

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MACHINEX INDUSTRIES, INC.,
Petitioner,

v.

JJG IP HOLDINGS, LLC,
Patent Owner.

IPR2020-00899
Patent 9,950,346 B2

Before GEORGE R. HOSKINS, MICHAEL L. WOODS, and
ROBERT L. KINDER, *Administrative Patent Judges*.

WOODS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)
ORDER
Denying Petitioner's Motion to Exclude
Dismissing Patent Owner's Motion to Exclude
37 C.F.R. § 42.64

I. INTRODUCTION

Petitioner, Machinex Industries, Inc., filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1–16 (“the challenged claims”) of U.S. Patent No. 9,950,346 B2 (Ex. 1001, “the ’346 patent”).¹ Pet. 4. We issued a decision to institute an *inter partes* review of these claims. Paper 11 (“Institution Decision” or “Inst. Dec.”).

After institution, Patent Owner, JJG IP Holdings, LLC, filed a Patent Owner Response (Paper 19, “PO Resp.” or “Response”), to which Petitioner replied (Paper 28, “Pet. Reply” or “Reply”). Patent Owner also filed a Sur-Reply to Petitioner’s Reply. Paper 29 (“PO Sur-Reply” or “Sur-Reply”).

Petitioner further filed a Motion to Exclude several of Patent Owner’s exhibits (Paper 34), to which Patent Owner opposed (Paper 35), and Petitioner Replied (Paper 37).

Patent Owner also filed a Motion to Exclude one of Petitioner’s Exhibits (Paper 43), to which Petitioner opposed (Paper 44).

Oral argument, or hearing, was held on July 21, 2021, and the Transcript of the hearing has been entered as Paper 42 (“Transcript” or “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. Petitioner bears the burden of proving unpatentability of the challenged claims, and the burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35

¹ Petitioner identifies itself and Machinex Technologies Inc. as the real parties-in-interest. Pet. 3. Patent Owner identifies itself as the sole real party-in-interest. Paper 4, 1.

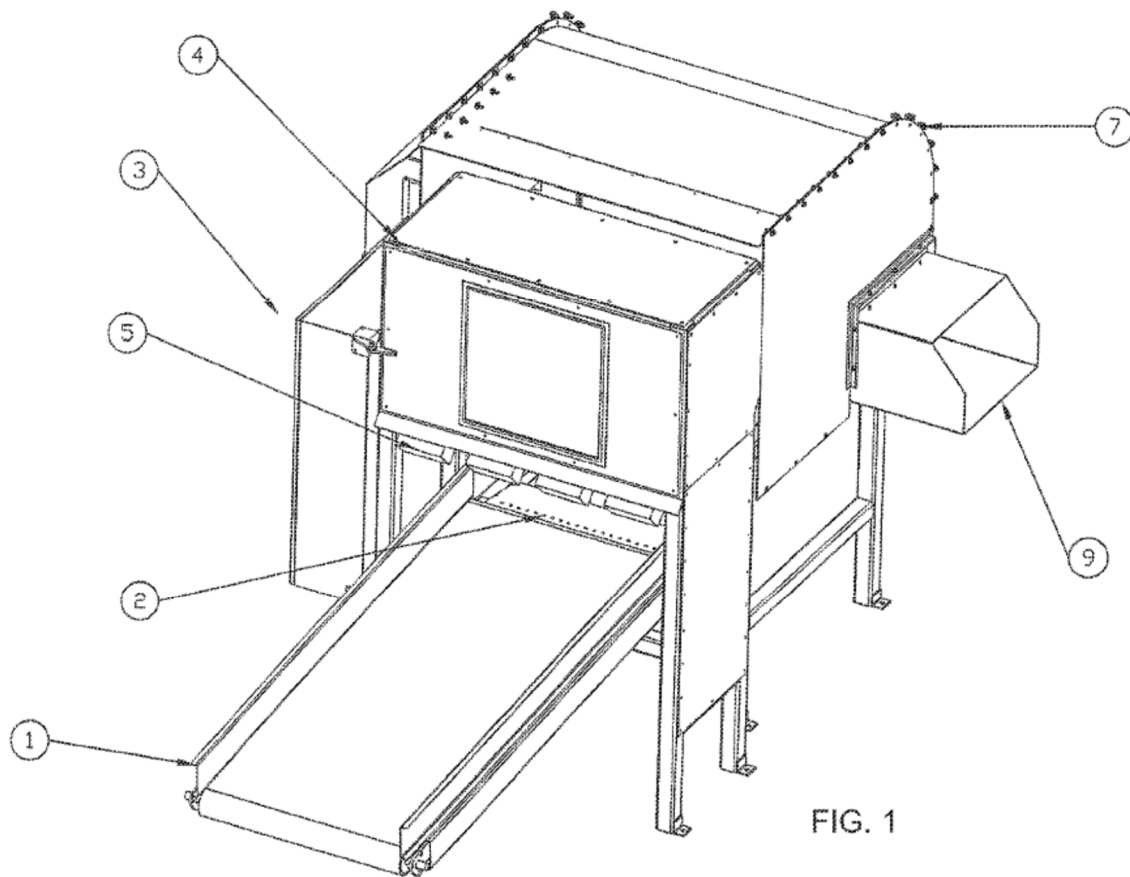
U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, Petitioner has shown that claims 1–16 of the ’346 patent are unpatentable.

A. Related Proceedings

The parties identify *JJG IP Holdings, LLP v. Machinex Indus., Inc.*, No. 1:19-cv-00437 (M.D.N.C.) as a related proceeding. Pet. 3; Paper 4, 1.

B. The ’346 Patent (Ex. 1001)

The ’346 patent is titled “Method and Apparatus for Sorting Recycled Material.” Ex. 1001, code (54). The patent describes an apparatus and method for sorting heterogeneous material, such as a mix of recycling material. *See id.* at code (57), 1:14–24. To illustrate an embodiment of the described system, we reproduce its Figure 1, below:



According to the '346 patent, Figure 1 “is a front perspective drawing illustrating a system for the separation of heterogeneous material.” *Id.* at 3:36–38. In particular, conveyor 1 carries material to identification camera enclosure 4, which encloses a camera (not shown). *See id.* at 4:1–4. “Disposed proximately” to the camera is array of lights 5, which highlight the target area for the camera. *Id.* at 4:4–5. In one embodiment, the camera is a hyperspectral camera, in which cameras and sensors “collect and then combine spatial and spectral information” as a set of images. *Id.* at 4:6–9. Computer system 3 is programmed to receive input from the camera and to provide output signals to ejector nozzles, which “eject desired product.” *Id.* at 5:5–9. The force from the ejector jets “propels the picked items into”

receiving hood 7, which is located above conveyer belt 1, where the items are pushed toward collection point 9. *Id.* at 5:23–28.

C. Illustrative Claims

Of the challenged claims, claims 1 and 14 are independent. Ex. 1001, 5:66–8:17. We reproduce claims 1 and 9 below, reformatted from the version provided in the '346 patent to include bracketed alphanumeric nomenclature that corresponds with Petitioner's modifications or nomenclature. *See* Pet. 40–51.

1. [*Limitation 1(p)*] A system for the identification and sorting of heterogeneous material, the system comprising:

[*Limitation 1(a)*] a hyperspectral identification system for capturing spectra of material,

[*Limitation 1(b)*] said hyperspectral identification system comprises at least one hyperspectral camera said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light corresponding to spectral signatures of target materials to be identified if present in said heterogeneous material and spacial data locating a position of said heterogeneous materials on a solid belt;

[*Limitation 1(c)*] said camera disposed proximate to a visible or infrared light source,

[*Limitation 1(d)*] said light source and said at least one hyperspectral camera are disposed on the same side of a stream of said heterogeneous material;

[*Limitation 1(e)*] said solid belt having first and second ends, said belt running beneath said hyperspectral identification system and upon which said heterogeneous material is conveyed from said first end to said second end,

[*Limitation 1(f)*] said belt traveling at a preset rate, said hyperspectral identification system being disposed over said second end of said belt;

[*Limitation 1(g)*] a computer configured to receive and analyze data from said hyperspectral identification system,

[*Limitation 1(h)*] to identify target materials of a first user defined category from among said heterogeneous materials,

[*Limitation 1(i)*] identify the spatial position of said target materials, and

[*Limitation 1(j)*] to trigger an ejection system at a preset time delay equal to the distance between said camera and said ejection system divided by the rate of travel of the belt; and

[*Limitation 1(k)*] said ejection system disposed immediately after said second end of said belt, whereby said desired materials are separated from said heterogeneous material,

[*Limitation 1(l)*] said ejection system being triggered by said computer.

9. The system according to claim 1 wherein said heterogeneous materials comprise waste and recyclable materials.

Ex. 1001, 5:66–6:32, 6:58–59; Pet. 40–51.

D. References Relied Upon

Petitioner's challenges rely on the following references (Pet. 4–6):

Name	Reference	Ex. No.
Carlsohn	Excerpts from Color Image Processing: Methods and Applications, CRC Press (2007)	1002
Sinram	WO Publication No. 2007/112591 A1, published Oct. 11, 2007	1003
Arleth	US Patent Publication No. 2004/0044436 A1, published Mar. 4, 2004	1004
Kampf	US Patent Publication No. 2005/0127285 A1, published June 16, 2005	1005
Ulrichsen	US Patent No. 6,353,197 B1, issued Mar. 5, 2002	1006
Mayhak	US Patent No. 5,339,961, issued Aug. 23, 1994	1007
Cowling2	US Patent Publication No. 2007/0278139 A1, published Dec. 6, 2007	1019

E. Alleged Grounds of Unpatentability²

Petitioner contends that the challenged claims are unpatentable based on the following asserted grounds (Pet. 4–6):

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis ³
1	1–5, 7, 9–12	103	Carlsohn, Arleth
2	8	103	Carlsohn, Arleth, Ulrichsen, Mayhak
3	1–7, 9–16	103	Carlsohn, Arleth, Sinram
4	8	103	Carlsohn, Arleth, Ulrichsen, Mayhak, Sinram
5	2	103	Carlsohn, Arleth, Kampf
6	2	103	Carlsohn, Arleth, Sinram, Kampf
7	12, 13	103	Carlsohn, Arleth, Cowling ²
8	12, 13	103	Carlsohn, Arleth, Sinram, Cowling ²

Petitioner supports its challenge with a declaration from Dr. Gonzalo R. Arce (Ex. 1008).⁴ Patent Owner supports its Response with declarations from Mr. Fred P. Smith (Exs. 2001, 2022).

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the ’346 patent issued asserts priority to a parent application filed before this date, and this priority is not at issue in this proceeding, we apply pre-AIA version of § 103.

³ Petitioner cites to the native page numbers of many of the exhibits. *See, e.g.*, Pet. 33 (citing to Carlsohn’s native page numbers 405–413, rather than the corresponding exhibit’s page numbers 39–47). For clarity of record, our

II. ANALYSIS

A. Preliminary Response Incorporated by Reference

In the Response, Patent Owner incorporates by reference “all the evidence and arguments previously presented by” Patent Owner, including, we presume, those made in the Patent Owner’s Preliminary Response. *See* PO Resp. 1–2.

We do not permit a Patent Owner to incorporate by reference arguments made in the Preliminary Response. Our Rules provide that “[a]rguments must not be incorporated by reference from one document into another document.” 37 C.F.R. § 42.5(a)(3). Furthermore, our Scheduling Order states that “Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.” Paper 12, 8 (bold emphasis omitted). Accordingly, arguments made by Patent Owner in its Preliminary Response, which were not otherwise made in the Response, are waived. *See* Tr. 4:23–5:9 (explaining the same during the oral argument).

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17 (1966).

citations will be to the exhibits’ page numbers, rather than the native page numbers.

⁴ By e-mail communication from the Board on June 25, 2020, we authorized Petitioner to file a corrected Exhibit 1008. Our reference to Exhibit 1008 is to the corrected, second-filed exhibit, filed on July 7, 2020.

Factors pertinent to a determination of the level of ordinary skill in the art include: (1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of workers active in the field. *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–97 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.* Moreover, these factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. Ltd, Inc. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

In determining a level of ordinary skill, we also may look to the prior art, which may reflect an appropriate skill level. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

In the Institution Decision, we determined that a person having ordinary skill in the art (“POSITA”) would have had a bachelor’s degree in electrical engineering, computer science, computer engineering, or a related subject, or four to five years of work experience with heterogeneous material sorting systems used in materials recycling facilities. Inst. Dec. 12–13.

Neither Petitioner nor Patent Owner disputes our determination of the level of ordinary skill in the art. *See generally* Pet. Reply; *see also* PO Resp. 5 (acknowledging our definition of a POSITA). Accordingly, we maintain our definition of the level of ordinary skill in the art as set forth in our Institution Decision. Inst. Dec. 12–13.

C. Claim Construction

In an *inter partes* review proceeding for a petition filed on or after November 13, 2018, a patent claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). *See* 37 C.F.R. § 42.100(b) (2019). This rule adopts the same claim construction standard used by Article III federal courts (*see id.*), which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) and its progeny. Under the *Phillips* standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Based on the final record before us, we determine that three clauses within the claims require express construction for purposes of this Final Decision. We address each in turn below.

1. “*at least one hyperspectral camera said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light corresponding to spectral signatures of target materials to be identified*”

At the institution phase, we determined that the plain and ordinary meaning of the claimed limitation, “said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light” as recited in Limitation 1(b), required a single hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared (“IR”) and visible light. Inst. Dec. 14–17.

Petitioner does not dispute our construction (*see generally* Pet. Reply) and Patent Owner expressly agrees with this construction (*see* PO Resp. 5

(“PO believes that construction is correct, as far as it goes.”)). Accordingly, we maintain the construction set out in our Institution Decision. *See* Inst. Dec. 14–17.

Patent Owner submits, however, that the claim language “corresponding to spectral images of target materials to be identified” requires that “the camera specifically be configured to receive spectral data *up to at least 1700 nm* (nanometers) in order to receive spectral data corresponding to spectral signatures of target materials to be identified, i.e. recyclable materials and commodities.” *Id.* at 5–6 (citing Ex. 2022 ¶¶ 6–7) (emphasis added); *see also* PO Sur-Reply 4 (“[T]he intrinsic evidence discloses that the claimed hyperspectral camera must image infrared wavelengths up to 1700 nm.”).

In support of Patent Owner’s proposed construction, Patent Owner points out that dependent claim 9 “requires that the heterogeneous materials to be sorted be comprised of waste and recyclable materials.” PO Resp. 6. Patent Owner further cites the Specification, which states, “Even another embodiment of the present invention provides such a method wherein heterogeneous material comprises waste material and recyclable material in combination.” *Id.* (citing Ex. 1001, 3:21–24).

In addition to citing claim 9 and the Specification, Patent Owner cites to statements made by John Green (a co-inventor of the ’346 patent) during prosecution, including:

Another important aspect of our invention to the recycling industry is its ability to sort previously un-sortable materials. Specifically, our development of hyperspectral technology has enabled the sorting of: black plastics, which are important to auto scrap and industrial recyclers; chlorine based plastics, such as PVC and vinyl so that they may be removed from the waste

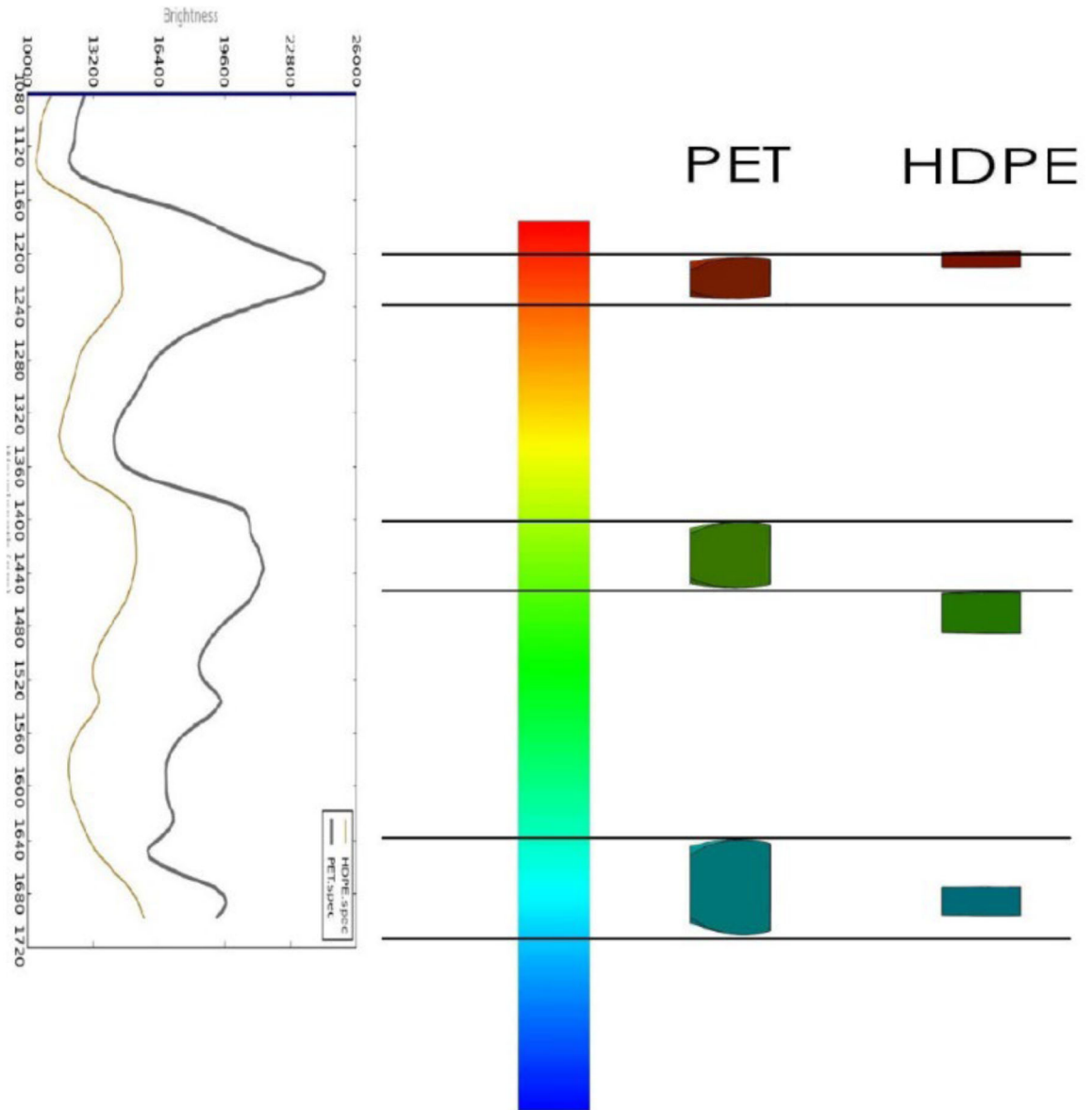
stream prior to their disposal at waste energy plants, extending the life of the plants' burn chambers and thereby raising the value of the feed stock; arsenic laden pressure treated wood, as differentiated from natural wood, so that it may be removed prior to power generation.

