. *Supra* §§ II.E.1.i, II.F.1.f. Heilper explains that the computer looks up the OCR-generated word in the dictionary to obtain the corrected word. Ex. 1005, 1:13–41, *quoted in* Pet. 72. As discussed above, this means that Heilper's dictionary is expected to contain the correct words. *Id.* In Nadaf's data set, like Brockhouse's, the correct words contain the candidate names, which would make a dictionary containing the correct candidate names, as Heilper teaches, an "election dictionary." *See supra* § II.F.1.f (describing Nadaf's OCR process); *see also* Pet. 72 (referring to the analysis of claim 23). Thus, for reasons similar to those discussed above with respect to the Brockhouse-Heilper combination in Section II.E.1.i, Petitioner shows that the Nadaf-Heilper combination teaches the "election dictionary." Pet. 71–72.

Also, Patent Owner argues that Petitioner has not presented sufficient evidence of motivation to combine these references. PO Resp. 69. According to Patent Owner, Petitioner "again relies on the same insufficient alleged motivation that it described in Ground 2." *Id.* Patent Owner argues that Petitioner's obviousness rationale is conclusory:

(a) this generic statement does not explain why a POSITA "would pick out these particular references and combine them to arrive at the claimed invention" . . . ; and (b) using a generic dictionary like the one in Heilper to look up candidate names in Nadaf could increase errors in the interpretation of a printed vote records, making the combined system unsatisfactory for use in an actual election.

*Id.* (emphasis omitted). Patent Owner further argues that Petitioner has not shown an expectation of success. *Id.* at 70.

We disagree for the reasons similar to those discussed in Section II.E.1.i. In particular, Petitioner proposes a specific improvement to Nadaf: correcting the OCR-generated results with Heilper's dictionary. Pet. 72. Heilper's teachings and Dr. Shamos's testimony support Petitioner's conclusion that the accuracy of Nadaf's OCR could be improved. *Id.*; Ex. 1005, 1:15–25 (disclosing that OCR is error prone); *see also supra* § II.E.1.i. The record shows that Heilper would have provided "OCR error correction safeguards" for Nadaf's OCR in the same way that it does for Brockhouse. *See* Ex. 1005, 1:15–25 (discussing how OCR is error prone), *quoted in* Pet. 72; *see also supra* § II.E.1.i. Heilper's teachings on this issue echo Dr. Shamos's testimony about the benefits of using dictionaries for OCR-error correction. Shamos Decl. ¶¶ 300–302; Ex. 1005, 1:20–21. Thus, we credit Dr. Shamos's testimony on this point. Shamos Decl. ¶¶ 300–302. And we determine that Petitioner provides sufficient "articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *Kahn*, 441 F.3d at 988.

From Petitioner's analysis, we find that a person of ordinary skill in the art would have made the proposed combination, and this combination would have been within the level of ordinary skill in the art. Upon review of the entirety of the record, we are persuaded by Petitioner's evidence and analysis. And we credit the undisputed testimony of Dr. Shamos. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter recited in claim 25 would have been obvious over Nadaf in combination with Heilper.

*H. Obviousness over Nadaf and Backert, or Nadaf and Herskowitz*

Petitioner asserts that the subject matter of claims 11–14 and 28 would have been obvious over Nadaf and Backert or Nadaf and Herskowitz.<sup>4</sup> Pet. 72–79.

*1. Independent Claims 11 and 28*

*a. Limitations Shared with Claims 6 and 23*

Claim 11 recites the same method as claim 6 up to and including generating a cast vote. *Compare* Ex. 1001, 9:39–52 (claim 11), *with id.* at 9:8–22 (claim 6). Likewise, claim 28 recites the same method as claim 23 up to and including generating a cast vote, except that claim 23 adds “the bar code including information indicative of the voter’s vote selections.” *Compare id.* at 11:30–12:9 (claim 28), *with id.* at 10:62–11:12 (claim 23).

Patent Owner argues that, because Petitioner relies on Nadaf to disclose generating the cast-vote record, this ground “fails for at least the same reasons as” the ground based on Nadaf alone. PO Resp. 70–71, 73 (citing Pet. 73–74; Lopresti Decl. ¶ 128). But, as discussed above, we disagree with Patent Owner’s arguments presented in connection with the ground based on Nadaf alone. *See supra* § II.F. For the reasons discussed in connection with claim 23 (*supra* § II.F.1), Petitioner shows that Nadaf

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<sup>4</sup> The Petition uses the term “and/or” in describing this challenge. *See* Pet. 3 (“Nadaf in view of Backert and/or Herskowitz”). In this decision, we need only consider whether Nadaf and Backert or Nadaf and Herskowitz. We do not base our determination on a single combination of the three references—i.e., Nadaf combined with Backert and Herskowitz together. Our understanding of the challenge is consistent with the heading on page 72 of the Petition: “Claims 11-14 and 28 Are Invalid as Obvious Over Nadaf in Light of Backert or Herskowitz (Ground 5).”

teaches the limitations in claim 11 that are also recited in claim 6 and the limitations in claim 28 that are also recited in claim 23.

*b. Confirming an Integrity of the Printed Vote Record*

Claim 11 recites, in part, “wherein a first hash produced from the data set is compared to a second hash provided on the printed vote record, a comparison of the first hash and the second hash confirming an integrity of the printed vote record.” Ex. 1001, 9:53–57. Claim 23 recites a similar limitation except that it requires “a second hash provided *in the bar code*,” rather than “on the printed vote record,” as in claim 11. *Compare id.* at 12:9–12 (emphasis added), *with id.* at 9:54–55.