...

Recycling markets further require the flexibility to easily differentiate between those plastics with the highest market value with and those with the lowest market value, such as those having outer plastic or inner wraps. In post-consumer plastics recycling, 50% of all incoming containers are PET [or polyethylene terephthalate] "water bottle" plastics. In case the PET "eye", or optical measuring device, went off line, a downstream optical sensor that could easily switch from HDPE plastics to PET and sort natural HDPE [or high-density polyethylene] plastics from Colored HDPE plastics without picking whites "all other sorting technologies are unable to differentiate White HDPE bottles from Natural HDPE" was desirable. Markets demand th[is] flexibility.

Id. at 7–8 (citing Ex. 2002, 262–63).

Patent Owner further submits that, during prosecution, Peter Mendre (the other co-inventor of the '346 patent) "describ[ed] the use of hyperspectral imaging in connection with the claimed invention . . . [and] a particular type of plastic sorting" that the inventors "were trying to achieve, providing the below illustration:"



Id. at 9–10 (citing Ex. 2002, 49; Ex. 2003, 129); PO Sur-Reply 5 (citing Ex. 2002, 49, Ex. 2003, 129).⁵ Patent Owner submits that the above “illustration shows how a POSITA could differentiate PET (a recyclable

⁵ The color figure provided by Patent Owner does not exist on either page 49 of Exhibit 2002 or page 129 of Exhibit 2003. Rather, these exhibits show a black-and-white version of the figure provided by Patent Owner.

plastic) from a waste plastic such as HDPE.” PO Resp. 10 (citing Ex. 1008 ¶ 59); PO Sur-Reply 5 (arguing the same).

Based on claim 9, the Specification, and the prosecution history of the ’346 patent, Patent Owner proposes that “the ’346 patent makes clear and the inventors made very clear during prosecution that their invention need[s] to be able to sort recyclable plastic waste from waste plastic, and to do that one needed to collect IR spectral data up to at least 1700 nm.” PO Resp. 10.

Patent Owner further cites to Carlsohn—one of the references cited by Petitioner—in support of its proposed construction. *See id.* at 10–12. In particular, Patent Owner cites to Carlsohn’s Figure 17.11 (*id.* at 10), which we reproduce, below:

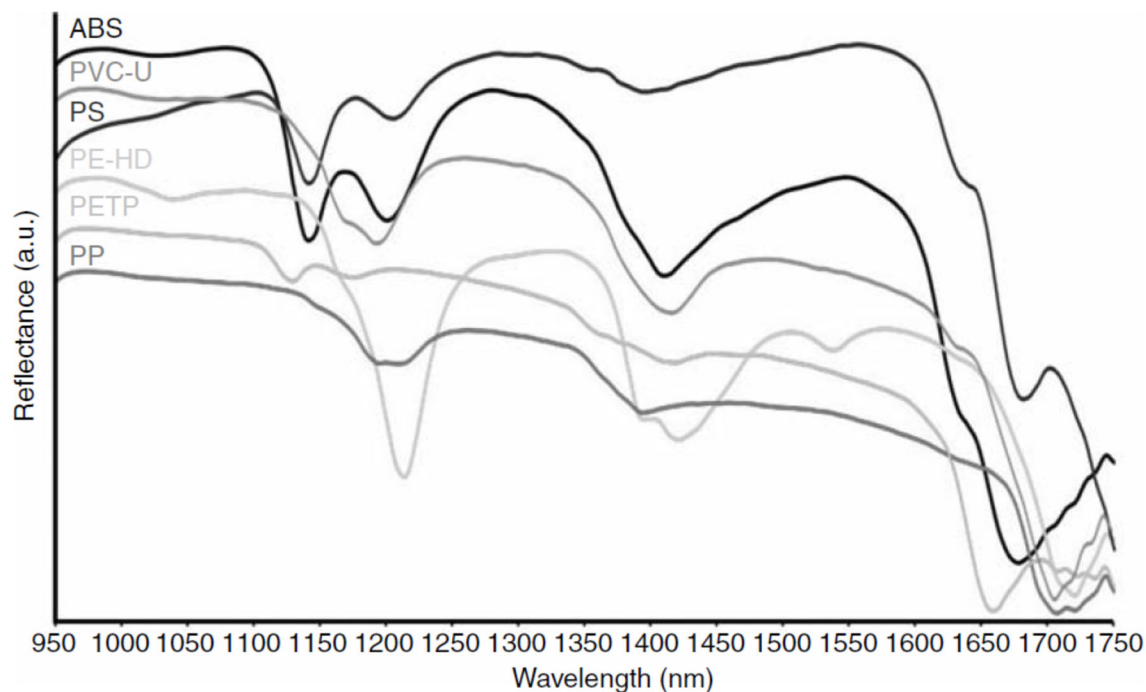


Figure 17.11 depicts “[r]eflectance spectra of ABS [or acrylonitrile butadiene styrene], PVC-U [or polyvinyl chloride] (unplasticized), PS [or polystyrene], PE-HD [or polyethylene] (high-density), PETP [or PET] and PP [or polypropylene] in the NIR [or near-infrared] band.” Ex. 1002, 45.

Carlsohn discloses that “[s]trong absorption features can be seen around 1200 nm and 1400 nm.” *Id.*

Patent Owner submits that a “POSITA understood, as explained by the inventors, that to be a useful system, IR spectral data needed to cover at least wavelengths from 900 to 1700 nm.” PO Resp. 11.⁶

In its Sur-Reply, Patent Owner further cites to Petitioner’s expert, Dr. Arce, for “repeatedly mention[ing] the wavelength ranges of the prior art documents as allegedly reading on the claims of the ’346 patent because the prior art included identification systems measuring reflectance of material between 400 nm and 1750 nm, and specifically the NIR range of 950-1750 nm.” PO Sur-Reply 8–9 (citing Ex. 1008 ¶¶ 27, 36, 37, 42, 59, 66, 67).

In its Reply, Petitioner contends that “Patent Owner tries to assert that the claims require at least one camera be able to cover wavelengths through the visible range up to the infrared wavelength of 1700 nm. This, however, is Patent Owner conjuring limitations to avoid the inevitable cancellation of claims.” Pet. Reply 7. Petitioner submits that “Patent Owner offers no instance in the specification, claims or prosecution history where the inventor says that the claims cover any particular wavelengths in the infrared range, let alone 1700 nm.” *Id.* (citing Ex. 1038, 28:3–22 (Smith deposition)).

We agree with Petitioner.

Any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness, and precision. *In re*

⁶ Patent Owner does not cite to any testimony, including Mr. Smith’s, in support of this assertion. *See* PO Resp. 11.

Paulsen, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Here, no such special definition exists.

As explained above, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Combing through Patent Owner’s numerous pages of briefing, as well as the Specification and the prosecution history, we find nothing in the record to support Patent Owner’s proposed construction that the claimed limitation requires a “single hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of visible and IR light up to at least *1700 nm in wavelength*.” PO Resp. 12 (emphasis added); *see also* PO Sur-Reply 10 (proposing the same). Petitioner is correct that the “1700 nm target is a purely arbitrary value, picked out of the air.” Pet. Reply 8; *see also* Tr. 8:23–12:1 (“Our point here is that this is truly arbitrate pluck, 1,700 nanometers, out of the air.”).

Patent Owner argues that claim 1 requires a 1700 nm wavelength limit based on a figure referenced by an inventor during prosecution (*see* PO Resp. 9) and a figure from Carlsohn (*see id.* at 10). There are multiple problems with Patent Owner’s construction, however.

First, nothing in the ’346 patent mentions any particular wavelengths, let alone one that is 1700 nm. Indeed, Patent Owner’s expert and counsel acknowledged as much. *See* Ex. 1038, 28:3–18 (Mr. Smith testifying on cross examination that he does not “think there is a particular” wavelength disclosed in the ’346 patent); *see also* Tr. 46:9–10 (“Specific wavelengths

are not mentioned in the specification.”). Moreover, Patent Owner appeared to acknowledge that the Specification does not provide explicit written description support for a hypothetical limitation requiring receiving spectral data up to at least 1,700 nanometers. *See* Tr. 45:10–47:8 (“a POSITA wouldn’t know that you need to go up to 1,700 to sort multiple recyclable materials” but “it would have to come down to the language discussing -- that mentions recyclable materials, plural”).

Second, the plain and ordinary language of claim 1 simply recites “heterogeneous material.” *See* Ex. 1001, 5:66–6:32. Although dependent claim 9 further recites “waste and recyclable materials,” neither independent claim 1 nor dependent claim 9 recites “plastic,” let alone polyethylene terephthalate or high-density polyethylene shown in the figure cited by Patent Owner. *See id.* at 5:66–6:32, 6:58–59; *see also* PO Resp. 9 (reproducing a figure referenced by an inventor during prosecution). Furthermore, we find no reference to “plastic,” let alone HDPE or PET, in the Specification. *See* Pet. Reply 8 (finding the same). *Even if* the claims and Specification recited “HDPE” or “PET,” however, nothing in the claims or Specification would lead us to believe that the material recited required any particular wavelength for “corresponding to spectral signatures of” that particular plastic, as Patent Owner argues. *See* Ex. 1001, 5:66–6:32.

Third, Patent Owner’s reliance on Carlsohn’s Figure 17.11 fails to support Patent Owner’s assertion that a “POSITA understood, as explained by the inventors, that to be a useful system, IR spectral data needed to cover at least wavelengths from 900 to 1700 nm.” PO Resp. 11. We agree with Petitioner that Carlsohn’s Figure 17.11 “shows that the relevant data trails off at about 1400 nm, well before 1700 nm.” Pet. Reply 9. Indeed,

Carlsohn’s own description of Figure 17.11 refers to the “[s]trong absorption features . . . seen around 1200 nm and 1400 nm,” reflecting Carlsohn’s focus on wavelengths much less than 1700 nm. Ex. 1002, 45. We further find that PETP—which is another name for PET—appears to drop off to zero at about 1650 nm, not 1700 nm. *See* Ex. 1002, 45 (Fig. 17.11); *see also id.* at 40 (defining polyethylene terephthalate as “PET” or “PETP”).

Fourth, Patent Owner’s reliance on Dr. Arce’s testimony is inapposite. *See* PO Sur-Reply 8–9. *Even if* Dr. Arce believes that “the prior art documents . . . read[] on the claims of the ’346 Patent *because* the prior art included identification systems measuring the reflectance of material between *400 nm and 1750 nm*” (*id.* at 8), this does not mean that we must construe the claim as requiring a 1700 nm wavelength range. In other words, simply because wavelengths falling between 400 to 1750 nm may satisfy the claimed limitation requiring a “plurality of selected spectral bands of infrared and visible light,” this is not to say that the claim requires receiving “spectral data in the visible and infrared ranges up to at least 1700 nm,” as Patent Owner proposes. *See id.* at 10.

Mr. Smith’s testimony that “[c]ameras utilizing InGaAs sensors (the standard for recycling) generally work in the 1000 nm to 1700 nm range” (Ex. 2022 ¶ 6) is not persuasive for similar reasons. In addition, this testimony relies on a website article published in 2016, well after the ’346 patent’s 2008 priority date. *See id.*; Ex. 1001, code (60). Further, the quotation from the website article provided by Mr. Smith fails to support his proposition that InGaAs sensors are “the standard for recycling,” in any time frame. *See* Ex. 2022 ¶ 6.

For at least these reasons, we agree with Petitioner that “there is no reason to arbitrarily build in a 1700 nm limitation into a claim.” Pet. Reply 10. Accordingly, we *do not* construe “at least one hyperspectral camera said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light corresponding to spectral signatures of target materials to be identified” as requiring a camera “configured to receive spectral data up to at least 1700 nm,” as Patent Owner proposes. *See* PO Resp. 6.

2. “*said camera disposed proximate to a visible or infrared light source*”

At the institution phase, we construed “disposed proximate to” by its plain and ordinary meaning, and determined that the plain and ordinary meaning of “proximate” is “nearby. Inst. Dec. 18. Accordingly, we construed “disposed proximate to a visible or infrared source,” as recited in Limitation 1(c), to mean “disposed nearby” the visible or infrared source. *See id.* We further note that during prosecution of the ’346 patent, the applicant acknowledged that the term “‘proximate’ is *broad in its scope*.” *See* Ex. 1020, 70 (emphasis added).

Petitioner does not dispute our construction (*see generally* Pet. Reply) and Patent Owner expressly agrees with this construction (*see* PO Resp. 12 (“PO does not here challenge that construction.”)). Accordingly, we maintain the construction set out in our Institution Decision. *See* Inst. Dec. 18.

3. “*said hyperspectral identification system being disposed over said second end of said belt*”

Patent Owner proposes that “said second end of said belt” should be construed to mean “the portion of the belt *immediately adjacent* the ejection system.” PO Resp. 14 (emphasis added); *see also id.* at 22. As such, Patent Owner explains that the claimed limitation, “said hyperspectral identification system being disposed over said second end of said belt,” as recited in Limitation 1(f), should be construed to mean “the hyperspectral identification system is positioned *over the portion of the belt immediately adjacent the ejection system.*” *Id.* at 14 (emphasis added).

Patent Owner explains that the “figures of the ’346 Patent support this understanding,” referencing Figures 1 and 5. *Id.* In addition to Figures 1 and 5, Patent Owner cites to the text of the Specification (*see id.* at 16–17) and the prosecution history (*see id.* at 17).

Petitioner’s position is that “a POSITA would understand the term [end] to be a term of approximation.” *See* Pet. Reply 15 (citing *Whirlpool Corp. v. LG Elecs., Inc.*, No. 1:04-CV-100, 2005 U.S. Dist. LEXIS 44479 (W.D. Mich. Nov. 8, 2005)). Petitioner explains that “[t]he term ‘second end’ must have been meant to convey a general location, as opposed to a particular point on the belt; otherwise, the system would not have time to process the data before items contacted the ejector system, rendering the system inoperable for its intended use.” *Id.*

We agree with Petitioner.

We find nothing cited by the Patent Owner in the Specification or prosecution history to support Patent Owner’s narrow construction that “second end” must be construed as “immediately adjacent the ejection system.” To illustrate, we address Figures 1 and 5 of the ’346 patent, which

Patent Owner directs our attention to. *See* PO Resp. 14–16. We first reproduce Figure 1 of the '346 patent, below:

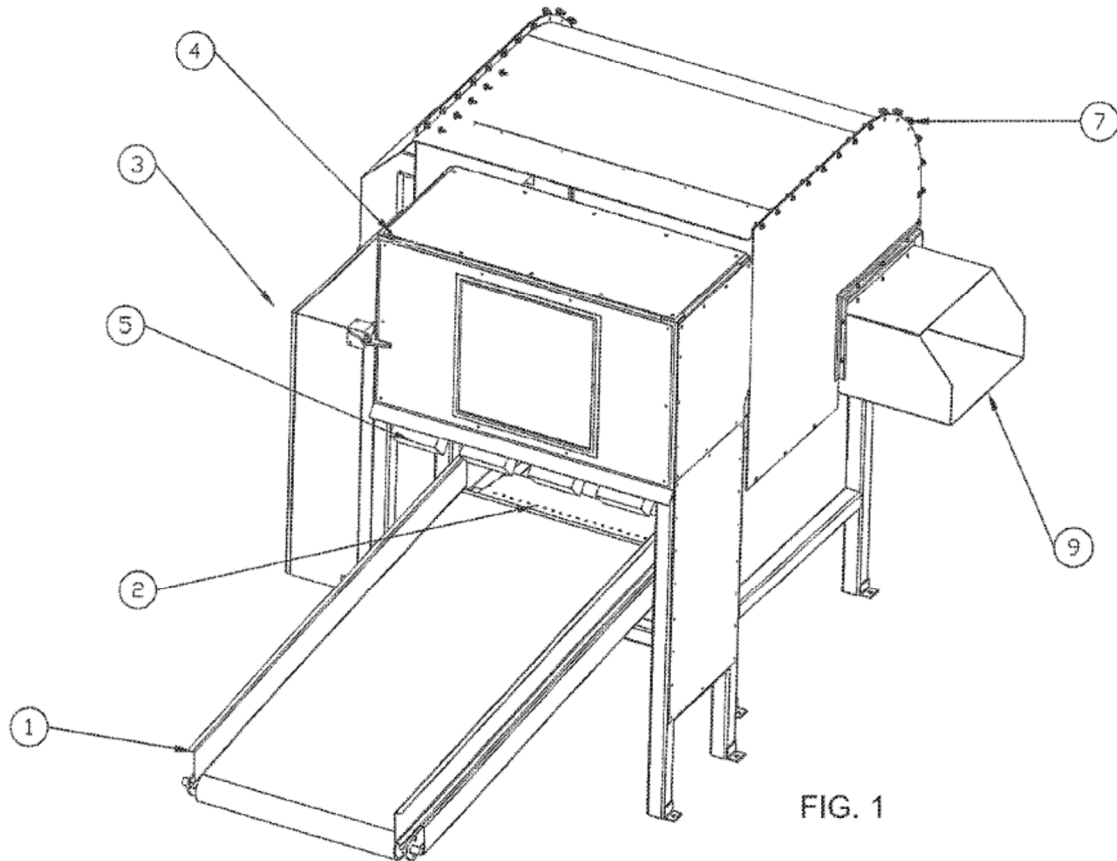


Figure 1 “is a front perspective drawing illustrating a system for the separation of heterogeneous material configured in accordance with one embodiment of the present invention.” Ex. 1001, 1:36–38.