Petitioner asserts that Nadaf uses digital signatures to ensure the PVR’s integrity. Pet. 78 (quoting Ex. 1007, 5:7–15, 6:2–10). In the quoted passages, Nadaf teaches that the ballot’s bar codes store the digital signatures of the elections judge and other auditing institutions. Ex. 1007, 5:6–9. Nadaf uses asymmetric cryptography to generate these signatures. *Id.* at 5:10–12. Nadaf’s audit process compares the text record to the bar code. *Id.* at 6:2–6. Petitioner asserts that it would have been obvious “to incorporate the additional hash value procedures” from Herskowitz or Backert to “further increase the security” of Nadaf’s voting method. Pet. 79.

In Patent Owner’s view, Petitioner’s combination of Nadaf with Herskowitz or Backert is “vague.” PO Resp. 74. Patent Owner argues that the Petition is not clear about whether Petitioner intends to use hashes along with Nadaf’s digital signatures. *Id.* at 76. According to Patent Owner, the cited prior art does not disclose a first hash produced from OCR-generated data. *Id.* at 74–75. In Patent Owner’s view, Petitioner relies entirely on Herskowitz and Backert to address the comparison of the two hashes, yet

merely adding those hash-value comparisons to Nadaf's method would not produce the claimed method. *Id.* at 75.

Patent Owner's arguments fail to consider the collective teachings of the references. *Id.* at 74–76. In the context of Petitioner's proposed combination, the hash protects the integrity of the votes. *See* Pet. 76–78. Specifically, Herskowitz's and Backert's hash values are applied to the voter's selections: Petitioner asserts that Herskowitz teaches "that the voter's vote selections are used directly to create the hash value." *Id.* at 76 (quoting Ex. 1009, Abstract). And Petitioner asserts that "Backert teaches that these digital signatures or message digests 'serve as unique identifiers *for the contents of electronic ballot[s]*.'" *Id.* at 77 (quoting Ex. 1008, 11:8–13) (emphasis added). Petitioner has shown that Nadaf teaches an OCR-generated data set that "identifies the voter's vote selections," as recited in the claims. *Id.* at 73; *see also supra* § II.H.1.a. Thus, the combination presented in the Petition uses Herskowitz's or Backert's hash procedures to protect Nadaf's OCR-generated data set. *Id.* at 72–79.

Patent Owner argues that the Petition "merely implies that 'the hash value procedures disclosed in Herskowitz and/or Backert' could be combined directly with the digital signatures of Nadaf." PO Resp. 76 (citing Pet. 78–79). In Patent Owner's view, "The digital signatures in Nadaf, and the bar codes in which the digital signatures are printed on the ballot, are not generated using OCR." *Id.* (citing Lopresti Decl. ¶ 130). Patent Owner argues that Dr. Shamos admitted that Herskowitz and Backert do not disclose the hash-value limitations. Sur-reply 20. Patent Owner argues that the Petition's reliance on the '966 patent's discussion of OCR indicates that Petitioner engaged in improper hindsight reasoning. PO Resp. 75 n.10 (citing Pet. 74). Patent Owner argues that, even after modifying Nadaf as

Petitioner proposes, the combination would still lack an OCR-derived hash. *Id.* at 76 (citing Lopresti Decl. ¶¶ 131–132; Ex. 1001, 9:53–55, 12:10–11). We disagree.

According to the Petition, an OCR-derived hash is the result of applying Herskowitz’s and Backert’s hash-value procedures to Nadaf’s OCR-generated data. Pet. 78–79. In particular, the Petition relies on Nadaf for the teachings related to performing OCR on the voter’s selections on the PVR. *Id.* at 73. The Petition states that the hash-value procedures are used on the voter’s vote selections to create the hash values. *Id.* at 76 (discussing Herskowitz), 77 (discussing Backert). So the Petition addresses the OCR-derived hash using a combination of these teachings. *Id.* at 78–79.

Patent Owner argues that Petitioner shows “only that a POSITA could use techniques from Herskowitz and/or Backert with Nadaf, without showing a POSITA would have been motivated to make such combinations.” Sur-reply 20 (emphasis omitted); *see also* PO Resp. 71 (arguing that the Petition’s obviousness rationale lacks a motivation to combine the references). Patent Owner argues that the Petition relies on improper hindsight because nothing in the Petition or prior art explains why it would be advantageous to compare specific hashes. PO Resp. 79. Patent Owner argues that Petitioner has not shown that a person of ordinary skill in the art would have had an expectation of success in combining the references. *Id.* Patent Owner views Petitioner’s rationale as conclusory. *Id.* at 77. We disagree.

After discussing the prior art, the Petition concludes that “[a] POSITA would have been motivated to incorporate the additional hash value procedures disclosed in Herskowitz and/or Backert to further increase the security of the electronic voting method disclosed in Nadaf.” Pet. 79. Patent

Owner's focus on this single statement ignores the analysis that leads up to this conclusion. *See, e.g.*, PO Resp. 71, 77, 79; Sur-reply 20.

In particular, the Petition provides an explanation that it was known that hash functions are used to protect a document's integrity. Pet. 75. The Petition develops this reasoning by first quoting a passage describing using hashes to detect altered ballots from WO 01/20562 A2 to Adler:

In step 408, each voter verifies the digital signature or hash function result provided with the ballot to ensure the ballot has not been altered and was received from the appropriate vote collection center.