We further reproduce Figure 5 of the '346 patent, below:

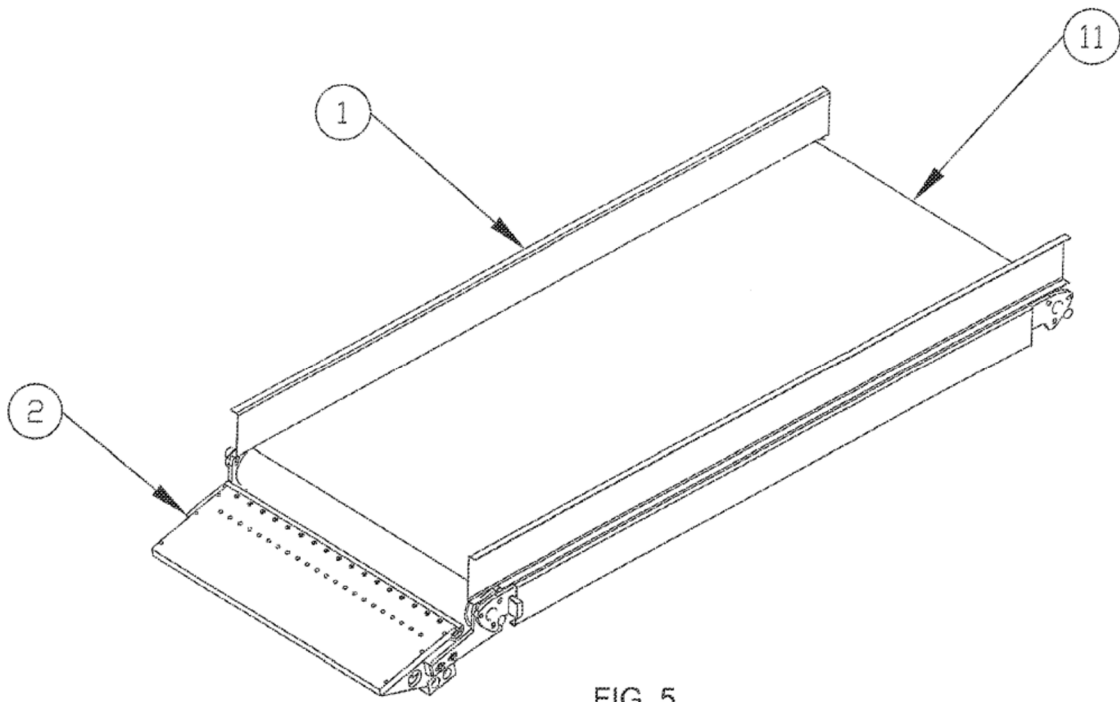


Figure 5 “is a front perspective drawing illustrating a conveyor [1], air knife and ejector [2] configured for use in a system for the separation of heterogeneous material configured in accordance with one embodiment of the present invention.” Ex. 1001, 1:50–57, 5:1–2, 5:11, Fig. 6 (exploded view of air knife and ejector 2).

Patent Owner submits that “hyperspectral identification system, item 4, is disposed over the second end of the belt, which is the portion of the belt (1) immediately adjacent the ejection system (2).” PO Resp. 16. Patent Owner quotes the following descriptions from the Specification:

- (1) “Immediately after the discharge of the accelerator conveyor 1 is disposed an air knife 2 that helps to levitate materials and decreases the likelihood of material lodging between the accelerator belt 1 and manifold ejector plate 14.” PO Resp. 16–17 (quoting Ex. 1001, 5:9–13); and
- (2) “Unselected items typically fall off the end of the optics conveyor or shaker deck and [are] dropped on a conveyor below that would transport that material to another optical system material where the process occurs again.” PO Resp. 17 (quoting Ex. 1001, 1:41–45) (emphasis omitted).

We do not find Figures 1 and 5 of the '346 patent, the cited portions of the Specification, or the prosecution history as requiring “said second end of said belt” to mean “the portion of the belt *immediately adjacent* the ejection system,” as argued by Patent Owner. *See* PO Resp. 14 (emphasis added). Any special definition for a claim term must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Paulsen*, 30 F.3d at 1480. Here, *even if* Figures 1 and 5 depict a hyperspectral identification system 4 is disposed over and immediately adjacent the terminus of the second end of the belt, we do not see the Specification as providing a special definition or meaning of the claimed limitation that requires “said second end of said belt” to mean “the portion of the belt *immediately adjacent* the ejection system” (*see id.* at 14). Without such a special definition or meaning, limitations may not be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993). Rather, we agree with Petitioner that the term “second end of said belt” is a term of approximation. *See* Pet. Reply 15.

Furthermore, we agree with Petitioner’s explanation that construing the claim to require the camera to be positioned *immediately adjacent*, or at the terminus of the belt, would render superfluous the claim 1 limitation,

“trigger[ing] an ejection system at a preset time delay equal to the distance between said camera and said ejection system divided by a rate of travel of the belt.” *See* Pet. Reply 14 (alteration in original); *see Stumbo v. Eastman Outdoors, Inc.*, 508 F.3d 1358, 1362 (Fed. Cir. 2007) (explaining that a claim interpretation that renders a claim term or phrase superfluous is disfavored).

Claim 1 requires that the “ejection system [is] disposed immediately after said second end of said belt,” and we do not see how there can be a “time delay equal to the *distance between said camera and said ejection system* divided by a rate of travel of the belt” if we were to adopt Patent Owner’s construction of “second end” as limited to the belt terminus. *See* Ex. 1001, 6:18–20, 6:29–30. In other words, requiring the camera to be positioned “over” the belt terminus per Patent Owner’s construction (Ex. 1001, 6:17–20), *and* requiring the ejection system to be *immediately after* the belt terminus (*id.* at 6:29–30) would leave no room for a “distance between said camera and said ejection system,” as the “distance between said camera and said ejection system” would be zero. *See* Pet. Reply 14 (explaining the same); *see also* Ex. 1001, 6:25–28. The camera and the ejection system would both be located at the belt terminus.

Patent Owner’s expert appears to agree with our understanding, as well. In particular, Mr. Smith acknowledged that there is a “distance between where the camera picks up the image and the ejection system.” *See* Ex. 1038, 58:14–19 (“Q Well, the point on the ejection system when it first makes contact with the – with the material? A It’s actually the distance between where the camera picks up the image and the ejection system.”); *see also* Pet. Reply 14 (explaining the same). As to whether the camera or

identification system is “immediately adjacent” the second end of the belt, Mr. Smith “totally agree[d]” that the camera cannot be at the “absolute edge of the second belt.” *See* Ex. 1038, 60:17–21 (“Q When we talk about the camera being over the second end of the belt, we have to assume, as a POSITA, that it’s not at the absolute edge of the second belt, don’t we? A I totally agree.”); *see also id.* at 61:3–6 (“Q And the claim presumes that the imaging system would not be disposed over the absolute edge on the second end of the belt? A Yeah.”).

Accordingly, we do not construe “said hyperspectral identification system being disposed over said second end of said belt” to mean “the hyperspectral identification system is positioned over the portion of the belt *immediately adjacent* the ejection system,” as proposed by Patent Owner. *See* PO Resp. 14 (emphasis added). Rather, we agree with Petitioner that the term “second end” is a term of approximation, and “convey[s] a general location, as opposed to a particular point on the belt” so that the hyperspectral identification system would “have the time to process the data before items contacted the ejector system.” *See* Pet. Reply 15.

4. *Other Claim Terms*

There are no other terms that require express construction for purposes of this Decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

D. Prior Art Status of Carlsohn

Before reaching the merits of Petitioner’s contentions, all of which rely on Carlsohn (*see* Pet. 4–6), we must determine as a threshold matter whether Carlsohn is a prior art printed publication under 35 U.S.C. § 102(b).

Carlsohn is a sixty-one page excerpt from a book titled “Color Image Processing Methods and Applications” (“the Book”). Ex. 1002, 1. Petitioner relies on Chapter 17 of the Book (*see, e.g.*, Pet. 33), which is titled “Spectral Imaging and Applications” (Ex. 1002, 27).

At the institution stage, and for purposes of institution, we determined that “Petitioner identifies, with particularity, evidence to establish a reasonable likelihood that Carlsohn was publicly accessible before the critical date of the challenged patent.” Inst. Dec. 22; *see also id.* at 19–22 (addressing Patent Owner’s arguments that Carlsohn is not a printed publication).

In its Response, Patent Owner argues that Carlsohn is not a printed publication under 35 U.S.C. § 102(b) and that Petitioner failed to meet its burden in establishing that Carlsohn qualifies as a printed publication. *See* PO Resp. 24–35. The parties further address this issue in Petitioner’s Reply (Pet. Reply 1–6) and Patent Owner’s Sur-Reply (PO Sur-Reply 1–4).

1. Relevant Law

Petitioner bears the burden of establishing by a preponderance of the evidence that Carlsohn is a printed publication. *See* 35 U.S.C. § 316(e); *Nobel Biocare Servs. AG v. Intradent USA, Inc.*, 903 F.3d 1365, 1375 (Fed. Cir. 2018); *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039,

Paper 29 at 11 (PTAB Dec. 20, 2019) (precedential) (citing *Nobel Biocare*, 903 F.3d at 1375).

The determination of whether a document is a “printed publication” under 35 U.S.C. § 102 “involves a case-by-case inquiry into the facts and circumstances surrounding the reference’s disclosure to members of the public.” *In re Klopfenstein*, 380 F.3d 1345, 1350 (Fed. Cir. 2004).

“Because there are many ways in which a reference may be disseminated to the interested public, ‘public accessibility’ has been called the touchstone in determining whether a reference constitutes a ‘printed publication’.” *Jazz Pharm., Inc. v. Amneal Pharm., LLC*, 895 F.3d 1347, 1355 (Fed. Cir. 2018) (quoting *In re Hall*, 781 F.2d 897, 898–99 (Fed. Cir. 1986)). A reference is considered publicly accessible if it was “disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art, exercising reasonable diligence, can locate it.” *Id.* at 1355–56 (quoting *In re Wyer*, 655 F.2d 221, 226 (CCPA 1981)); *see also Medtronic, Inc. v. Barry*, 891 F.3d 1368, 1380 (Fed. Cir. 2018) (“reference will be considered publicly accessible if it was ‘disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence[] can locate it’”) (internal quotation omitted).

2. *Petitioner’s Evidence and Position*

Petitioner asserts that “Carlsohn was published over one year before November 18, 2008, the ’346 Patent’s earliest claimed priority date, and thus is prior art under § 102(b),” citing the sworn testimony of Dr. Arce. Pet. 4 (citing in part Ex. 1008 ¶¶ 52–56). In support of this assertion, Petitioner

cites to Carlsohn's 2007 copyright date (*id.* (citing Ex. 1002, 1, 5–10)) and submits a May 2007 Amazon.com webpage that appears to show the Book (containing Carlsohn) for sale before the critical date (*see id.* at 4–5 (citing Ex. 1032)). Petitioner further submits two webpage screenshots (Exs. 1033, 1034) that identify the Book as a “New Book Published!” before the critical date. *See* Pet. 5. Petitioner also submits evidence that over 550 copies of the Book had been sold to the public prior to the critical date. Pet. Reply 1 (citing Ex. 1037 (“Ms. Militello’s testimony”)).

3. *Analysis*

Patent Owner’s argument attacks generally the veracity and sufficiency of Petitioner’s evidence. *See* PO Resp. 24–35; *see also* PO Sur-Reply 1–4.

After considering the arguments and weighing the evidence presented by the parties, we credit Dr. Arce’s testimony and Ms. Militello’s testimony and find that Carlsohn was disseminated or otherwise made available to the extent that POSITAs, exercising reasonable diligence, could locate it before the critical date of the invention. *See Medtronic*, 891 F.3d at 1380. In particular, we find that Petitioner’s evidence and testimony that over 550 copies of the Book had been sold prior to the critical date establishes, *on its own*, that Carlsohn is a prior art printed publication under 35 U.S.C. § 102(b). We further find that Petitioner’s evidence and testimony that the Book was available for sale on the Internet before the critical date of the invention also establishes, *on its own*, that Carlsohn is a prior art printed publication.

We address each of Patent Owner’s arguments separately, below.

First, Patent Owner argues that “neither Petitioner nor its declarant, Dr. Arce, explain how, why, or when a POSITA could have located Carlsohn or would have bothered to review Carlsohn to find the relevant section here relied upon, let alone provide competent evidence establishing either proposition.” PO Resp. 25. Patent Owner further argues that neither Petitioner nor Dr. Arce attempt to establish that the particular discussion relied upon by Petitioner—namely, Chapter 17’s SpectroSort discussion—was “uploaded to a website, deposited in an indexing library, or in some other way meaningfully indexed prior to November 18, 2007.” *Id.* at 26–27; *see also* PO Sur-Reply 2 (“Finding a chapter in a compilation is tantamount to finding a needle in a haystack”). Patent Owner asserts that “neither provides the Board with any explanation on how the allegedly relevant information found on pages 407-412 of [Carlsohn] could have been located by a member of the public at any point in time.” PO Resp. 27. Patent Owner also argues that “Petitioner must show that a POSITA could meaningfully, exercising reasonable diligence, find Carlsohn, a chapter in the Book.” *Id.* Patent Owner contends that “even if Dr. Arce had conducted the reasonable diligence of a POSITA, the Amazon Listing would not have been found” and that “neither Petitioner nor Dr. Arce show how a POSITA would even locate [Carlsohn] out of the millions of listings on Amazon.com.” *Id.* at 29; *see also id.* at 30 (“Petitioner has failed to explain how the Amazon Listing’s mere existence constitutes accessibility.”).

Patent Owner further attacks Petitioner’s expert, Dr. Arce, for failing to correctly identify search terms that a user would have used to locate Carlsohn, and contends that “even if Dr. Arce had conducted the reasonable diligence of a POSITA, the Amazon listing would not have been found.”

See id. at 29; *see also id.* (“[W]hen asked what search terms a POSITA might use, the search terms Dr. Arce provided do not appear anywhere on the Amazon listing.”).

Through the supplemental declaration of Mr. Smith (Ex. 2022), Patent Owner submits the following evidence to support its position: “Documents on Color Image Processing that Don’t Have Anything on Hyperspectral Imaging” (Exhibit E of Exhibit 2022); Google Search Pages (Exhibit F of Exhibit 2022); and Yahoo Search Pages (Exhibit G of Exhibit 2022). Mr. Smith testifies that these exhibits “show[] how unlikely a POSITA would be to search further into a book entitled ‘Color Image Processing’ for good information on hyperspectral imaging in the NIR range or for help with recycling in general.” Ex. 2022 ¶ 12 (addressing Exhibit E); *id.* ¶¶ 15–17 (addressing Exhibit F); *id.* ¶¶ 18–19 (addressing Exhibit G).⁷

We do not agree with Patent Owner.

Patent Owner’s contentions that a POSITA would not have been able to locate the particular pages within Chapter 17 of the Book (i.e., Carlsohn) is premised on an overly narrow test for determining public accessibility. The test does not require Petitioner to identify the particular search terms used for locating the Book. Further, the test for determining public accessibility does not require a specific showing that sets forth the particular search terms that a skilled artisan would have used to locate the particular pages of a multi-chapter publication. *See* Pet. Reply 3 (arguing the same). As explained above, determination of whether a document is a “printed

⁷ Patent Owner’s filing of Exhibits E, F, and G as part of and combined with Exhibit 2022 is prohibited under our Rules. 37 C.F.R. § 42.6(a)(3). We nonetheless consider these documents here.

publication” under 35 U.S.C. § 102 “involves a *case-by-case inquiry into the facts and circumstances* surrounding the reference’s disclosure to members of the public.” *Klopfenstein*, 380 F.3d at 1350 (emphasis added). “Because *there are many ways in which a reference may be disseminated* to the interested public, ‘public accessibility’ has been called the touchstone in determining whether a reference constitutes a ‘printed publication.’” *Jazz Pharm.*, 895 F.3d at 1355 (emphasis added).

Having conducted a “case-by-case inquiry into the facts and circumstances,” as set forth in *Klopfenstein*, and following the guidance of *Jazz Pharm.* that “there are many ways in which a reference may be disseminated to the interested public,” we find that Petitioner has shown, for the reasons explained below, that Carlsohn was publicly accessible and disseminated and qualifies as a prior art printed publication under 35 U.S.C. § 102(b).

As to Patent Owner’s evidence that a POSITA would not have found Carlsohn based on particular terms used with Google and Yahoo search engines (*see* Ex. 2022 ¶¶ 15–21, Exs. F, G), missing from Patent Owner’s evidence is a similar search performed on Amazon, where Petitioner submits evidence that Carlsohn was sold before the critical date (*see* Ex. 1032). Patent Owner’s Google and Yahoo evidence does not directly address Petitioner’s evidence that Carlsohn was publicly accessible through Amazon.

Patent Owner further argues that the main title of the Book, “Color Image Processing,” “is so general a term of art that countless applications could be relevant.” PO Resp. 30–31. As to the *editor* of the Book, Patent Owner contends that “Dr. Arce does not explain how a POSITA would even

be aware of the editor, Rastislav Lukac, testifying that he ‘[doesn’t] know if somebody in the field would know him or not.’” *Id.* at 31 (quoting Ex. 2023, 84:5–20 (Acre deposition)). As to the publisher of the Book, Patent Owner argues that Petitioner “fail[s] to show accessibility because [Exhibit 1037] does not establish that a POSITA would have known CRC Press to be an established publisher in heterogeneous material sorting systems.” *Id.* at 32. Patent Owner explains that “CRC Press’ parent company, Taylor and Francis Group, is purportedly in the business of publishing academic texts . . . [, however,] a POSITA may not have a college degree, with his/her sole relevant experience being in the field of heterogeneous material sorting systems used in materials recycling facilities.” *Id.* (citing Ex. 1037 ¶ 2; Inst. Dec. 12–13 (defining POSITA)). Patent Owner further argues, “Missing from Petitioner’s evidence is what would have led a POSITA, i.e., someone interested in heterogeneous waste separation using a hyperspectral imaging system, to seek out the Book prior to November 18, 2007.” *Id.* at 33 (citing Ex. 2001 ¶¶ 44–46).

As to these arguments, we also find them unavailing. Even if we take as true Patent Owner’s assertions that CRC Press and Taylor and Francis Group are in the business of publishing *academic texts*, and that these publishers, along with Editor Rastislav Lukac, are not well-known within the heterogeneous material sorting systems community, Patent Owner’s argument again applies an overly narrow test for public accessibility. *See* Pet. Reply 3 (arguing the same). There is no requirement that the publisher or its editor be well known within the particular field that a POSITA operates within. Moreover, there is no requirement that the title of the book

be uniquely descriptive to the subject matter searched, in order to aid a skilled artisan in finding the particular subject matter of his or her interest.

After weighing the testimony of Petitioner's and Patent Owner's declarants, we credit Ms. Militello's testimony (Ex. 1037) and find that it establishes that Carlsohn was publicly accessible and, in fact, disseminated, before the critical date of the invention.

Exhibit 1037 is a declaration from Corinne Militello, the Vice President and Assistant General Counsel for Taylor & Francis Group (Americas). Ex. 1037 ¶¶ 1–2. Ms. Militello testifies that she was “asked to verify certain details about the publication of *Color Image Processing: Methods and Applications*, CRC Press © 2007.” *Id.* ¶ 3. Ms. Militello further testifies that

This publication date of October 20, 2006 is when CRC Press made this book available to purchasers and third parties such as universities, teachers, libraries, and resellers. From October 20, 2006 to November 17, 2007, CRC Press advertised this book, and shipped numerous physical copies of this book, to such third parties. The confidential internal business records of CRC Press indicate that CRC publically distributed over 550 copies of *Color Image Processing: Methods and Applications* prior to November 17, 2007, mostly (over 500 copies) as actual sales. CRC continued to advertise and ship this book from November 17, 2007 to November 17, 2008, and thereafter.

Id. ¶ 5.

Specifically, we credit Ms. Militello's testimony, including that “CRC publically distributed over 550 copies of *Color Image Processing: Methods and Applications* prior to November 17, 2007, mostly (over 500 copies) as actual sales.” *Id.* We find that *her testimony alone* establishes that the Book including Carlsohn was published on October 20, 2006, and was publicly accessible before the critical date of the invention, November 17, 2007.

In addition to Ms. Militello’s testimony, we further find persuasive Petitioner’s Amazon sales evidence (Ex. 1032) as evidence that the Book and its Carlson chapter was publicly accessible before the critical date. This evidence further supports a finding that Carlsohn was a printed publication before the critical date of the invention. The webpage from Amazon.com shows the Book (containing Carlsohn) for sale on May 9, 2007 (Ex. 1032, 1–2 (header information)), which is before the critical date of November 17, 2007. The book for sale on the Amazon webpage matches Exhibit 2002 (Carlsohn), as both identify the same title (“Color Image Processing Methods and Applications”), cover (depicting yellow, orange, blue, and pink flowers over a black background with binary numbers), ISBN (0-8493-9774-X), editors (Rastislav Lukac and Konstantinos N. Plataniotis), and publisher (CRC Press). *Compare* Ex. 1032, 1, *with* Ex. 1002, 1–5. We further note that the ISBN number from Carlsohn also matches that of Ms. Militello’s testimony. *Compare* Ex. 1002, 5 (“ISBN (0-8493-9774-X)), *with* Ex. 1037 ¶¶ 3 (“As shown on the publication page, this book bears the International Standard Book Number (ISBN)-10 of 0-8493-9774-X, and the ISBN-13 of 978-0-8493-9774-5”), 4 (“this webpage corresponds to the book bearing ISBN 9780849397745, which omits the hyphens but is the same as the ISBN-13 reflected on the publication page of Appendix A”).

We also find persuasive the testimony of Petitioner’s expert, Dr. Arce, who testifies that Carlsohn is prior art under 35 U.S.C. § 102(b). *See* Ex. 1008 ¶¶ 52–56. Dr. Arce testifies that the Amazon.com web listing (Ex. 1032) “is a May 9, 2007 Wayback Machine printout of an [Amazon] webpage.” *Id.* ¶ 53. Dr. Arce further states that the two webpage printouts that identify Carlsohn as a “New Book Published!” are also Wayback

Machine printouts that identify Carlsohn as available for purchase in October 2006 (Ex. 1033) and July 2007 (Ex. 1034). *See* Ex. 1008 ¶¶ 54–56.

Finally, Patent Owner argues that Exhibits 1032–1034 are “legally deficient” as the “webpage exhibits have not been proven to be authentic . . . and each is hearsay to which no evidentiary exception applies.” *See* PO Resp. 34–35 (citing Fed. R. Evid. 803, 901). Although Patent Owner did not file a motion to exclude Exhibits 1032–1034, Patent Owner submits that “neither the webpage Exhibits, Exs. 1032–1034, nor Dr. Arce’s testimony concerning them should be considered.” *Id.* at 35 (citation omitted).

In its Reply, Petitioner points out that Exhibits 1032, 1033, and 1034 are “located through the Wayback Machine . . . [and] each show[s] that [Carlsohn] was available via Amazon and through the publisher’s website prior to the critical date.” Pet. Reply 2 (citing Ex. 1008 ¶ 53). Dr. Arce testifies that Exhibits 1032–1034 are Wayback Machine printouts from www.amazon.com, www.colorimageprocessing.com/books, and www.colorimageproceessing.org, respectively. *See* Ex. 1008 ¶¶ 53–55. Dr. Arce, however, is a professor from the University of Delaware, not a custodian from the Wayback Machine Internet Archive. *See id.* ¶¶ 4–5. In addition to Dr. Arce’s testimony, however, Petitioner also cites to a declaration from the Book’s publisher, and submits that “the publisher’s declaration confirms that the book was published on October 20, 2006, and that between then and November 17, 2007, it publicly distributed more than 550 copies of the book.” Pet. Reply 3 (citing Ex. 1037).

Patent Owner’s evidentiary objection to Exhibits 1032–1034 has some merit. As explained above, Petitioner’s Exhibit 1032 is a Wayback Machine screenshot of the Book for sale on amazon.com on May 9, 2007, and

included a hyperlink for interested viewers to “Search inside this book”; Exhibit 1033 is a Wayback Machine screenshot from the publisher, CRC, indicating the Book as a “New Book Published!” on October 25, 2006; and Exhibit 1034 is Wayback Machine screenshot of a webpage created by the book’s editors/authors, Rastislav Lukac and Kostas Plataniotis, indicating the Book as sold on July 1, 2007. *See* Pet. Reply 2–3 (confirming the same information). Although Petitioner relies on these exhibits as evidence that Carlsohn was for sale and published before the critical date of the ’346 patent, Petitioner *does not* submit sworn testimony from a custodian of records at the Wayback Machine Internet Archive to confirm the publication dates of these screen shots. Despite this shortcoming, however, Patent Owner’s argument ignores Petitioner’s other corroborating evidence, namely, the sworn testimony of Ms. Militello. *See* PO Resp. 33–35. Taken as a whole, including Ms. Militello’s uncontroverted testimony (Ex. 1037), we find that the preponderance of the evidence supports a finding that Carlsohn was publicly accessible before the critical date of the ’346 patent. Importantly, Ms. Militello testifies that over 550 copies of Carlsohn were sold and or distributed before the critical date of the ’346 patent. *See* Ex. 1037 ¶ 5.

4. *Summary*

After considering the arguments and weighing the evidence presented by the parties, we find that Petitioner has met its burden to show that Carlsohn was disseminated or otherwise made available to the extent that POSITAs, exercising reasonable diligence, could locate it before the critical date of the invention. *See Medtronic*, 891 F.3d at 1380.

E. Principles of Law

“In an . . . [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). This burden never shifts to Patent Owner. *Dynamic Drinkware*, 800 F.3d at 1378.

Petitioner’s challenges are based on obviousness. Pet. 4–6; *supra* § I.E. A claim is unpatentable as obvious under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations.⁸ *Graham*, 383 U.S. at 17–18.

F. Ground 1 – Claims 1–5, 7, and 9–12 Obvious over Carlsohn and Arleth

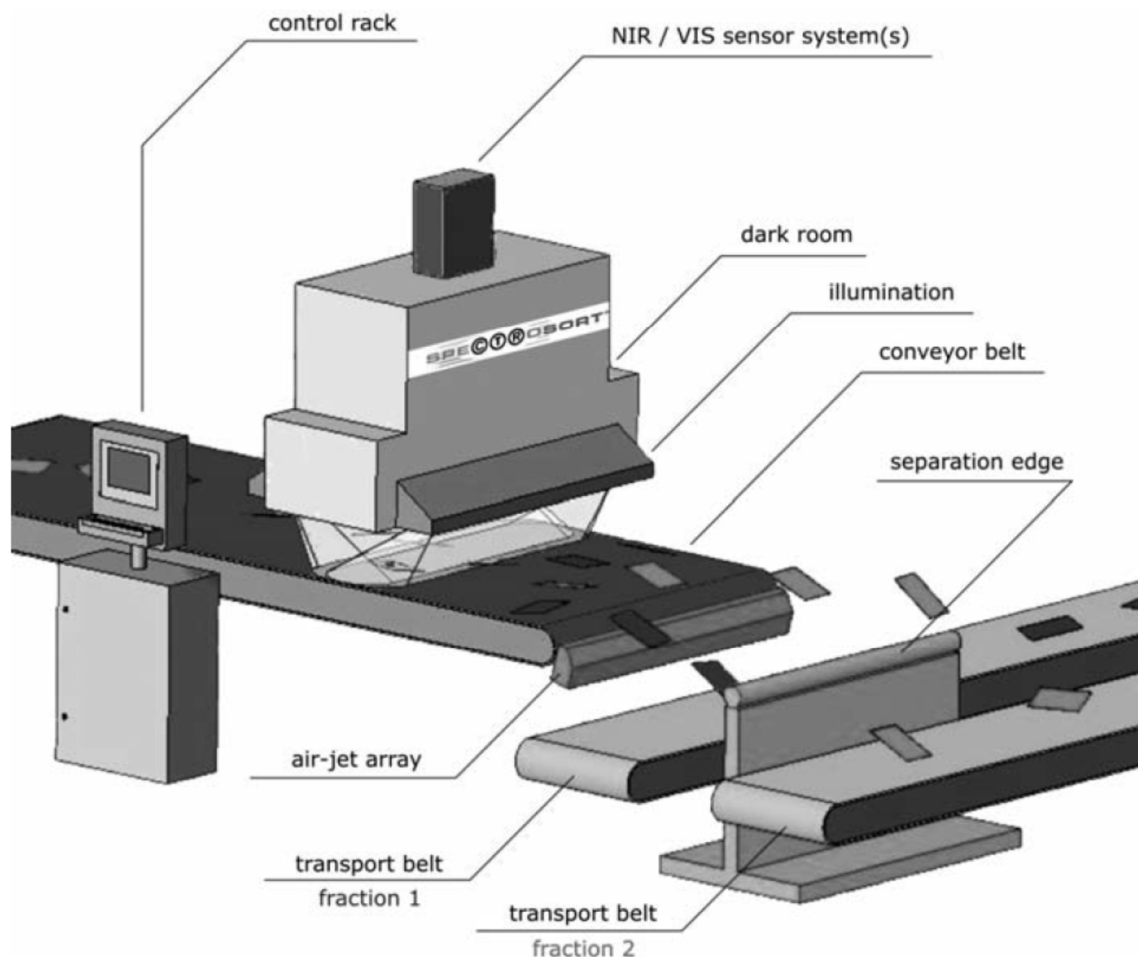
Petitioner asserts that claims 1–5, 7, and 9–12 are unpatentable as obvious over Carlsohn and Arleth. Pet. 33.

⁸ Patent Owner has not submitted argument and objective indicia of nonobviousness. *See generally* PO Resp.

1. *Carlsohn (Ex. 1002)*

Carlsohn is a sixty-one page excerpt from a book titled “Color Image Processing Methods and Applications.” Ex. 1002, 1.⁹ Petitioner relies on Chapter 17 of Carlsohn (*see, e.g.*, Pet. 33), which is titled “Spectral Imaging and Applications” (Ex. 1002, 27).

Carlsohn discloses a sorting system named SpectroSort that generates hyperspectral images of heterogeneous waste to determine the identity and location of the waste for subsequent sorting. *See* Ex. 1002, 39–47. To illustrate SpectroSort, we reproduce Carlsohn’s Figure 17.10, below:



⁹ For clarity of record, our citations to Carlsohn will be to the exhibit’s page numbers, rather than the book’s native page numbers. *See supra* n.2.

Figure 17.10 depicts “The SpectroSort® hardware setup” as “Reproduced from the SpectroSort® product sheet.” Ex. 1002, 43. As shown in the above figure, the SpectroSort includes a conveyor belt, an NIR/VIS sensor system, and an air-jet array to sort products onto two different transport belts. *See id.* at 41–43.

2. *Arleth (Ex. 1004)*

Arleth is a U.S. Patent Application titled “Process and Installation for Separating Plastics, According to Type, From Recycled Plastic Mixtures.” Ex. 1004, code (54). Arleth discloses a “process by which plastics are separated from recycled plastic mixtures according to type.” *Id.* ¶ 1. Arleth further discloses, “[t]he plastic parts to be selected and their position are determined by optical sensors and [] sorting logic (stored program control unit) in the optomechanical sorting device.” *Id.* To illustrate an embodiment of Arleth’s system, we reproduce its Figure 4, below:

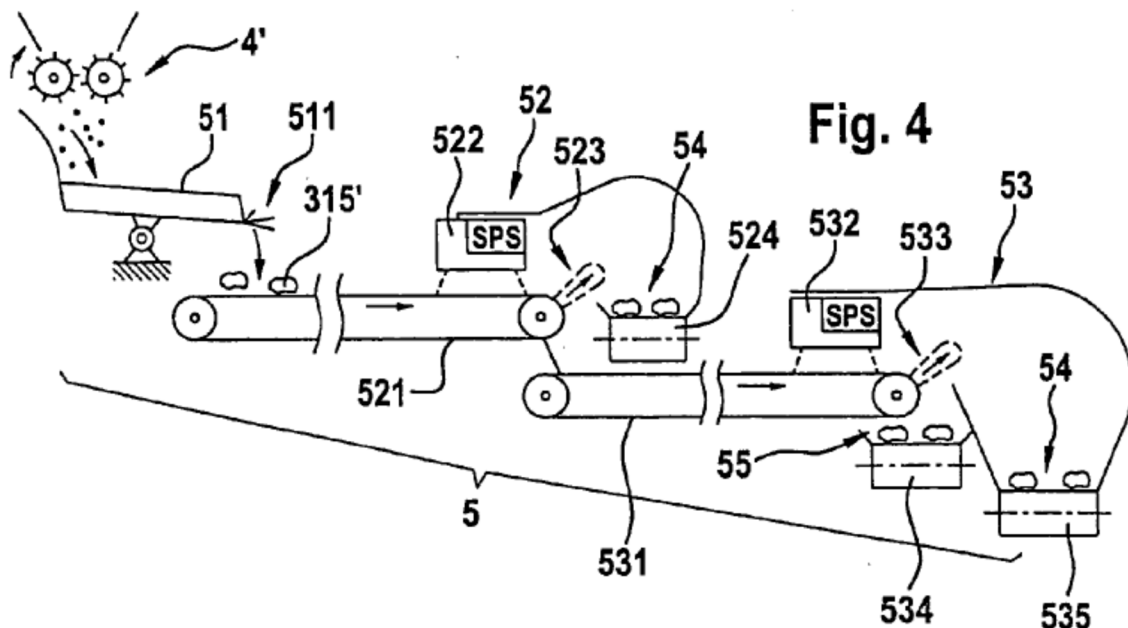


Figure 4 is a “schematic representation of a sorting system with two subsequently arranged sorting devices with the same features.” Ex. 1004, ¶ 27.

3. *Independent Claim 1*

We address the claim limitations using Petitioner’s nomenclature as identified above. *See supra* § I.C. In addressing the majority of the limitations, Petitioner submits an annotated version of Carlsohn’s Figure 17.10 (Pet. 34), which we reproduce, below:

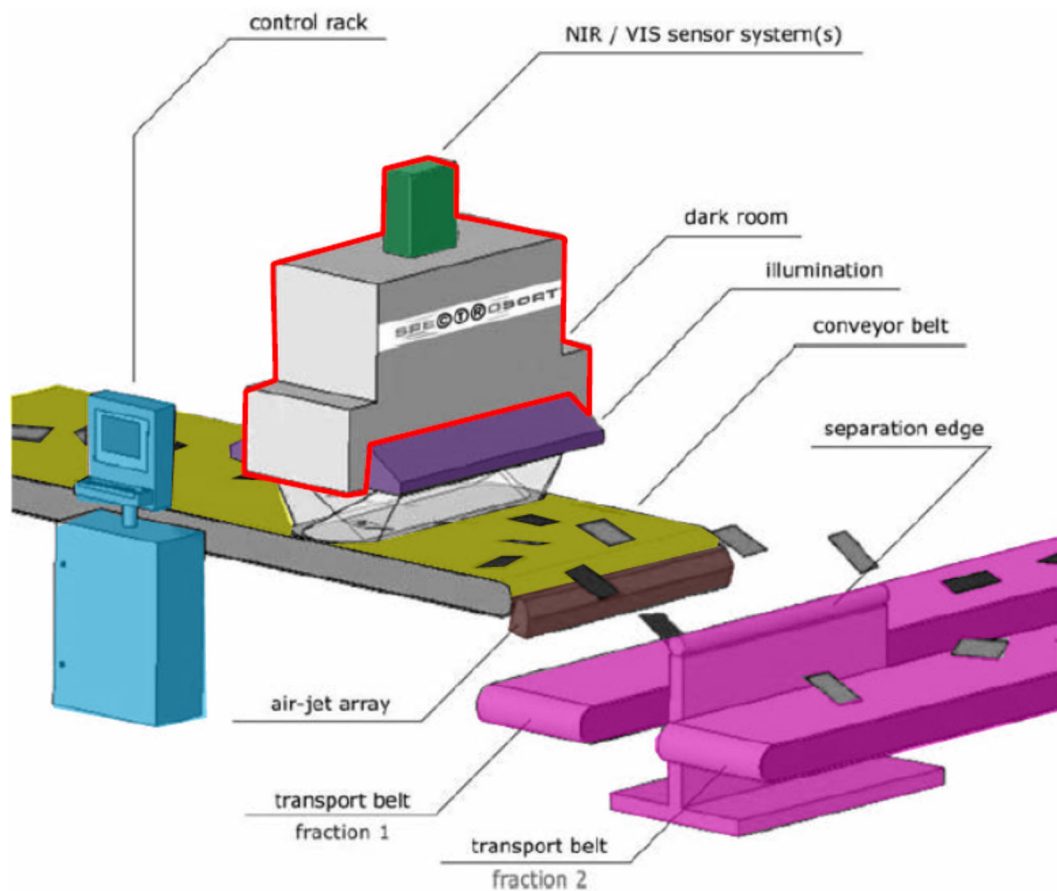


FIGURE 17.10
The SpectroSort[®] hardware setup. (Reproduced from the SpectroSort[®] product sheet.)