*Id.* (quoting Ex. 1037, 33:4–6). Because the passage explains that hashes provide a solution to the altered-ballot problem, this passage supports Petitioner's obviousness rationale that adding hashes would provide an additional measure of security. *Id.* Building on the altered-ballot problem statement, the Petition then explains how the specific teachings from Herskowitz and Backert help ensure ballot integrity in Nadaf. *Id.* at 75–77. In the sections that follow, we discuss how the cited parts of Herskowitz and Backert adequately support the Petition's obviousness rationale.

(1) *Herskowitz*

Claim 11 recites two hash values: “a *first hash* produced from the data set is compared to a *second hash* provided on the printed vote record.”

Ex. 1001, 9:53–56. Petitioner asserts that Herskowitz “teaches the generation of first and second hash values that are compared to confirm [the] integrity of the vote record.” Pet. 77. Petitioner's assertion is adequately supported. *See id.* at 75–77 (citing Ex. 1009, Abstract, 1:44–58, 2:10–39).

In particular, Herskowitz's electronic voting system assigns confidential hash numbers to the ballot choices. Ex. 1009, 1:44–48. After the voter makes the selections, the system totals the corresponding hash

numbers to produce a hash value for the voter. *Id.* at 1:48–50. The system then encrypts that hash value to produce an “encrypted hash total (EHT).” *Id.* at 1:52–58. Herskowitz stores the EHT in memory and prints it on the voter’s receipt. *Id.* Herskowitz compares the stored EHT to the printed one. *Id.* at 2:10–31. That is, Herskowitz teaches a first hash (a recorded hash) and a second hash (the printed EHT) provided on the printed vote record. Pet. 76.

These teachings from Herskowitz support Petitioner’s conclusion that using the “additional hash value procedures disclosed in Herskowitz” would increase security. *Id.* at 79. In Herskowitz, matching EHTs indicate that the voter’s receipt is “correct.” Ex. 1009, 2:12–14. Unmatched EHTs are “strong evidence” that the receipt “is a forgery.” *Id.* at 2:15–17. Patent Owner questions whether Herskowitz would make Nadaf’s digital signatures more secure. PO Resp. 78 (citing Ex. 1007, 14:15–18; Lopresti Decl. ¶ 136). But detecting a forgery would increase security in Nadaf’s system for at least the reason Herskowitz’s process would provide an additional assessment of the ballot’s integrity. See Pet. 79. In this way, Petitioner provides sufficient “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness” for claim 11. *Kahn*, 441 F.3d at 988.

Claim 28 recites “a second hash provided *in the bar code*,” rather than “on the printed vote record,” as recited in claim 11. Compare Ex. 1001, 12:9–12 (emphasis added), with *id.* at 9:54. As for this limitation, Petitioner asserts that Nadaf’s bar code stores the digital signatures of the elections judge and other auditing institutions. Pet. 78 (quoting Ex. 1007, 5:7–15, 6:2–10). In this way, Nadaf teaches that a bar code can store security information, such as a second hash. See *id.* So, for reasons similar to those

discussed in connection with claim 11, Petitioner has adequately supported the obvious rationale for claim 28.

Patent Owner argues that Petitioner’s “suggestion to use stored *electronic* records from Herskowitz (Ex. 1009, 2:7-12) to verify the digital signatures from Nadaf would not meet the hashing limitations in the claims, which require comparing two hashes *from a printed record*.” Sur-reply 20. Patent Owner argues that Herskowitz does not compare two hashes that are both from the printed vote record’s information. PO Resp. 76–77. Patent Owner argues that Herskowitz’s comparison involves at least one electronic hash. *Id.* at 76 (citing Ex. 1008, 12:9–30; Ex. 1009, 2:7–12). Patent Owner argues that Petitioner has not explained how the prior art compares two *printed* hashes. *Id.* at 78.

Nadaf’s data, though, is from the printed record because Nadaf performs OCR on the printed ballots. Pet. 73; *see also supra* § II.H.1.a. We note that Petitioner does not assert that Herskowitz teaches a first hash produced from the OCR-generated data set. *See* Pet. 79. Rather, Petitioner states that Herskowitz “teaches the generation of first and second hash values.” *Id.* at 77. In this ground, Petitioner proposes combining Nadaf’s OCR-generated data set with Herskowitz’s hash-value process. *Id.* at 76–79. That is, running Herskowitz’s process on Nadaf’s data produces hashes from a printed record. *See id.*

Patent Owner argues that, “[t]o solve certain problems in electronic voting, Nadaf adds a paper verification ballot that is carefully secured and sealed to avoid any tampering,” but “the paper receipt of Herskowitz can be taken home, handled, and shared however the voter chooses.” PO Resp. 77–78 (citing Lopresti Decl. ¶ 135, Ex. 1007, 4:7–9, 19:12–13). Patent Owner argues that, in view of these differences, one would not have combined these

references. *Id.* Patent Owner’s argument, though, lacks any evidence that sealing ballots in the way that Nadaf describes renders additional security measures superfluous. *See id.* In fact, even Nadaf does not rely solely on sealing and securing the ballots. Rather, Nadaf’s system uses digital signatures as an additional measure to ensure the integrity of the ballots. *See* Pet. 78 (citing Ex. 1007, 5:7–15, 6:2–10). Because Dr. Lopresti has not sufficiently accounted for this teaching from Nadaf or otherwise adequately supported the assertions with the evidence of record, we give little weight to Dr. Lopresti’s testimony on this point. *See* Lopresti Decl. ¶ 135.

From the entirety of the record, we find that Petitioner has shown that a person of ordinary skill in the art would have combined Nadaf and Herskowitz. This combination would have been within the level of ordinary skill in the art. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 11 and 28 would have been obvious over Nadaf and Herskowitz.