According to Petitioner, and as shown above, Figure 17.10 depicts a hyperspectral camera that can capture a hyperspectral image, or

“hypercube,” of the waste by collecting both spatial and spectral information. *Id.* Petitioner adds color to Carlsohn’s original Figure 17.10 and references this annotated figure in addressing several of the claim limitations. *See, e.g., id.* at 41 (referencing the green “spectral imaging” system).

a) Limitation 1(p) - A system for the identification and sorting of heterogeneous material

Petitioner submits that Carlsohn’s SpectroSort system is a system for sorting heterogeneous material, namely, different papers and polymers. Pet. 40 (citing Ex. 1002, 39–40, 44–46; Ex. 1008 ¶¶ 57–59, 70, 71).

Carlsohn discloses, “The main focus of SpectroSort is the sorting of paper and polymers in an industrial environment.” Ex. 1002, 40. Carlsohn explains that there are two kinds of paper that have to be separated: (1) paper that can be freed of ink, or “de-inking” paper, such as white office paper; and (2) “non-de-inking” paper, such as nonprinted cardboard. *Id.* Carlsohn also explains that there are many different polymers to be sorted for recycling, including polyethylene and polystyrene. *Id.*

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(p), to the extent that the preamble is limiting, for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

b) Limitation 1(a) - a hyperspectral identification system for capturing spectra of material

Petitioner asserts that Carlsohn discloses this limitation. Pet. 40–41 (citing Ex. 1002, 41–46; Ex. 1008 ¶¶ 61–64). Petitioner references annotated Figure 17.10 (reproduced *supra*), and submits that the “illumination unit” (annotated to be purple) illuminates the material to be identified, so a spectral imaging unit (annotated to be green) receives the reflected light. Pet. 41 (citing Ex. 1002, 41–43).

Carlsohn discloses, “The heart of SpectroSort® is a [near-infrared (“NIR”)] spectral imaging system that is able to distinguish de-inking from non-de-inking material based on those differences.” Ex. 1002, 41.

Dr. Arce testifies that SpectroSort’s spectral imaging system “includes at least one hyperspectral camera configured to capture and (at least temporarily) store hyperspectral images of waste that include both spatial and spectral data: the visible . . . and near-infrared . . . sensor units.” Ex. 1008 ¶ 61; *see also supra* (annotated Figure 17.10).

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(a) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

c) Limitation 1(b) - said hyperspectral identification system comprises at least one hyperspectral camera said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light corresponding to spectral signatures of target materials to be identified if present in said heterogeneous material and spacial data locating a position of said heterogeneous materials on a solid belt¹⁰

As construed above, the claimed limitation “said hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light” requires a *single* hyperspectral camera configured to receive spectral data from a plurality of selected spectral bands of infrared and visible light. *See supra* § II.C.1. In our claim construction, we also determined that the limitation *does not* require the camera be “configured to receive spectral data up to at least 1700 nm,” as Patent Owner proposes. *See id.*; *see also* PO Resp. 6.

Petitioner submits that it would have been obvious to use ImSpector V10’s spectral range of approximately 400–1000 nm *and* ImSpector N17’s spectral range of about 900–1750 nm for SpectroSort’s VIS and NIR units, respectively. *See* Pet. 43. In particular, Petitioner submits that “Carlsohn calls for sensor units using ImSpector models . . . without specifying which to use.” *Id.* (citing in part Ex. 1002, 43). Petitioner further submits that known options of ImSpector models include ImSpector V10 and N17. *Id.* Petitioner asserts that the V10’s spectral range was approximately 400–1000

¹⁰ We understand that the claim’s recitation of “spacial” data to be an inadvertent and harmless typographical error, and the intended term is properly spelled as “spatial” data. *See* Pet. 42 (acknowledging the same by using [sic] in reciting the claim).

nm and the N17's spectral range was approximately 900–1750 nm. *Id.* Petitioner explains that “[b]ecause ImSpector’s V10 spectral range includes [infrared (“IR”)] and [visible (“VIS”)] wavelengths, *the sensor unit using it meets any single-camera-IR-and-VIS requirement.*” *Id.* (citing Ex. 1008 ¶¶ 66–67) (emphasis added). Petitioner reasons that a “POSITA would have selected ImSpector V10 and N17 for SpectroSort’s VIS and NIR units, respectively, because they meet SpectroSort’s wavelength specifications and cover a continuous range from about 400-1750 nm.” *Id.* (citing Ex. 1002, 41–44, Fig. 17.11; Ex. 1008 ¶¶ 66–67). Petitioner elaborates that a POSITA “would have understood that doing so ‘would have facilitated accurate material identification’ by ‘eliminating a gap in coverage between VIS and NIR wavelengths.’” *Id.* at 44 (quoting Ex. 1008 ¶ 67).

Patent Owner presents numerous arguments nested in its general contention that disputes Petitioner’s reason for using the ImSpector V10 sensor in Carlsohn’s system. *See* PO Resp. 35–38. As explained below, none of these arguments are persuasive.

Patent Owner submits that “the ImSpector V10 cannot itself be considered the required ‘single hyperspectral camera.’” *Id.* at 37. Patent Owner further submits that Petitioner failed to “prove[] by a preponderance of the evidence that a POSITA could and would have used the ImSpector V10 (whatever that is) with the camera chip and lens disclosed in Carlsohn.” *See id.*

Patent Owner’s argument is not persuasive. Patent Owner’s argument relies on physically incorporating ImSpector’s V10 sensor with Carlsohn’s identification system. Bodily incorporation, however, is not the standard for obviousness analysis. *See In re Mouttet*, 686 F.3d 1322, 1332–33 (Fed. Cir.

2012); *see also* *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015) (“[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference” (citation omitted)), *cert. denied*, 137 S. Ct. 292 (2016). In the present case, a POSITA would have been able to use ImSpector V10 and N17 sensors as SpectroSort’s VIS and NIR units, respectively. A POSITA is “a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 420–21. We are not persuaded that using the ImSpector V10 and N17 sensors as SpectroSort’s VIS and NIR units, respectively would have been “uniquely challenging or difficult for one of ordinary skill in the art.” *Leapfrog Enter. Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 420). Indeed, Carlsohn discloses the general use of ImSpector sensors, without specifically identifying particular models. *See, e.g.*, Ex. 1002, 43 (“Imaging spectrographs are commercially available for visible (VIS) and NIR wavelengths (ImSpector from Specim)”).

We credit Dr. Arce’s testimony that Carlsohn’s SpectroSort’s material identification is based on both visible and infrared spectra, and its system includes both VIS and NIR sensor units. Ex. 1008 ¶ 66 (citing Ex. 1002, 41, 43). Carlsohn is silent as to the particular ImSpector models used, but the ImSpector V10 and N17 models were available before the critical date of the ’346 patent, and had spectral ranges of 400–1000 nm and 900–1750 nm, respectively. *See id.*; *see also id.* n.3 (explaining that the ImSpector V10 was available before the critical date of the ’346 patent). We agree with and credit Dr. Arce’s testimony that the “ImSpector V10 and N17 would have been obvious options for SpectroSort’s VIS and NIR sensor units,” as they

meet Carlsohn's need for capturing spectra over the required spectral range. *See id.* ¶ 66 (citing Ex. 1002, 41–44, Fig. 17.11).

Patent Owner further argues that in addition to Petitioner's failure to provide sufficient evidence, "there are two additional reasons the ImSpector V10, in combination with the asserted system of Carlsohn, fails." PO Resp. 37. "First, there is no evidence in the record why a POSITA would have bothered to swap out the VIS and NIR hyperspectral cameras used for the devices selected by Dr. Arce." *Id.* Patent Owner also argues, "Further, if the two cameras of Carlsohn were replaced by a single camera using a ImSpector V10, the system would not work as intended . . . [because] Dr. Arce makes very clear that to achieve sorting . . . a full range of spectra is needed to be interrogatable, e.g., wavelengths from 400 to 1750 nm." *Id.*

Patent Owner's arguments are not persuasive.

As to Patent Owner's first argument, that "there is no evidence in the record why a POSITA would have bothered to swap out the VIS and NIR hyperspectral cameras" (*id.*), we disagree. Petitioner cites substantial evidence.

Petitioner reasons that a "POSITA would have selected ImSpector V10 and N17 for SpectroSort's VIS and NIR units, respectively, because they meet SpectroSort's wavelength specifications and cover a continuous range from about 400-1750 nm." Pet. 43 (citing Ex. 1008 ¶¶ 66, 67; Ex. 1002, 41–44, Fig. 17.11). Petitioner further explains that a "POSITA would have understood that doing so 'would have facilitated accurate material identification' by 'eliminating a gap in coverage between VIS and NIR wavelengths.'" *Id.* at 44 (quoting Ex. 1008 ¶ 67). Dr. Arce testifies that "using such sensors would have facilitated accurate material identification."

Ex. 1008 ¶ 67. Dr. Arce explains that accurate material identification is facilitated as illustrated by Cowling1 and Arleth, for example.¹¹ *See id.*

Petitioner cites to Cowling1’s teaching that “VIS through SWIR ‘is more useful . . . for discriminating materials.’” Pet. 44 (citing Ex. 1018 ¶¶ 25–30) (alteration in original). Cowling1 discloses,

The operational waveband of a hyperspectral sensor can be from the visible (VIS) through to the long-wave infra-red (LWIR). *Experimental measurements indicate that the visible/short-wave infra-red (VIS/SWIR) region is more useful than the medium-wave infra-red long-wave infra-red (MWIR/LWIR) region for discriminating individual materials and for Sorting coloured glass.* Tests also suggest that the MWIR/LWIR region is more suited for discriminating between polymer-coated and non-coated glasses and provides more separability between other material and plastic and glass classes.

Ex. 1018 ¶ 25 (emphasis added). We agree with Petitioner and credit Dr. Arce’s testimony that Cowling1 teaches that the visible and short-wave infra-red region is more useful than other regions for “discriminating individual materials and for sorting coloured glass.” *Id.*; *see also* Pet. 44 (quoting the same); *see also* Ex. 1008 ¶ 67 (testifying to the same). Cowling1 is evidence to support Petitioner’s reasoning to use the ImSpector V10 and N17 sensors.

Petitioner further cites to Arleth’s teaching that “‘wavelengths rang[ing] from . . . NIR . . . to visible light’ are useful for plastic sorting.” Pet. 44 (quoting Ex. 1004 ¶ 47). Arleth discloses

To perform the comparison resulting in the determination of each plastic type, “optically identifiable criteria”, namely rays of different wavelengths could be evaluated using “sorting logic”. These wavelengths range from the so-called near infrared

¹¹ US 2007/0029232 A1, published Feb. 8, 2007. Ex. 1018 (“Cowling1”).

(NIR)—with wavelengths reaching from between 0.7 μm to 2.5 μm —to visible light with significantly shorter wavelengths.

Ex. 1004 ¶ 47. We agree with Petitioner and credit Dr. Arce’s testimony and find this paragraph teaches using wavelengths ranging from the near infrared region to the visible region for determining plastic type. *See* Pet. 44 (finding the same); *see also* Ex. 1008 ¶ 67 (testifying to the same). Arleth is further evidence to support Petitioner’s reasoning to use the ImSpector V10 and N17 sensors.

As to Patent Owner’s second argument, that “if the two cameras of Carlsohn were replaced by a single camera using an ImSpector V10, the system would not work as intended. . . [because] Dr. Arce makes very clear that to achieve sorting . . . a full range of spectra is needed to be interrogatable, e.g., wavelengths from 400 to 1750 nm” (PO Resp. 37), we disagree.

Patent Owner’s argument presumes that Carlsohn’s system will not work if the ImSpector V10 is used, because a “full range of spectra is needed” with “wavelengths from 400 to 1750 nm.” *See id.* As explained above, however, Petitioner’s proposed combination would detect spectra within this range. We agree with Petitioner’s contention that a “POSITA would have selected ImSpector V10 and N17 sensors for SpectroSort’s VIS and NIR units, respectively, because they meet SpectroSort’s wavelength specifications and cover a continuous range from about 400-1750 nm.” Pet. 43 (citing Ex. 1002, 41–44, Fig. 17.11; Ex. 1008 ¶¶ 66–67). Although Petitioner proposes to use both the ImSpector V10 and N17 sensors, Petitioner relies on ImSpector V10’s sensor as “meet[ing the] single-camera-IR-and-VIS requirement,” “[b]ecause ImSpector V10’s spectral range includes IR and VIS wavelengths” within its range of 400–1000 nm. *See id.*

(citing Ex. 1008 ¶¶ 66, 67). For the reasons explained above, we agree with and credit Dr. Arce’s testimony as to the same. Ex. 1008 ¶¶ 66, 67; *see also id.* ¶ 66 (“The ImSpector V10 and N17 would have been obvious options for SpectroSort’s VIS and NIR sensor units.”).

Patent Owner further argues that the claims of the ’346 patent “require the ‘single hyperspectral camera’ be able to capture spectra up to at least 1700 nm in wavelength.” PO Resp. 38. For the reasons discussed above in our Claim Construction, Patent Owner’s argument is premised on a claim construction that we do not adopt. *See supra* § II.C.1. Specifically, the claim does not require the single camera to capture wavelengths up to 1700 nm.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(b) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

d) Limitation 1(c) - said camera disposed proximate to a visible or infrared light source

As discussed above, we construe “disposed proximate to” to mean “disposed nearby.” *See supra* § II.D.2. We further note that during prosecution of the ’346 patent, the applicant acknowledged that the term “‘proximate’ is broad in its scope.” *See* Ex. 1020, 70.

Petitioner asserts that SpectroSort’s “VIS and NIR sensor units” (shown in green in annotated Figure 17.10) “are disposed proximate to a visible or infrared light source” (shown in purple). Pet. 46; *see also supra* (depicting Carlsohn’s annotated Figure 17.10). Petitioner explains that

SpectroSort's "sensor units are 'proximate' to the illumination unit because they are positioned (1) close thereto (e.g., relative to the length of the conveyor) and (2) to allow SpectroSort to achieve the '346 Patent's objective: to receive reflected light with 'sufficient intensity' to achieve accurate 'classification results.'" Pet. 46 (citing Ex. 1002, 43, Figs. 17.9, 17.10).

We reproduce Carlsohn's Figure 17.9 (Ex. 1002, 42), below:

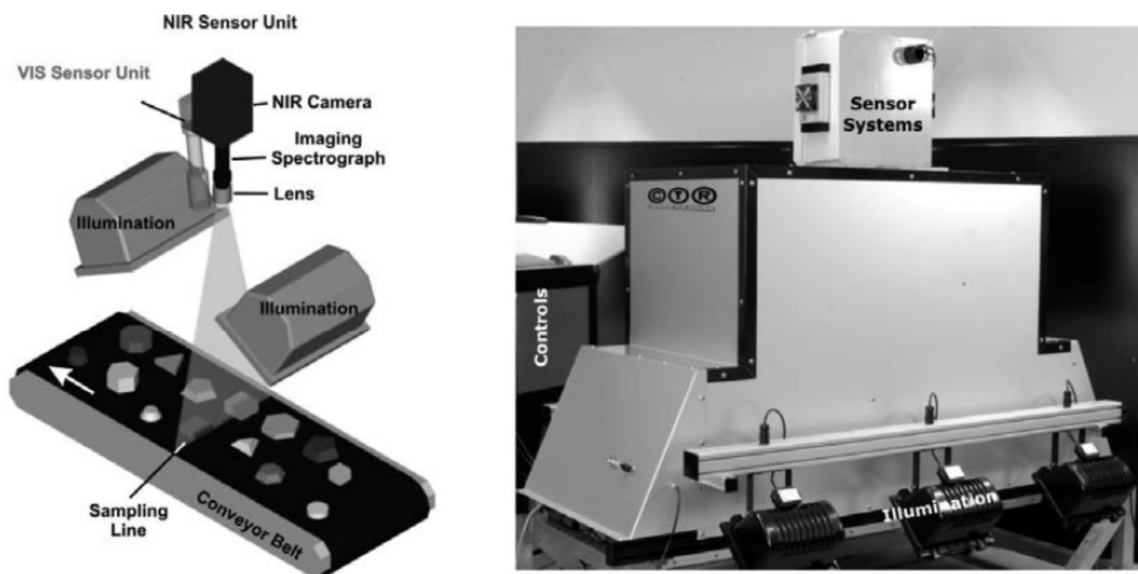


FIGURE 17.9

Figure 17.9 depicts "[s]etup (left) and photograph (right) of an industrial spectral imaging system (CTR SpectroSort®, 1.8 m observation in length)." *Id.* Both images show the camera ("Imaging Spectrograph" or "Sensor Systems") and the light source ("Illumination") of the system.

Patent Owner argues that "[t]he location of the light source, i.e., 'illumination,' which 'are specially modified floodlights,' is not specifically described in Carlsohn." PO Resp. 39 (citing Ex. 1002, 43). As to Carlsohn's Figure 17.9, Patent Owner submits that "the positions of the illumination components shown in the drawing *on the left* of Fig. 17.9 may

not be accurately depicted.” *Id.* at 40 (citing Ex. 2001 ¶ 61) (emphasis added). In its Sur-Reply, Patent Owner further argues that “Carlsohn shows a camera above the camera enclosure and thus not ‘proximate’ or ‘nearby’ to the light source.” PO Sur-Reply 11.

We do not agree with Patent Owner’s arguments.

During prosecution of the ’346 patent, the applicant acknowledged that the term “‘proximate’ is broad in its scope” (*see* Ex. 1020, 70), and we agree with Petitioner that Carlsohn’s light source is also proximate, or nearby, its camera, as shown in Figure 17.9 (*see* Pet. 46). Even if Carlsohn’s camera is *above* its light source, this arrangement does not preclude Carlsohn’s camera from also being “proximate” or nearby the light source, contrary to Patent Owner’s argument. *See* PO Sur-Reply 11.

Petitioner correctly points out that “[t]he light sources shown in the ’346 patent are in the same relative position” as Carlsohn. *See* Pet. Reply 12. We further agree with Petitioner that there is nothing in the ’346 patent that leads us to construe “proximate” as requiring a closer relation between the camera and light source than what is shown in Carlsohn’s Figure 17.9. *See id.*; Ex. 1001, Fig. 1. We credit Dr. Arce’s testimony that a “POSITA would have understood that SpectroSort’s light sources are ‘proximate’ to the sensor units, as that term is used in the ’346 Patent, in part because they are relatively close thereto compared to the length of SpectroSort’s conveyor,” as shown in Carlsohn’s Figures 17.9 and 17.10. Ex. 1008 ¶ 68.

As correctly pointed out by Dr. Arce, during prosecution of the ’346 patent, the applicant stated that the illumination source is “position[ed] . . . proximate to the camera so as to achieve ‘high degrees of reflectance.’” Ex. 1020, 70; *see also* Ex. 1008 ¶ 68 (quoting the same). Carlsohn similarly

discloses that “[t]he light source must provide a spatially sufficiently homogeneous illumination of the sample with sufficient intensity over the required spectral range” (Ex. 1002, 43) and we agree with Dr. Arce that in order for SpectroSort’s light sources to provide sufficient illumination, the camera must be “proximate” or nearby the illumination (*see* Ex. 1008 ¶ 68), just as described by the applicant during prosecution of the ’346 patent (*see* Ex. 1020, 70).

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(c) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

e) Limitations 1(d) and 1(e) - said light source and said at least one hyperspectral camera are disposed on the same side of a stream of said heterogeneous material, said solid belt having first and second ends, said belt running beneath said hyperspectral identification system and upon which said heterogeneous material is conveyed from said first end to said second end

Petitioner submits that Carlsohn’s SpectroSort is configured to transport the heterogeneous material from the first end of the conveyor to a second end, such that there is a stream of material. *See* Pet. 47 (citing in part Ex. 1002, 41, 43, Fig. 17.10). Petitioner further submits that “SpectroSort’s light source and cameras are disposed on the same side of the stream.” *Id.*

We again reproduce Petitioner’s annotated Figure 17.10 (Pet. 34), below:

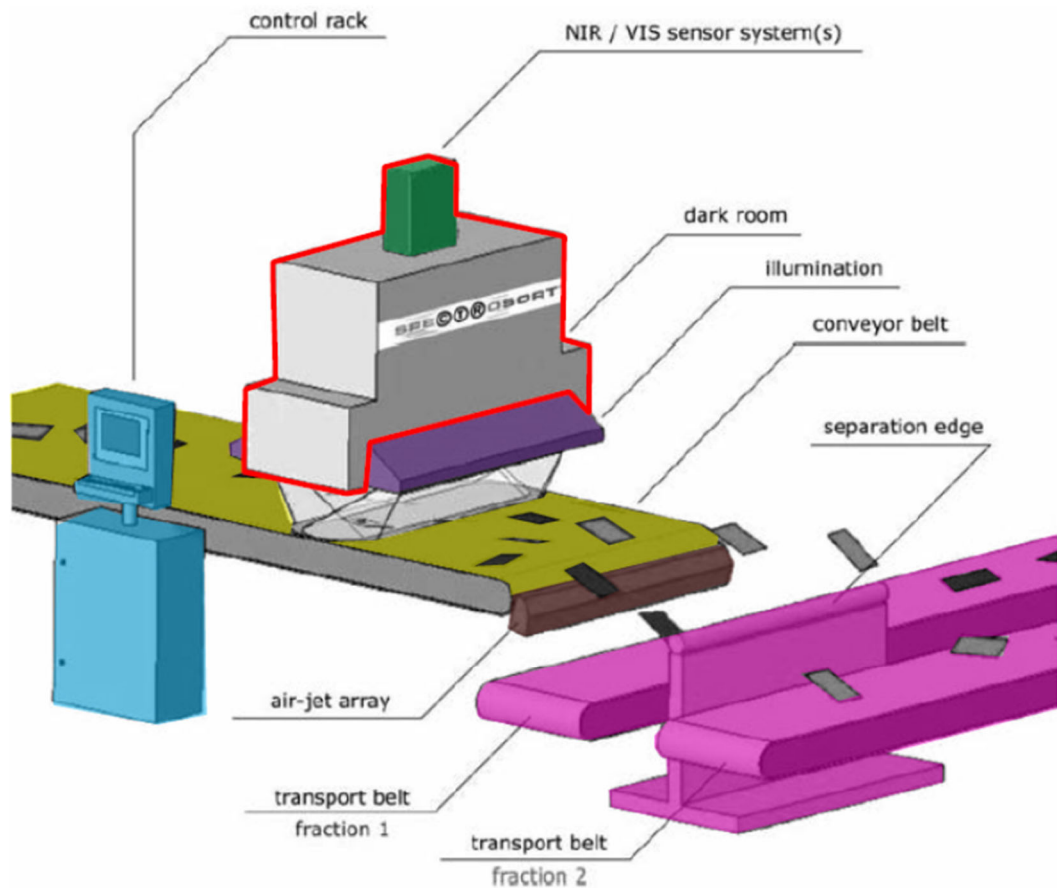


FIGURE 17.10
The SpectroSort® hardware setup. (Reproduced from the SpectroSort® product sheet.)

Figure 17.10 depicts SpectroSort’s hardware setup, including a conveyor belt (yellow) transporting material (fraction 1 black pieces, and fraction 2 gray pieces) from the left to the right. *See* Ex. 1002, 43. The figure depicts material traveling under an “NIR/VIS sensor system,” a “dark room,” and “illumination.” *Id.*

Dr. Arce testifies, “The emitted light reflects off of the waste being sorted, enters SpectroSort’s dark room, and travels to the [spectral imaging (“SI”)] system.” Ex. 1008 ¶ 63. Dr. Arce explains, “The measured light originates from SpectroSort’s illumination unit [purple], which includes an

array of floodlights on each side of SpectroSort’s ‘dark room’ *such that the floodlights and cameras are on the same side of the waste stream.*” *Id.* (emphasis added). Dr. Arce further testifies that SpectroSort’s SI system satisfies the claimed “hyperspectral identification system.” *See id.* ¶¶ 61, 69; *see also* Pet. 47.

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitations 1(d) and 1(e) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

f) Limitation 1(f) - said belt traveling at a preset rate, said hyperspectral identification system being disposed over said second end of said belt

Petitioner submits that the SpectroSort’s belt travels at a “preset rate.” Pet. 47 (citing Ex. 1002, 43). Carlsohn discloses that “SpectroSort is the transport system providing a relative movement of the samples perpendicular to the first spatial axis (sampling line) at a *constant speed.*” Ex. 1002, 43 (emphasis added).

We agree with Petitioner and find that SpectroSort’s conveyor belt’s “constant speed” satisfies the claimed “said belt traveling at a preset rate.”

Petitioner further submits that “SpectroSort’s identification system is over the second end of the belt.” Pet. 47–48 (citing Ex. 1002, Fig. 17.10; Ex. 1008 ¶¶ 61, 69). Referencing annotated Figure 17.10 (reproduced *supra*), Dr. Arce testifies that “SpectroSort includes an identification system

[red outline] that is over the second end of the conveyor belt and has a spectral imaging ('SI') system [green]." Ex. 1008 ¶ 61 (citing Ex. 1002, 41–43, Fig. 17.10) (alterations in original).

Patent Owner disputes Petitioner's assertion, arguing that "Carlsohn does not show or suggest 'said hyperspectral identification system being disposed over said second end of said belt.'" PO Resp. 43; *see also* PO Sur-Reply 11 ("Carlsohn, specifically [Figures] 17.9 and 17.10, do not show the SpectroSort identification unit as being disposed over the second end of the belt." (emphasis omitted)). In support of this position, Patent Owner cites to the cross examination testimony of Dr. Arce and submits that Dr. Arce "*admits* that Carlsohn does not show or suggest 'said hyperspectral identification system being disposed over said second end of said belt.'" Rather, he admits that the 'SpectroSort identification unit is disposed closer to the terminus of the belt than to the beginning of the belt.[']" PO Resp. 47 (emphasis added); *see also id.* at 46–47 (citing Ex. 2023, 108:23–110:24). Patent Owner further argues that "Petitioner *admits* that Carlsohn does not show the hyperspectral identification system disposed over the second end of the conveyor belt" by presenting its alternative challenge to the claims, relying on obviousness for this claim limitation rather than disclosure in Carlsohn in alternative Ground 3. *See id.* at 49 (citing Pet. 74–80) (emphasis added).

We disagree with Patent Owner that both Dr. Arce and Petitioner separately "admit" that Carlsohn does not disclose the limitation.

As to Dr. Arce's cross-examination testimony, although Dr. Arce testified that the "end of the belt" is "where it sort of curves" (*see* Ex. 2024, 110:18–20), he also expressed confusion with Patent Owner's same line of

questioning (*see id.* at 110:15–16 (“A. I mean, I’m not sure if I understand your question.”)). With this confusion, we do not find Dr. Arce as *admitting* to Patent Owner’s position that Carlsohn’s hyperspectral identification system is not over the “second end” of its conveyor belt, as that term is used in claim 1. For example, in his initial declaration, Dr. Arce testifies that “SpectroSort includes an identification system [red outline] that is over the second end of the conveyor belt,” referencing the annotated version of Carlsohn’s Figure 17.10, reproduced above. Ex. 1008 ¶ 61 (alteration in original).

As to Petitioner’s “admission” that the camera is not over the second end of the belt, we disagree with Patent Owner’s position that simply because Petitioner presents an *alternative* challenge to address the claimed limitation that Petitioner admits that the first position is flawed. *See* PO Resp. 49. Indeed, Petitioner unequivocally submits that “SpectroSort’s identification system is over the second end of the belt.” Pet. 47–48 (citing Ex. 1002, Fig. 17.10). Petitioner presents the alternative challenge, in which Petitioner proposes to move Carlsohn’s identification system closer to the terminus of the belt, in the event that the “SpectroSort’s identification system is not sufficiently close to the conveyor’s terminus for (1) it to be over the conveyor’s ‘second end’ and/or (2) the cameras and light source that are part of/connected to the identification system to be on the ‘same side’ of the waste stream.” *See id.* at 74–75.

Having established that neither Dr. Arce nor Petitioner admits that Carlsohn’s identification system is *not* over the second end of the conveyor belt, we understand that Patent Owner’s argument is one of claim construction; that is, whether the “second end” of the belt is “immediately

adjacent the ejection system,” as Patent Owner argues. *See* PO Resp. 13–22. As explained in our Claim Construction section, we do not construe “said hyperspectral identification system being disposed over said second end of said belt” to mean “the hyperspectral identification system is positioned over the portion of the belt *immediately adjacent* the ejection system.” *See supra* § II.C.3. Rather, we agree with Petitioner that the “second end” is a term of approximation, conveying a general location, rather than the terminus of the belt. *See* Pet. Reply 15. Indeed, Mr. Smith acknowledged as much during cross examination. *See* Ex. 1038, 60:17–21 (“Q When we talk about the camera being over the second end of the belt, we have to assume, as a POSITA, that it’s not at the absolute edge of the second belt, don’t we? A I totally agree.”).

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(f) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

g) Limitation 1(g) - a computer configured to receive and analyze data from said hyperspectral identification system

Petitioner submits that Carlsohn’s Figure 17.10 depicts a “control rack” (shown in blue), which is a computer that is configured to receive and analyze data from its hyperspectral identification system. *See* Pet. 48; *see also supra* (annotated Figure 17.10).

Carlsohn discloses that its control rack contains “a standard state-of-the-art industry PC . . . for data acquisition and real-time evaluation.” Ex. 1002, 43.

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(g) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

h) Limitation 1(h) - to identify target materials of a first user defined category from among said heterogeneous materials

Petitioner submits that Carlsohn’s SpectroSort computer is configured to identify target materials, such as whether the materials are of a particular type of polymer or whether the paper is “de-inking” or “non-de-inking.” Pet. 48 (citing in part Ex. 1002, 41, 44–46, Fig. 17.12).

Carlsohn discloses, “The heart of SpectroSort® is a NIR spectral imaging system that is able to distinguish de-inking from non-de-inking material based on those differences.” Ex. 1002, 41.

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(h) for the reasons stated by Petitioner

in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

i) Limitation 1(i) - identify the spatial position of said target materials

Petitioner submits that “SpectroSort’s computer is configured to identify the spatial position of the identified materials based on the position of the pixels representing them in the hypercube.” Pet. 49 (citing in part Ex. 1002, 44).

Carlsohn discloses, “*Spatially resolved material identification* and the subsequent sorting is currently the prevalent SpectroSort application.” Ex. 1002, 44 (emphasis added).

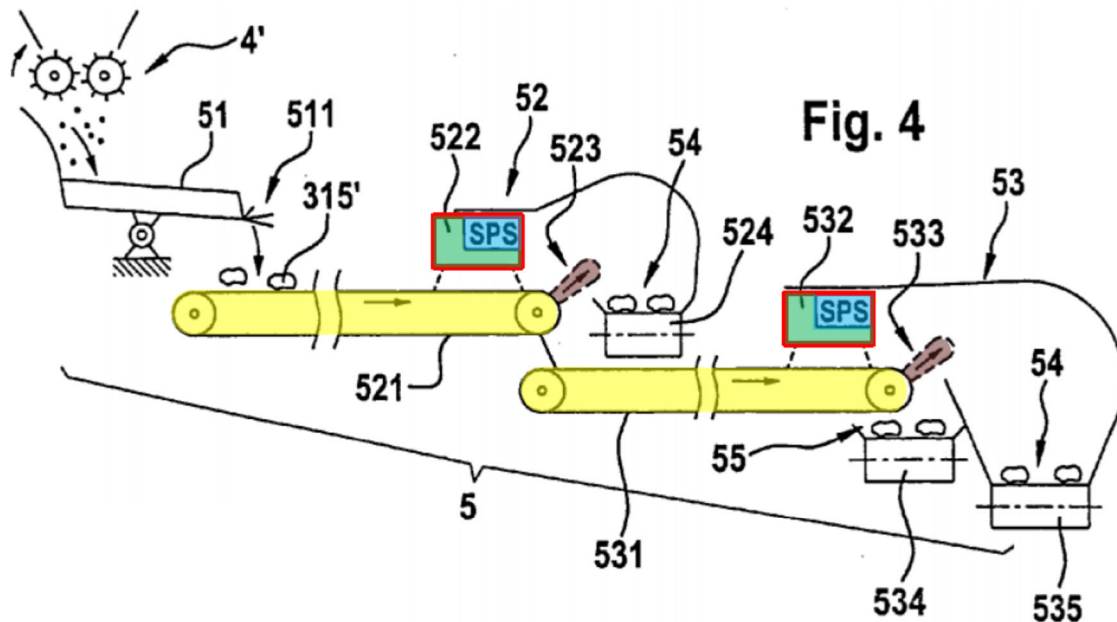
Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(i) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

j) Limitation 1(j) - to trigger an ejection system at a preset time delay equal to the distance between said camera and said ejection system divided by the rate of travel of the belt

To satisfy this limitation, Petitioner relies on Arleth’s teaching of a conveyor-speed-based ejection system and reasons that a skilled artisan would have modified Carlsohn’s SpectroSort system to incorporate a similar ejection system. *See* Pet. 37–40, 49–50.

Petitioner submits an annotated version of Arleth's Figure 4 (*id.* at 38), which we reproduce, below:



Annotated Version of Arleth's FIG. 4
("Annotated8")

Arleth's Figure 4 depicts a "schematic representation of a sorting system with two subsequently arranged sorting devices with the same features." Ex. 1004 ¶ 27. Plastic parts 315' are transported on conveyor 521, 531 (shown in yellow) and sensors 522, 532 (shown in green) identify reflected signals from the parts, compare them to stored data about known plastics, and determine if any of the parts are "destined to be ejected." *Id.* ¶ 46. Any parts that are "destined to be ejected" are ejected using nozzles 523, 533 (shown in brown) and a processor "calculates the time and duration of the control of the ejection nozzle(s) on the basis of the movement parameter of the conveyor belt." *Id.* ¶¶ 46, 49.

Petitioner reasons that "it would have been obvious to configure SpectroSort's computer to delay actuation of the ejection system for a time

delay equal to the distance between its cameras . . . and the ejection system (measured along the direction of belt travel).” Pet. 50. In support of Petitioner’s reasoning, Dr. Arce testifies that “an appropriate conveyor-speed-based time delay would have been the distance an object had to travel from its scanning location divided by the conveyor’s speed.” Ex. 1008 ¶ 93. Petitioner further reasons that using such conveyor-speed-based time delay would have permitted proper ejection unit timing without the need for mechanisms, such as sensors, to detect when scanned material reaches the ejection unit. Pet. 40. Dr. Arce further testifies that the modification would “ensure proper ejection timing, especially because SpectroSort’s conveyor runs ‘at a constant speed.’” Ex. 1008 ¶ 93.