(2) *Backert*

Petitioner also asserts that Backert teaches hash-value procedures. Pet. 77–78 (citing Ex. 1008, Abstract, 11:8–13, 12:21–36; Shamos Decl. ¶ 327). The cited passages from Backert describe verifying digitally signed ballots using a cryptographic hash. *See, e.g.*, Ex. 1008, 12:21–30, *quoted in* Pet. 77–78. In particular, Backert creates a message digest for a ballot’s contents using a hashing algorithm. *Id.* at 11:5–7. The message digest is a cryptographic hash that serves as a unique identifier. *See id.* at 10:65–11:9. According to Backert, “it is computationally infeasible to generate a different electronic ballot that will hash to the same message digest.” *Id.* at 11:8–13. In this way, Backert teaches a first hash produced from the data set representing the ballot’s contents. Pet. 77–78.

The data set representing the ballot's contents in Nadaf is an OCR-generated data set. *Id.* at 73; *see also supra* § II.H.1.a. Although Patent Owner argues that Petitioner has not explained how the prior art compares two *printed* hashes (PO Resp. 78), computing a hash from Nadaf's data using Backert's process, as described in the Petition, would produce a hash from the printed record. Pet. 77–78.

That first hash is compared to a second hash, as taught by Backert: A holding area stores digitally signed electronic ballots until the voter verifies them. Ex. 1008, 11:41–46. When the ballots are later retrieved from storage, Backert verifies the digital signature. *Id.* at 12:21–30. To do so, Backert calculates a cryptographic hash for the ballot and compares this hash to the ballot's message digest. *Id.* at 12:21–30, 34–36. A non-match indicates that the ballot was improperly stored or altered. *Id.* at 12:33–36. Considering these teachings, Petitioner sufficiently shows that Backert teaches a first and second hash value—i.e., the cryptographic hash and the message digest—that confirm the ballot's integrity when compared. Pet. 78 (citing Ex. 1008, 12:31–36).

Patent Owner argues that Backert does not compare two hashes that are both from a *printed* vote record's information. PO Resp. 76–77. Patent Owner argues that Backert's comparison always involves at least one electronic hash. *Id.* at 76 (citing Ex. 1008, 12:9–30; Ex. 1009, 2:7–12). According to Patent Owner, “Backert eschews paper records entirely, opting instead to add more electronic security features.” *Id.* at 78. Patent Owner argues that Petitioner has not explained how the prior art compares two hashes that are *printed*. *Id.*

We agree with Patent Owner that the claims do require producing the first and second hash from the printed record. *Id.* at 76–78. But Petitioner

does not assert that Backert teaches an OCR-generated data set. *See* Pet. 77–78. Rather, the Petition identifies Nadaf as teaching that data set and proposes applying Backert’s process to it. *See id.*

For example, Petitioner asserts that, when Backert’s “cryptographic hash and message digest (i.e. first and second hash values) match, the accuracy and integrity of the ballot is confirmed.” *Id.* at 78 (citing Ex. 1008, 12:31–36). The Petition then cites Nadaf’s discussion of the accuracy and integrity of the *printed* ballot. *Id.* at 78–79. The Petition proposes incorporating Backert as an “additional” hash-value procedure. *Id.* To accomplish this, the Petition indicates that Backert is applied to Nadaf’s printed record because the Petition cites Nadaf’s discussion of using the barcode to verify the PVR. *Id.* (citing Ex. 1007, 5:7–15, 6:2–10). In this way, Petitioner shows that the Nadaf-Backert combination teaches or suggests comparing two hashes from the printed record. *See id.*

As discussed above, Petitioner asserts that Nadaf’s bar code stores the digital signatures of the elections judge and other auditing institutions. *Id.* (quoting Ex. 1007, 5:7–15, 6:2–10). Although Nadaf uses digital signatures in this way, the record shows that adding Backert would further improve security because it would provide an additional assessment of the ballot’s integrity. *See id.* at 79. Specifically, Backert’s assessment detects alterations to the ballot. Ex. 1008, 12:33–36, *cited in* Pet. 78. These teachings support Dr. Shamos’s testimony, which we credit on this point. *See* Shamos Decl. ¶¶ 327–330. On this record, we agree with Petitioner’s conclusion that a person of ordinary skill in the art would have added Backert’s hash-value process to Nadaf’s voting method. Pet. 74–79.

Thus, Petitioner shows that Nadaf and Backert collectively teach or suggest “wherein a first hash produced from the data set is compared to a

second hash provided on the printed vote record, a comparison of the first hash and the second hash confirming an integrity of the printed vote record,” as recited in claim 11. *Id.* For the same reasons and for reasons similar to those discussed in Section II.H.1.b(1), Petitioner has also shown that Nadaf and Backert collectively teach or suggest claim 28, which requires “a second hash provided in the bar code.” *See id.*; *supra* § II.H.1.b(1) (discussing claim 28 and Nadaf’s bar codes).

From the entirety of the record, we find that a person of ordinary skill in the art would have combined Nadaf and Backert. This combination would have been within the level of ordinary skill in the art. Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter of claims 11 and 28 would have been obvious over Nadaf and Backert.

### (3) *Petitioner’s Reply*

Petitioner points out in its Reply that Nadaf teaches digital signatures, which also generate hashes. Pet. Reply 24–26. In response, Patent Owner argues that Petitioner presents a new theory for the first time in its Reply. Sur-reply 19–23. In Patent Owner’s view, Petitioner now relies on Nadaf alone for generating and comparing the hashes recited in claims 11 and 28, and this alleged new theory relies on a new exhibit describing the ECDSA standard in its obviousness rationale. *Id.* at 21–23.

Yet the details of the ECDSA standard are irrelevant to our analysis because the Petition does not rely on Nadaf alone to teach the hash values. *See* Pet. 72–79. Rather, the Petition describes applying Herskowitz’s and Backert’s hash-value procedures to Nadaf’s data as an “additional” measure to “further increase security.” *Id.* at 79. So the analysis in this decision focuses on the collective teachings of Herskowitz, Backert, and Nadaf as

described in the Petition. *See id.* To the extent that Petitioner’s Reply or Dr. Shamos’s Supplemental Declaration suggests that Nadaf alone anticipates claims 11 and 28, this rationale is not a basis for our decision.

## 2. *Claims 12–14*

Claims 12–14 directly or indirectly depend from claim 11. *See* Ex. 1001, 9:58–63. Claim 12 recites, “The method of claim 11, wherein the second hash is provided in a bar code on the printed vote record.” *Id.* at 9:58–59. A similar limitation is also found in claim 28, which is discussed in Section II.H.1. Claims 13 and 14 recite limitations about a bar code similar to those of claims 8 and 9, which are discussed in Sections II.F.3–5.

Patent Owner does not substantively address Petitioner’s assertions about claims 12–14 or otherwise contend that the art lacks any of the recited features. Rather, Patent Owner argues that “Ground 5 [based on Nadaf and Herskowitz or Nadaf and Backert] fails for at least the same reasons as Ground 3 [based on Nadaf].” PO Resp. 71. Patent Owner also argues that “Ground 5 [based on Nadaf and Herskowitz or Nadaf and Backert] fails because [Petitioner] has not shown that the secondary references supply the additional element of claims 11-14 and 28 that [Petitioner] concedes are missing from Nadaf.” *Id.*

We disagree with Patent Owner’s arguments for the reasons discussed above. *Supra* § II.H.1. Upon review of the entirety of the record, we are persuaded by Petitioner’s analysis, and we credit the testimony of Dr. Shamos. Pet. 73–74 (citing Ex. 1007, 14:10–13; Shamos Decl. ¶¶ 308–309).

In particular, Petitioner explains that Nadaf discloses the bar-code limitations of claims 12, 13, and 14 as discussed in the section of the Petition that analyzed Nadaf. Pet. 73–74 (citing Ex. 1007, 14:10–13;

Shamos Decl. ¶¶ 308–309). In the cited passage, Nadaf discloses that verification ballot 14, shown in Figure 4, shows the complete vote encoded in a two-dimensional bar code with the digital signatures. Ex. 1007, 14:10–13.

In Section II.H.1, we analyzed the collective teachings of Herskowitz, Backert, and Nadaf with respect to claim 28, which Petitioner asserts “is virtually identical to dependent claim 12.” Pet. 73. In Sections II.F.3, 4, and 5 of this Decision, we analyzed the arguments and evidence about one- and two-dimensional bar codes. For the same reasons as discussed in those sections, we determine that Petitioner’s analysis shows that the collective teachings of Herskowitz, Backert, and Nadaf teach or suggest the limitations of claims 12, 13, and 14. *Supra* §§ II.F.3–5, II.H.1.

Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter recited in claims 12–14 would have been obvious.

*I. Obviousness over Nadaf, Heilper, Backert, and Herskowitz*

Petitioner asserts that the subject matter of claims 20–22 is unpatentable as having been obvious over Nadaf, Heilper, and Backert or Nadaf, Heilper, and Herskowitz. Pet. 80–85.

*1. Claim 20*

Claim 20 recites limitations similar to those recited in claims 11 and 28 except that (1) the voter selection is performed with a ballot-marking device (BMD), (2) the voter-readable text includes a candidate name, and (3) an election dictionary is used. *Compare* Ex. 1001, 10:33–54, *with id.* at 9:39–57 (claim 11), 11:30–12:12 (claim 28).

For claim 20, the Petition’s analysis and evidence repeats or is substantially similar to the analysis and evidence that we discussed in Sections II.F through H of this decision. *See* Pet. 80–83.

Likewise, Patent Owner relies on arguments similar to those that we discussed above.

In particular, Patent Owner argues that the Nadaf does not disclose “generating a cast vote record from the OCR data set.” PO Resp. 80. We disagree with that argument for the reasons discussed in Section II.F.1.g.

Patent Owner argues that neither Backert nor Herskowitz discloses “a first hash produced from the first data set is compared to a second hash provided on the PVR to confirm an integrity of the PVR.” *Id.* In Patent Owner’s view, Petitioner ignores that “first data set” must be created “utilizing optical character recognition (OCR) on the scanned candidate name,” and the cited references do not disclose generating a hash based on an OCR data set. *Id.* We disagree with those arguments for the reasons discussed in Section II.H.

Patent Owner argues that an election dictionary as recited in claim 20 would not have been obvious from Heilper. *Id.* (citing Pet. 82–83). We disagree for the reasons discussed in Section II.G.

Patent Owner further argues that Petitioner’s “arguments for combining Herskowitz and/or Backert with Nadaf were deficient in Ground 5, and [Petitioner] has not provided any basis for a different conclusion in [this ground].” *Id.* at 80. We disagree that Petitioner’s reasons are insufficient as discussed in Section II.H.

Patent Owner also argues that Petitioner “repeats the same arguments from Ground 2 and 4 regarding ‘the importance of ensuring that a cast vote record is accurate in an official election,’” which Patent Owner views as

“conclusory.” *Id.* at 81. We disagree for the reasons discussed in Section II.G.