Patent Owner does not dispute Petitioner’s assertions or reasoning for modifying Carlsohn. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth and as modified satisfies Limitation 1(j) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

k) Limitation 1(k) - said ejection system disposed immediately after said second end of said belt, whereby said desired materials are separated from said heterogeneous material

Petitioner submits that Carlsohn’s SpectroSort system discloses this limitation. Pet. 51 (citing in part Ex. 1002, 43).

Carlsohn discloses that its “air-jet array” (shown in brown in annotated Figure 17.10) “provides the actual separation of material into two

material fractions.” Ex. 1002, 43; *supra*. In particular, Carlsohn’s Figure 17.10 explicitly shows the air-jet array as separating “fraction 1” onto a first transport belt and “fraction 2” onto a second transport belt, with the two transport belts separated by a “separation edge.” *See* Ex. 1002, 43.

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(k) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

l) Limitation 1(l) - said ejection system being triggered by said computer

Petitioner submits that Carlsohn’s SpectroSort system discloses this limitation. *See* Pet. 51.

Carlsohn discloses an “air-jet array” which receives input/output signals from its computer. *See, e.g.*, Ex. 1002, 46 (“[I]nformation like position, size, and orientation of an object” obtained by the computer “can serve as control parameters for an automatic sorter, in this case, an air-jet array.”).

Patent Owner does not dispute Petitioner’s assertions. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth satisfies Limitation 1(l) for the reasons stated by Petitioner

in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

m) Summary of Independent Claim 1

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by the teachings of Arleth satisfies the limitations of claim 1 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

4. Dependent Claim 2

Claim 2 depends from claim 1 and further comprises, “a conveyer to deliver said heterogeneous material to said system.” Ex. 1001, 6:33–35.

To address this claim, Petitioner submits that “SpectroSort comprises a conveyor that drives its belt to deliver material to the identification system.” Pet. 51 (citing Ex. 1002, 43; Ex. 1008 ¶ 71).

Carlsohn’s Figure 17.10 depicts a conveyor belt for delivering material within the system.

As to claim 2, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 2 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

5. *Dependent Claim 3*

Claim 3 depends from claim 1 and further comprises, “a receiving system, whereby said materials of a first user defined category are segregated and collected.” Ex. 1001, 6:36–38.

To address this claim, Petitioner references Carlsohn’s annotated Figure 17.10 (reproduced *supra*) and submits that “Carlsohn discloses that SpectroSort includes a receiving system [pink] comprising two transport belts and a separation edge.” Pet. 52 (citing Ex. 1002, 43, Fig. 17.10; Ex. 1008 ¶ 71).

Carlsohn’s system receives, segregates, and collects materials into at least two material fractions; “fraction 1” and “fraction 2.” *See* Ex. 1002, 43, Fig. 17.10.

As to claim 3, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 3 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

6. *Dependent Claim 4*

Claim 4 depends from claim 1 and further comprises, “an array of lights disposed proximate to said hyperspectral identification system.” Ex. 1001, 6:39–41.

To address this claim, Petitioner submits that “Carlsohn discloses that SpectroSort’s illumination unit comprises an array of lights.” Pet. 52 (citing Ex. 1002, 43, Fig. 17.0; Ex. 1008 ¶ 63).

Carlsohn’s Figures 17.9 and 17.10 each depicts at least two sets of illuminations proximate to, or nearby, its hyperspectral identification system.

As to claim 4, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 4 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

7. *Dependent Claim 5*

Claim 5 depends from claim 4 and further recites, “wherein said lights have a wavelength suitable for hyperspectral imaging.” Ex. 1001, 6:42–43.

To address this claim, Petitioner submits that “Carlsohn discloses that SpectroSort’s lights have a wavelength suitable for hyperspectral imaging (e.g., are visible and infrared light sources).” Pet. 53 (citing Ex. 1002, 43; Ex. 1008 ¶ 68).

Carlsohn discloses that its “light sources must provide . . . illumination of the same with sufficient intensity over the required spectral range.” Ex. 1002, 43.

As to claim 5, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 5 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

8. *Dependent Claim 7*

Claim 7 depends from claim 1 and further recites, “wherein said hyperspectral identification system is configured to collect spectral and spatial information from heterogeneous material entering said system and store said spectral and spatial information as images.” Ex. 1001, 6:47–51.

To address this claim, Petitioner submits that “SpectroSort’s hyperspectral identification system can collect spectral and spatial information from heterogeneous material entering the system . . . [and it] can store that information as images to form the hypercube using the push-broom scanning principle.” Pet. 53 (citing Ex. 1002, 41–42, 44–46, Fig. 17.8; Ex. 1008 ¶¶ 61, 69).

Dr. Arce testifies that “[Carlsohn’s] SI system includes at least one hyperspectral camera configured to capture and (at least temporarily) store hyperspectral images of waste that include both spatial and spectral data: its visible (‘VIS’) and near-infrared (‘NIR’) sensor units.” Ex. 1008 ¶ 61 (citing Ex. 1002, 41–43 (“SI system can feature one or several of these units (e.g., to cover a wider spectral range),” Figs. 17.8 (depicting the system as generating a “spectral hypercube” including spatial data along the “1st spatial axis” and the “2nd spatial axis” and spectral data in each pixel), 17.9, 17.10 (depicting a “VIS sensor Unit” and a “NIR Sensor Unit”))).

As to claim 7, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 7 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

9. *Dependent Claim 9*

Claim 9 depends from claim 1 and further recites, “wherein said heterogeneous materials comprise waste and recyclable materials.” Ex. 1001, 6:58–59.

To address this claim, Petitioner submits that “Carlsohn discloses that the heterogeneous materials SpectroSort can sort comprise waste and recyclable materials.” Pet. 54 (citing Ex. 1002, 39–41).

Carlsohn discloses that “[t]he main focus of SpectroSort is the sorting of paper and polymers in the industrial environments” and that the paper and polymers are then “recycled in a lot of countries in the world.” Ex. 1002, 39–41, 44–46; *see also* Pet. 54 (finding the same).

As to claim 9, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 9 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

10. Dependent Claim 10

Claim 10 depends from claim 1 and further recites, “wherein said computer can select a plurality of user defined materials.” Ex. 1001, 6:60–61.

To address this claim, Petitioner submits that “SpectroSort’s computer can select a plurality of user-defined materials, such as [de]inking material, non-deinking material, different polymer types, and (if so-modified) different glass types.” Pet. 55.

Carlsohn discloses “Sorting of Paper and Polymers” (Ex. 1002, 40) and that data processing may be performed “using a standard PC” (*id.* at 44).

As to claim 10, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 10 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

11. Dependent Claim 11

Claim 11 depends from claim 1 and further recites, “wherein said ejection system comprises a mechanical ejector.” Ex. 1001, 6:62–63.

To address this claim, Petitioner submits that “it would have been obvious to use a mechanical ejector for SpectroSort’s ejection system.” Pet. 57 (referencing the rejection of claim 1).

As discussed above, we agreed with Petitioner’s reasoning that a skilled artisan would have modified Carlsohn’s SpectroSort system to incorporate a mechanical ejector as taught by Arleth. *See supra* § II.F.3.j; *see also* Pet. 37–40, 49–50.

As to claim 11, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 11 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

12. Dependent Claim 12

Claim 12 depends from claim 1 and further recites, “wherein said ejection system comprises a fluid jet.” Ex. 1001, 6:64–65.

To address this claim, Petitioner submits that “Carlsohn discloses that SpectroSort’s ejection system is an air-jet array; because air is a fluid, the air-jet array satisfies the limitation.” Pet. 56.

Carlsohn discloses that “an airjet array [may] provide[] the actual separation of material into two material fractions.” Ex. 1002, 43.

As to claim 12, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s teachings satisfies the limitations of claim 12 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

13. Summary of Ground 1

Based on the foregoing, we determine that Petitioner has proven by a preponderance of the evidence that claims 1–5, 7, and 9–12 are unpatentable in view of Carlsohn as modified by the teachings of Arleth.

G. Ground 2 – Claim 8 Obvious over Carlsohn, Arleth, Ulrichsen, and Mayhak

Petitioner submits that claim 8 is unpatentable under 35 U.S.C. § 103 in view of Carlsohn, Arleth, Ulrichsen, and Mayhak. Pet. 57.

1. Ulrichsen (Ex. 1006)

Ulrichsen is a U.S. Patent titled “Determination of Characteristics of Material.” Ex. 1006, code (54). Ulrichsen discloses a “system for automatically inspecting matter for varying composition . . . through which one or more streams of matter are advanced and particular materials therein are detected through their diffusely reflected IR spectra, if any.” *Id.* at code (57). To depict an embodiment of Ulrichsen’s system, we reproduce its Figure 2, below:

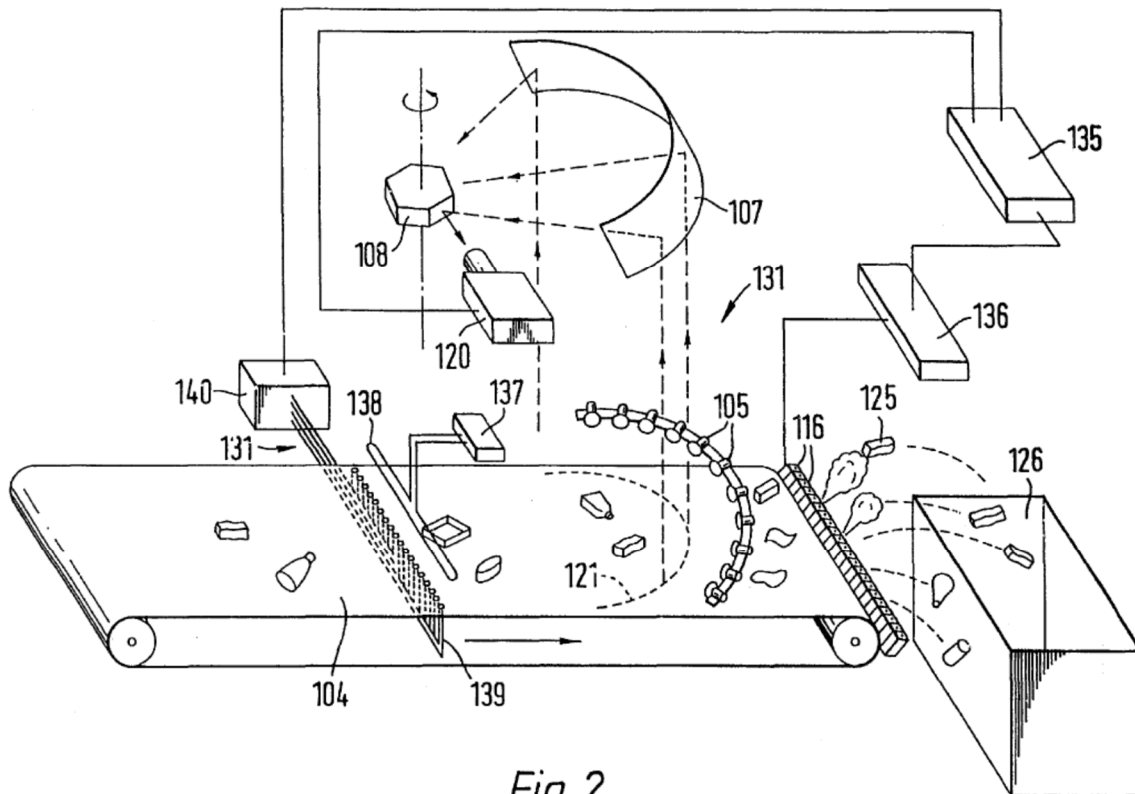


Fig. 2

Figure 2 depicts a system for sorting waste objects of different compositions, with detection from above. Ex. 1006, 10:26–30. In particular, Figure 2 shows detection unit 120 that receives light reflected from illuminated waste. *Id.* at 11:50–58, 12:1–22. To sort the waste, detection unit 120 controls air nozzles 116 (located at the terminus of conveyor 104) for directing polymer-coated cartons 125 into bin 126. *Id.* at 13:13–50.

2. *Mayhak* (Ex. 1007)

Mayhak is a U.S. Patent titled “Debagger Sorting Machine.” Ex. 1007, code (54). *Mayhak* discloses a “machine for removing yard waste from bags and for sorting the waste.” *Id.* at code (57). To illustrate an embodiment of *Mayhak*’s machine, we reproduce its Figure 1, below:

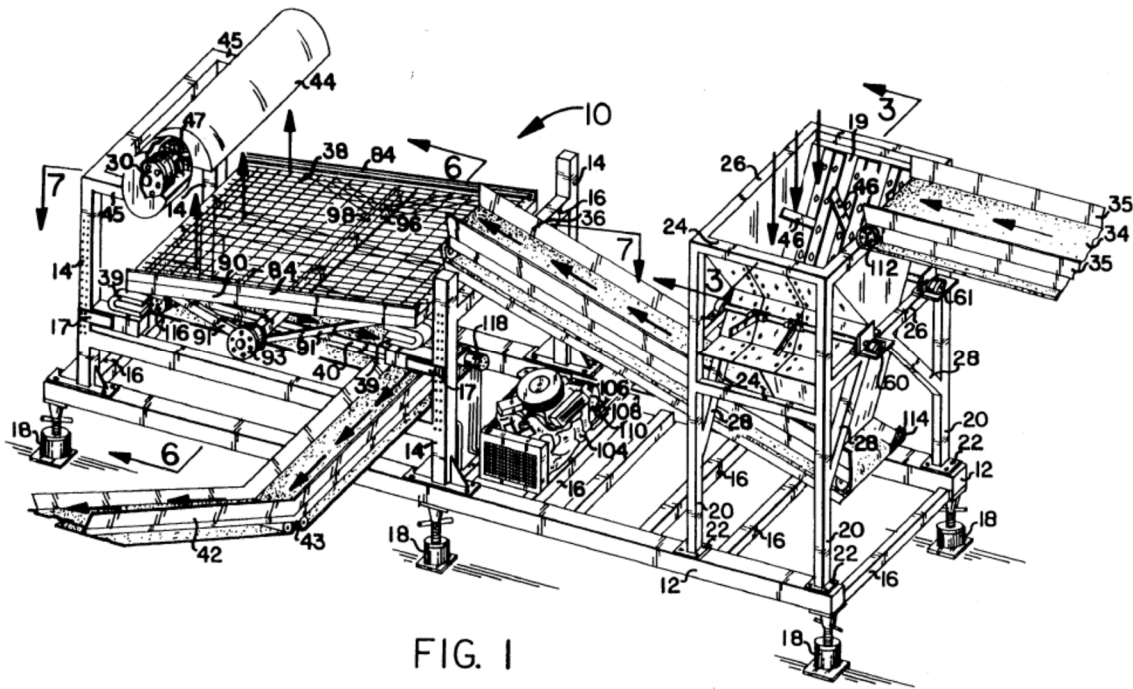


Figure 1 depicts a perspective view of Mayhak's debagging sorting machine. Ex. 1007, 5:41–42. In particular, Mayhak discloses debagger sorter machine 10 supported by a steel frame structure. *Id.* at 6:15–20. The machine also has hood 44 mounted above the low end of inclined screen 38. *Id.* at 7:21–22. Hood 44 contains fan 47 driven by hydraulic motor 30. *Id.* at 7:22–23. Fan 47 lifts bags and bag parts from screen 38 and ejects them to the rear of the machine. *Id.* at 7:25–27. Material that does not either fall through the screen or which was not ejected from the screen by the blower will vibrate off the low end of the screen, where it can be collected separately. *Id.* at 7:28–31.

3. Analysis

Claim 8 depends from claim 1 and further recites, “wherein said ejection system comprises a plurality of independently controlled air nozzles disposed beneath said material, and a blower hood disposed above said

material, said blower hood providing an air current whereby said selected material is blown out of a discharge port.” Ex. 1001, 6:52–57.

To address this limitation, Petitioner proposes to modify Carlsohn’s SpectroSort system based on the teachings from Ulrichsen and Mayhak. *See* Pet. 57–61.

Petitioner relies on Ulrichsen’s teaching of a “‘two step’ air ejection” that targets materials. *See id.* at 58 (citing Ex. 1006, 13:26–32). Ulrichsen discloses that once the materials (in this instance, beverage cartons 125) are lifted by nozzles 116, “they may be hit with a second air impulse, for example, a transverse air flow . . . to make them land in a bin at the side of the conveyor belt 104.” Ex. 1006, 13:26–32; *see also id.* at Fig. 2 (reproduced *supra*).

As for Mayhak, Petitioner relies on Mayhak’s teaching of a blower above screen 38 that has hood 44 and fan 47. *See* Pet. 58. Mayhak teaches that bags are lifted from the screen to the blower, which “blows the bag and bag parts off the screen to one side where they are collected and disposed of separately.” Ex. 1007, 7:21–27; *see also id.* at Fig. 1 (reproduced *supra*).

In modifying Carlsohn’s SpectroSort system based on the teachings of Ulrichsen and Mayhak, Petitioner reasons that a “POSITA would have included a blower hood disposed over SpectroSort’s air-jet array . . . to provide a transverse air flow to eject material lifted by the air-jet array out of a discharge port.” Pet. 59 (citing Ex. 1008 ¶¶ 100–102). Dr. Arce testifies that the two-step air ejection method for separating waste material is taught by Ulrichsen as advantageous. *See* Ex. 1008 ¶ 100.

As to claim 8, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by the teachings of Arleth, Ulrichsen, and Mayhak satisfies the limitations of claim 8 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

H. Ground 3 – Claims 1–7 and 9–16 Obvious over Carlsohn, Arleth, and Sinram

Petitioner challenges claims 1–7 and 9–16 as being unpatentable under 35 U.S.C. § 103 in view of Carlsohn, Arleth, and Sinram. Pet. 5.

1. Sinram (Ex. 1003)

Sinram is an international patent publication titled “System and Method for Identifying and Sorting Material.” Ex. 1003, code (54). Sinram discloses an “automatic sorting system for identifying and sorting non-[homogeneous] material” using spectral analysis. *See id.* at code (57).