Patent Owner also argues that “Ground 6 fails for the additional reason that ES&S has not argued (much less shown) that a POSITA would have an expectation of success in making its proposed combination.” *Id.* Patent Owner, however, does not provide any reasons specific to the combination proposed in this ground. *See id.* We disagree with Patent Owner’s arguments for the reasons that follow and the reasons discussed above in Sections II.G and H.

In particular, Petitioner sufficiently shows that Nadaf teaches or suggests the subject matter recited in claims 11 and 28 that is also recited in claim 20. *Supra* § II.H.1. Also, Petitioner explains why one of ordinary skill in the art would have used Heilper’s dictionary to ensure OCR accuracy in Nadaf, as discussed in connection with claim 25. *Supra* § II.G.

As for the hash function, Petitioner asserts that “the use of hash algorithms was well known in the electronic voting machine art and is specifically disclosed in Backert and Herskowitz,” referring to Sections X(A)(3) and X(E)(2) of the Petition. Pet. 80. In Section X(E)(2), Petitioner explains that it was known that hash functions are used to protect a document’s integrity. *Id.* at 75. The Petition develops this reasoning by first quoting a passage describing using hashes to detect altered ballots from WO 01/20562 A2 to Adler. *Id.* (quoting Ex. 1037, 33:4–6). Because the passage explains that hashes provide a solution to the altered-ballot problem, this passage supports Petitioner’s obviousness rationale that adding hashes would provide an additional measure of security. *Id.* Building on the altered-ballot problem statement, the Petition then explains how the specific teachings from Herskowitz and Backert help ensure ballot integrity in Nadaf.

*Id.* at 75–77. For the reasons discussed above, Herskowitz and Backert adequately support the Petition’s obviousness rationale. *Supra* § II.H.

As for the remaining limitations of claim 20, Petitioner asserts that (1) Nadaf records votes with a BMD and (2) Nadaf’s voter-readable text includes a candidate name. In particular, Petitioner asserts that Nadaf contrasts direct-recording electronic voting machines with the invention:

This set of equipment will bring the vote printed on paper ballots to the electoral process, however, with another level of security, where the ballot printed with the citizen’s vote will be handled only by the voter casting the vote.

Ex. 1007, 4:7–9, *quoted in* Pet. 81.

According to Petitioner, “A POSITA would have understood Nadaf to be a BMD.” Pet. 81 (citing Ex. 1007, 4:5–9; Shamos Decl. ¶ 337). In the ’966 patent, a “wide range” of BMDs may be used. Ex. 1001, 4:27–30. Like Nadaf’s BMD, in one example, the voter enters selections, and the BMD prints a PVR with its internal printer. *Id.* at 4:39–45. On this record, Petitioner sufficiently shows that Nadaf teaches the recited BMD. *See* Pet. 81.

As for the candidate’s name, Petitioner asserts that Nadaf shows the candidate name “Joana Maria Silva,” among others, on the PVR. *Id.* at 81–82. Nadaf’s Figure 4 is reproduced below with Petitioner’s annotations. *Id.* at 82.



**Nadaf's Figure 4 above shows a PVR with the candidate names highlighted by Petitioner in yellow. Pet. 82.**

According to the passages cited in the Petition, ballot 14 shows the voter's choices for each office being contested in the election. Ex. 1007, 14:10–12. That is, Nadaf's Figure 4 shows the candidate name “Joana Maria Silva” next to the office “Dep. Estadual,” among the other choices. *Id.* Fig. 4, *discussed in* Pet. 81–82. Thus, the record supports Petitioner's assertion that Nadaf teaches or suggests the candidate name recited in claim 20.

Thus, we determine that Petitioner has shown by a preponderance of the evidence that the subject matter recited in claim 20 would have been obvious.

## 2. Claim 21

Claim 21 recites,

The method of claim 20, further comprising: providing *additional data* in the first data set, the additional data set obtained by scanning additional information related to the voter's vote selection to assist in identifying the voter's vote selection.

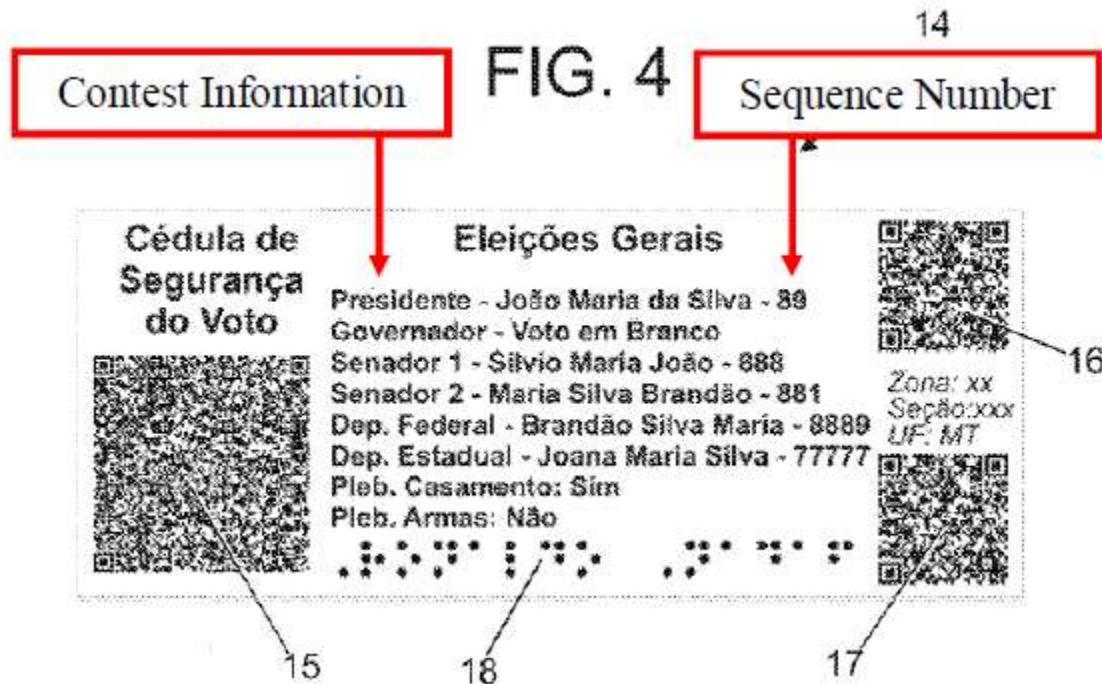
Ex. 1001, 10:55–59 (emphasis added).

The '966 patent discloses that the additional data can be information other than the candidate's name, such as "sequence number data," "line number data affiliated with the contest," "the contest name itself," or "data related to the candidate." *Id.* at 5:14–22.

Petitioner asserts that the subject matter of claim 21 would have been obvious over Nadaf, Heilper, and Backert or Nadaf, Heilper, and Herskowitz. Pet. 83–84. Petitioner cites to Nadaf in analyzing the subject matter recited in claim 21. *See id.*

Patent Owner argues that "[a]s in Ground 2 [based on Brockhouse and Heilper], ES&S assumes that just because additional information is present on printed record in Nadaf therefore the additional information would be scanned and provided 'to assist in identifying the voter's vote selection.'" PO Resp. 81. We disagree.

In particular, Petitioner asserts that Nadaf's PVR has the contest name (e.g., "Presidente") and a sequence number. Pet. 83–84. Nadaf's Figure 4 is reproduced below with Petitioner's annotations. *Id.* at 84.



**Nadaf's Figure 4 with Petitioner's text boxes pointing to the "contest information" and "sequence number." Pet. 84.**

With this analysis and evidence, Petitioner has shown that Nadaf teaches or suggests the recited "additional data set obtained by scanning additional information related to the voter's vote selection to assist in identifying the voter's vote selection," as recited in claim 21. *See id.* As shown in annotated Figure 4, above, the PVR's text includes the contest information. *Id.* As discussed in the Sections analyzing the challenges based on Nadaf, Petitioner shows that Nadaf applies OCR to the scanned image of the PVR to create a data set identifying the voter's selections. *Id.* at 65 (citing Ex. 1007, 18:9, 19:7–13; Shamos Decl. ¶¶ 270–273); *supra* §§ II.F.1.g (analyzing the grounds based on Nadaf alone) and II.I.1 (analyzing claim 20, from which claim 21 depends). So we are persuaded that Nadaf scans the contest information accompanying the voter selections to create the recited data set. Pet. 84. And Nadaf's Figure 4 and Petitioner's analysis show that the contest information identifies the contest name

(e.g., “Presidente”) corresponding to the voter’s selection. *See id.* In at least this way, Petitioner has shown that the resulting contest-information data assists in identifying the voter’s vote selection, as recited in the claim. *See id.*

According to Patent Owner, “the secondary considerations discussed in Ground 2—ES&S’s inability to solve the OCR problem for candidates with similar names—also apply to claim 21.” PO Resp. 82. We disagree for the reasons discussed in connection with that ground, which also apply here because the basis for the argument is the same. *See supra* § E.1.i(5).

Upon review of the entirety of the record, we are persuaded by Petitioner’s evidence and analysis, and we credit the testimony of Dr. Shamos. *See* Pet. 83–84 (citing Shamos Decl. ¶¶ 347–348).

### 3. Claim 22

Claim 22 depends from claim 20 and further recites a second hash. Ex. 1001, 10:60–61 Petitioner asserts that claim 22 is virtually identical to claim 12 (Pet. 84), which in turn, is virtually identical to claim 28 (*id.* at 73). We agree. *Compare* Ex. 1001, 10:60–61 (claim 22), *with id.* at 9:58–59 (claim 12), *id.* at 12:9–12 (claim 28, in part).

In its challenge to claim 22, Petitioner refers to the section of the Petition that has the analysis of claim 28. Pet. 85 (citing Pet. § X(E)(2)). In Section II.H.1, we analyzed the collective teachings of Herskowitz, Backert, and Nadaf with respect to claim 28. For the same reasons discussed in that section, Petitioner has shown that the subject matter recited in claim 22 would have been obvious over Nadaf, Heilper, and Backert or Nadaf, Heilper, and Herskowitz.

Upon review of the entirety of the record, we are persuaded by Petitioner’s evidence and analysis, and we credit the undisputed testimony of Dr. Shamos. *See* Pet. 84–85.

*J. Indefiniteness*

Petitioner asserts that claims 4, 5, 26, and 27 are indefinite. Pet. 85–86.

Petitioner asserts that claim 4 is indefinite because it is “ungrammatical and meaningless as written.” *Id.* Because claim 5 depends from claim 4, Petitioner asserts that claim 5 is also indefinite. *Id.* at 86.

For the reasons discussed above in Section II.E.3, we determine that claims 4 and 5 are unpatentable as obvious over Brockhouse and Heilper. Thus, we do not separately assess the patentability of these claims based on the remaining grounds in this proceeding. *See SAS*, 138 S. Ct. at 1359 (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc.*, 809 F. App’x at 990 (recognizing that the “Board need not address issues that are not necessary to the resolution of the proceeding” and, thus, agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

As for claims 26 and 27, with our authorization, Patent Owner obtained a Certificate of Correction for claim 26 after we issued the Decision to Institute in this proceeding. Paper 12. In its motion, which was granted, Patent Owner argued that the requested correction would address a “typographical error” in claim 26 that is correctable under 35 U.S.C. § 255. Paper 10, 3 (Patent Owner’s Motion). On November 11, 2020, Patent Owner requested the Certificate of Correction from the Director. Ex. 2004 (Request

for Certificate of Correction). The Certificate of Correction issued on December 15, 2020. Ex. 2015 (Certificate of Correction).

Claim 26 originally recited “[t]he method of claim 25, wherein the data set wherein a candidate’s name, the data set combined with additional information related to the voter’s vote selection to assist in identifying the voter’s vote selection.” Ex. 1001, 11:23–26. This was the language that was analyzed in the Petition. Pet. 86. In the Certificate of Correction, “wherein the data set wherein” was deleted from claim 26 and “wherein the data set includes” was inserted in its place. Ex. 2015. For the reasons discussed in our Order, we decline to retroactively apply the Certificate of Correction in this proceeding. Paper 18. Thus, we consider the language in claim 26 that was analyzed in the Petition to be at issue here. *Id.*

As for that language, Petitioner asserts that claim 26 includes the following indefinite limitation: “wherein the data set wherein a candidate’s name, the data combined with additional information related to the voter’s vote selection to assist in identifying the voter’s vote selection.” Pet. 86. Because claim 27 depends from claim 26, Petitioner asserts that claim 27 is also indefinite. *Id.* According to Petitioner, “The meaning of this limitation, as written, is indiscernible.” *Id.* (citing Shamos Decl. ¶¶ 362–364). We agree that at least the phrase “wherein a candidate’s name” is meaningless as recited because it is unclear what the phrase modifies. As such, the claim “fail[s] to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *See Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014).

Patent Owner does not contest Petitioner’s assertions. *See generally* PO Resp.; Sur-reply. Instead, Patent Owner points to the language in the Certificate of Correction:

Hart has requested a Certificate of Correction to address a typographical error in claim 26. EX2004, 1-2. With this correction, claim 26 will follow the language of claim 4, and thus—for the same reasons as claim 4—claim 26 and its dependent claim 27 should not be held indefinite. EX2006, ¶149.

PO Resp. 84. We, however, decline to retroactively apply the Certificate of Correction in this proceeding. Paper 18

We are persuaded by Petitioner’s cited evidence and analysis, which Patent Owner does not contest. *See* Pet. 86 (citing Shamos Decl. ¶¶ 362–364). Thus, Petitioner has shown by a preponderance of the evidence that claims 26 and 27 are indefinite.

#### *K. Eligibility*

Petitioner presents a cumulative challenge to claims 1–30: Petitioner asserts that the subject matter of claims 1–30 is ineligible for patent protection under 35 U.S.C. § 101. Pet. 24–46. Because we determine that these claims are unpatentable in light of prior art or indefinite for the reasons discussed above, we do not separately assess the patentability of these claims based on the remaining ground in this proceeding. *See SAS*, 138 S. Ct. at 1359 (holding that a petitioner “is entitled to a final written decision addressing all of the claims it has challenged”); *Boston Sci. Scimed, Inc.*, 809 F. App’x at 990 (recognizing that the “Board need not address issues that are not necessary to the resolution of the proceeding” and, thus, agreeing that the Board has “discretion to decline to decide additional instituted grounds once the petitioner has prevailed on all its challenged claims”).

### III. CONCLUSION

Petitioner has shown that claims 1–30 are unpatentable.

#### IV. ORDER

It is  
ORDERED that claims 1–30 of the '966 patent are unpatentable; and  
FURTHER ORDERED that, because this is a Final Written Decision,  
parties to this proceeding seeking judicial review of the Decision must  
comply with the notice and service requirements of 37 C.F.R. § 90.2.

In summary, we find as follows.

| Claims Challenged      | 35 U.S.C. § | Reference(s)/ Basis                 | Claims Shown Unpatentable   | Claims Not Shown Unpatentable |
|------------------------|-------------|-------------------------------------|-----------------------------|-------------------------------|
| 1–30                   | 101         | Eligibility <sup>5</sup>            |                             |                               |
| 1–5, 15–19             | 103         | Brockhouse, Heilper                 | 1–5, 15–19                  |                               |
| 6–10, 23, 24, 29, 30   | 102         | Nadaf                               | 6, 7, 9, 10, 23, 24, 29, 30 |                               |
| 6–10, 23, 24, 29, 30   | 103         | Nadaf <sup>6</sup>                  | 8                           |                               |
| 25                     | 103         | Nadaf, Heilper                      | 25                          |                               |
| 25                     | 103         | Nadaf <sup>7</sup>                  |                             |                               |
| 11–14, 28              | 103         | Nadaf, Backert, Herskowitz          | 11–14, 28                   |                               |
| 20–22                  | 103         | Nadaf, Heilper, Backert, Herskowitz | 20–22                       |                               |
| 4, 5, 26, 27           | 112(b)      | Indefiniteness                      | 26, 27                      |                               |
| <b>Overall Outcome</b> |             |                                     | 1–30                        |                               |

<sup>5</sup> As explained above, we do not reach this ground. *See supra* § II.K.

<sup>6</sup> As explained above, we do not reach this ground for claims 6, 7, 9, 10, 23, 24, 29, and 30. *See supra* §§ II.F.2, 5.

<sup>7</sup> As explained in Section II.G, because we find that the subject matter of this claim would have been obvious over Nadaf in combination with Heilper, we do not reach the ground based on Nadaf alone.

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