2. Analysis

Petitioner largely relies on the same assertions and reasoning discussed above under Ground 1, namely, Carlsohn and Arleth. *See* Pet. 62–65. In further combining Carlsohn and Arleth with Sinram, Petitioner submits that the proposed modification addresses the limitations of claims 6 and 13–16, which are not addressed under Ground 1. *See id.* at 66–74. Petitioner also submits, as an alternative to its challenge of claim 1 under Ground 1, that a POSITA would have further relied on Sinram’s teachings

and additional rationale for addressing Limitations 1[d] and 1[f]. *See id.* at 75.

3. *Independent Claim 1*

Petitioner relies mostly on the same findings and reasoning relied upon under Ground 1. *See* Pet. 62–65. As discussed above in connection with Ground 1, Petitioner asserts that Carlsohn’s “SpectroSort’s identification system is over the second end of the belt.” *Id.* at 47–48 (citing Ex. 1002, Fig. 17.10; Ex. 1008 ¶¶ 61, 69); *see also id.* at 74 (“SpectroSort’s identification system is disposed over the conveyor’s second end”).

Petitioner relies on Sinram in the *alternative* and submits,

To the extent PO argues that SpectroSort’s identification system is not sufficiently close to the conveyor’s terminus for (1) it to be over the conveyor’s “second end” and/or (2) the cameras and light source that are part of/connected to the identification system to be on the “same side” of the waste stream, it would have been obvious to position the identification system closer to the terminus in Grounds 1-3.

Id. at 75 (citing Ex. 1008 ¶¶ 76–81; Ex. 1003, Fig. 5; Ex. 1002, Fig. 17.10).

In support of its alternative position, Petitioner submits another annotated version of Carlsohn’s Figure 17.10 to illustrate the proposed modification. *Id.* at 76. We reproduce that annotated Figure 17.10, below:

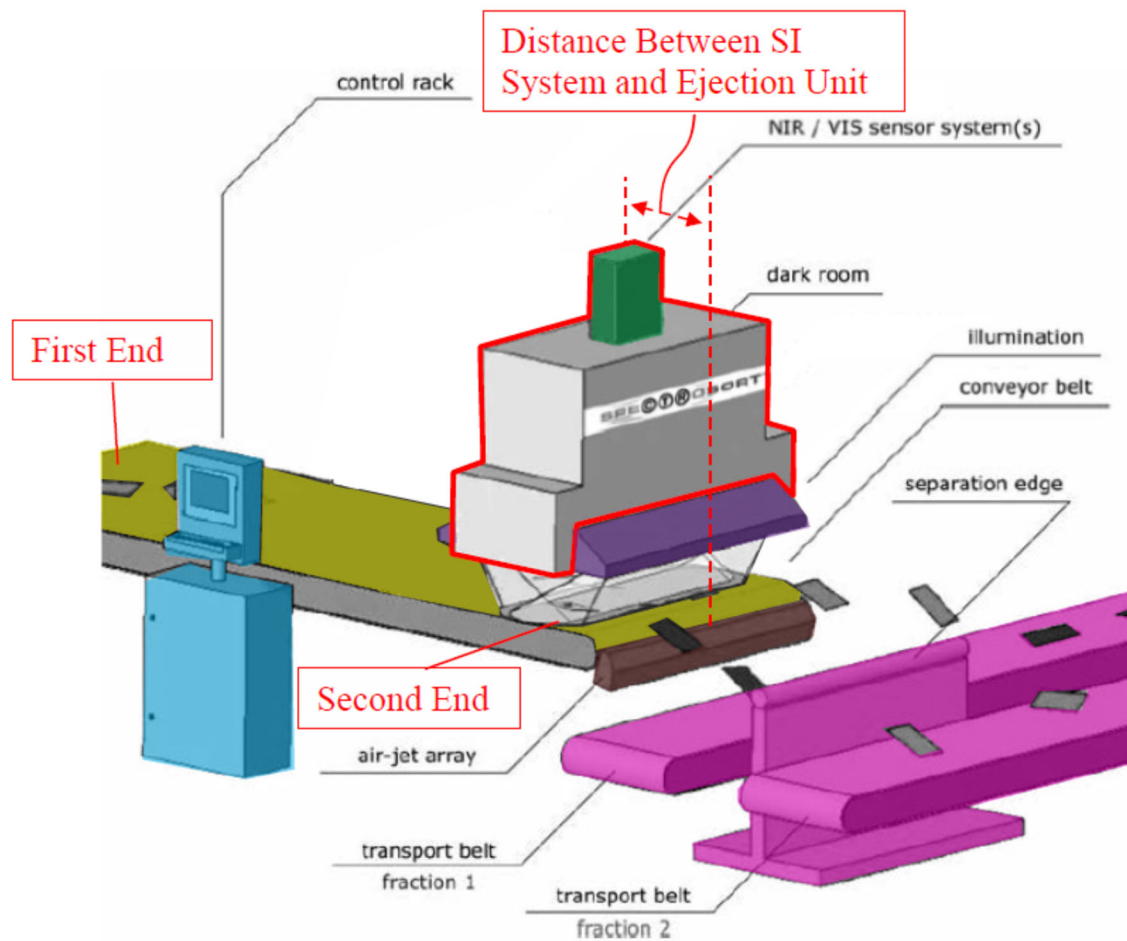
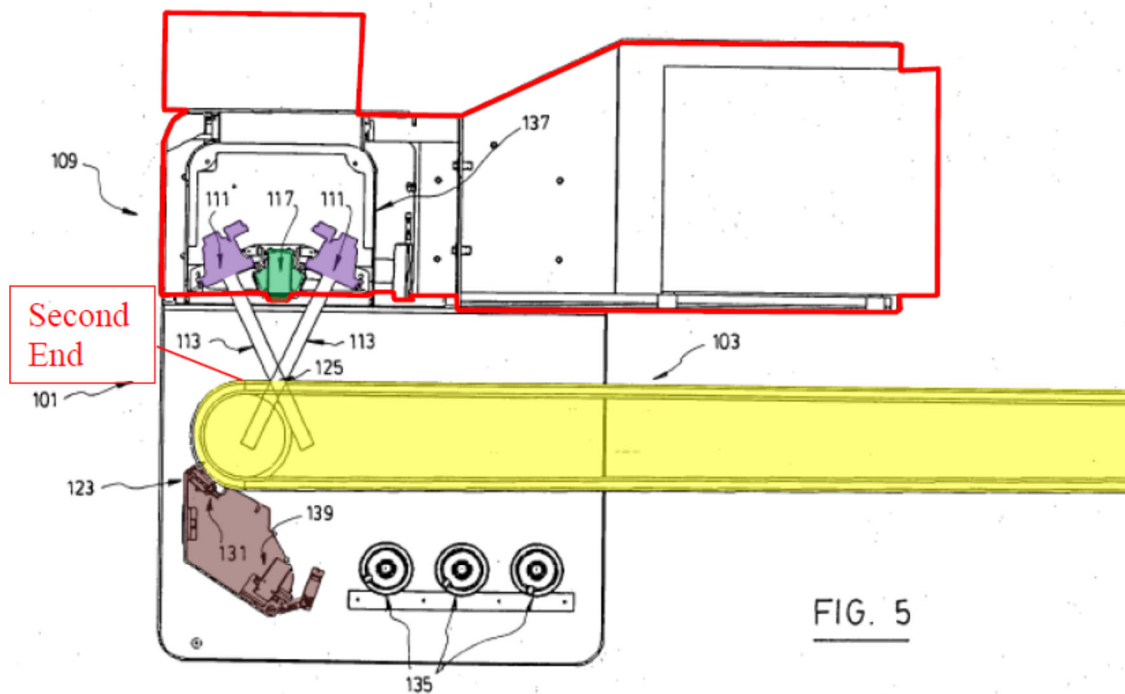


FIGURE 17.10
The SpectroSort[®] hardware setup. (Reproduced from the SpectroSort[®] product sheet.)

Annotated Figure 17.10 depicts Carlson’s “NIR/VIS sensor system(s),” “illumination,” and “dark room” shifted closer to the terminus of the “second end” of the “conveyor belt.” In arriving at this proposed modification, Petitioner relies on Sinram’s teachings, namely, Sinram’s Figure 5, and submits an annotated version of this figure. *See* Pet. 62. We reproduce Petitioner’s annotated version of Sinram’s Figure 5, below:



Annotated Version of Sinram's FIG. 5
("Annotated6")

Sinram's "Figure 5 is an enlarged view of a portion of . . . a carriage of the identification unit." Ex. 1003, 6. Specifically, Figure 5 depicts system 101 comprising sorting unit 123 and second end 103b of conveyor belt 103. *Id.* at 11. Petitioner submits that Sinram's "identification system 109 is disposed over belt 103's second end at the terminus thereof." Pet. 76. Petitioner submits that Sinram's arrangement "confirms that placing SpectroSort's identification system closer to the conveyor's terminus as well would have been an obvious option." *Id.* (citing in part Ex. 1008 ¶ 76).

In support of Petitioner's proposed modification, Dr. Arce testifies that "a POSITA would have understood the positioning of Sinram's identification unit to be relevant to the positioning of SpectroSort's identification system in view of the similarities between the devices." Ex. 1008 ¶ 77. Dr. Arce further testifies that a

POSITA would have been motivated to move SpectroSort's identification system in this manner to facilitate accurate sorting. It was known that recyclable material that SpectroSort handles or would have been obvious for SpectroSort to handle—such as glass or plastic bottles and paper products—can shift on a conveyor after being identified by an optical sensor.

Id. ¶ 78. Dr. Arce explains that a “POSITA would have understood that moving SpectroSort's system closer to the conveyor's terminus would facilitate accurate sorting by reducing the distance between the scanning point and the air-jet array and thereby mitigat[e] the risk of objects shifting after being scanned[,] because there would be less time for them to shift.”

Id.

Patent Owner argues that “a POSITA would not be motivated by Sinram to move the Carlsohn hyperspectral identification system over the second end of the belt.” PO Resp. 51. In support of this argument, Patent Owner submits that “[t]he system in Carlsohn utilizes an imaging spectrograph and a NIR camera to obtain the spectral data . . . while Sinram does not use a hyperspectral camera.” *Id.* at 52 (citing in part Ex. 2001 ¶¶ 51, 53). Patent Owner further explains that “Sinram uses a combination of 64 lenses, a multiplexer, and a spectrometer, making the devices described in Sinram and Carlsohn incompatible at a basic level.” *Id.* (citing Ex. 2001 ¶ 54).

We do not agree with Patent Owner's argument. Even if “Carlsohn utilizes an imaging spectrograph and a NIR camera,” while “Sinram uses a combination of 64 lenses, a multiplexer, and a spectrometer,” these are differences without a distinction. In addressing the particular limitation, which requires the “hyperspectral identification system being disposed over said second end of said belt,” Petitioner simply relies on Sinram for teaching

an identification system disposed over the terminus of a second end of a conveyor belt. *See* Pet. 76 (citing in part Ex. 1003, Fig. 5). Based on Sinram’s teaching, Petitioner reasons that a skilled artisan would have “plac[ed] SpectroSort’s identification system closer to the conveyor’s terminus” and that this “would have been an obvious option.” *Id.* (citing in part Ex. 1008 ¶ 77). Petitioner explains that the modification “would have facilitated accurate sorting.” *Id.* at 76–77 (citing Ex. 1008 ¶ 78). *Even if* we agree with Patent Owner’s extensive summary outlining the differences between Carlsohn’s system and Sinram’s system (*see, e.g.*, PO Resp. 53–56), these differences do not persuade us that a skilled artisan would not have modified Carlsohn based on Sinram’s teachings, and as proposed by Petitioner. At the end of the day, Sinram’s Figure 5 depicts identification system 109 over the terminus of the second end of conveyor belt 103 (*see* Ex. 1008 ¶ 73 (depicting Sinram’s annotated Fig. 5)), and Patent Owner’s extensive argument regarding the differences between Carlsohn’s and Sinram’s particular identification systems are inapposite.

Patent Owner further argues that “process-time concerns in the Carlsohn system preclude considering Sinram’s identification-system-at-the-terminus sorter.” PO Resp. 58 (citing Ex. 2022 ¶ 25). Patent Owner contends that “Carlsohn’s identification system takes at best two minutes to process the image and identify the selected material” (*id.*) and that “Carlsohn’s identification system cannot process the large amounts of data a hyperspectral system of the ’346 Patent would” (*id.* at 59). Patent Owner argues that as a result, “a POSITA would not be motivated in view of Sinram to move the identification system in Carlsohn to the second end of the belt.” *Id.* (citing Ex. 2001 ¶ 65; Ex. 2022 ¶ 22).

We do not agree with Patent Owner's second argument. Rather, we agree with Petitioner that a "POSITA would know that moving the imaging system closer to the terminus of the belt would involve a tradeoff, either requiring higher processing power to process images more quickly, processing fewer images, and/or slowing the belt to allow the processing to take place in order to engage the ejector system." Pet. Reply 17.

We first point out that Carlsohn discloses that "[f]or the SpectroSort system, the time for acquisition, processing, data evaluation, and post[-]processing of one sample line is *less than 15 ms.*" Ex. 1002, 44 (emphasis added); *see also* Ex. 1008 ¶ 79 (testifying that Carlsohn's 15 ms scan time is about the same as Sinram's 14.3 ms scan time). 15 ms processing time is a far cry from Patent Owner's calculation of two minutes, and Patent Owner's attempt to ignore Carlsohn's 15 ms teaching presumes, without sufficient basis, that "Carlsohn's identification system cannot process the large amounts of data" in that time. *See* PO Resp. 59.

As explained above, Patent Owner's argument is premised on Carlsohn's system needing "at best two minutes to process the image and identify the selected material." PO Resp. 58 (citing Ex. 2001 ¶ 65). We disagree with Patent Owner's assertion that at least two minutes is required.

In support of Patent Owner's two-minute processing time, Mr. Smith testifies that

Table 17.2 of Carlsohn gives the error rates and processing times for various experiments classifying tomatoes to train the system. According to this table, it would take the system on average 430 seconds (7.2 minutes) to classify each tomato if all 186 bands (i.e., 186 reflection values between 490 nm and 730 nm) are used. Additionally, the error rate would be about 10% to 12%. If only 19 discrete bands between 490 nm and 730 nm are used, then it would take the system 120 seconds (2 minutes) to classify

each tomato, with an error rate of 7% to 10%. If Carlsohn is moved to the terminus of the belt like Sinram, the belt would have to stop moving for about 2 minutes after each row of items is scanned or the belt would have to move extremely slow (way slower than the desired feed rate for recycling facilities) such that Carlsohn has enough time to classify the items in the row and determine which items to keep and which items to eject.

Ex. 2001 ¶ 65 (citing Ex. 1002, 30, 38). As explained above, Mr. Smith’s testimony is based on Carlsohn’s Figure 17.2. We further reproduce Carlsohn’s Table 17.2, below:

TABLE 17.2

Error Rates for Five Tomatoes for a Varying Number of Wavelength Bands (Features), Using Parzen Classification

Spectra	Error Rate for Tomato					Processing Time [s]
	1	2	3	4	5	
186 bands (color constant normalized)	0.11	0.10	0.11	0.12	0.11	430
Smoothed (Gauss $\sigma = 2$)	0.09	0.10	0.12	0.09	0.08	418
Subsampled to 19 bands	0.08	0.10	0.09	0.07	0.08	120
Feature selection (four bands)	0.12	0.13	0.15	0.11	0.13	

Although Figure 17.2 depicts “Error Rates for Five Tomatoes for a Varying Number of Wavelength Bands (Features), Using Parzen Classification,” with “Processing Times” of between 120 to 430 seconds, this tomato experiment is not a teaching that Carlsohn’s SpectroSort system needs “at best two minutes to process the image and identify the selected material,” as Patent Owner and Mr. Smith contend. *See* PO Resp. 58 (citing Ex. 2001 ¶ 65). Upon close examination of this Table, upon which Mr. Smith’s testimony relies (Ex. 2001 ¶ 65), the “data used in this experiment are a random selection of 1000 pixels from spectral images of *five tomatoes in five ripeness classes* The processing time is the mean of the elapsed time needed for training the Parzen classifier *per tomato.*” Ex. 1002, 38

(emphases added). Even if it may take two minutes to classify each tomato, with varying ripeness and under this particular experiment, this fact is inapposite; Petitioner relies on Carlsohn’s SpectroSort system for sorting and classifying paper, plastic, and glass—not tomatoes. *See, e.g.*, Pet. 44 (“And it would have permitted SpectroSort to sort glass too, e.g., by color and/or to remove ceramic glass, which a POSITA would have been motivated to do”); *see also* Ex. 1008 ¶ 78 (“POSITA would have been motivated to move SpectroSort’s identification system in this manner to facilitate accurate sorting. It was known that recyclable material that SpectroSort handles or would have been obvious for SpectroSort to handle—such as glass or plastic bottles and paper products—can shift on a conveyor after being identified by an optical sensor.”).

To reiterate, Carlsohn discloses that “[f]or the SpectroSort system, the time for acquisition, processing, data evaluation, and post[-]processing of one sample line is *less than 15 ms.*” Ex. 1002, 44 (emphasis added).

Patent Owner discounts Carlsohn’s 15 ms teaching and argues that “[e]ven in view of Sinram, Carlsohn’s hyperspectral identification system could not be placed over the second end of the belt because around the time of the Critical Date, November 18, 2007, there were no adequately powerful computer and algorithm options to analyze desired materials before reaching the ejection system.” PO Resp. 60 (citing Pet. 78); *see also id.* at 59 (acknowledging the 15 ms processing time but nevertheless arguing that “Carlsohn’s identification system cannot process the large amounts of data” in that time).

We do not agree with Patent Owner’s argument. Again, Carlsohn teaches that “the SpectroSort system, the time for acquisition, processing,

data evaluation, and post[-]processing of one sample line is less than 15 ms.” Ex. 1002, 44. We credit Dr. Arce’s testimony and find that a processing time of less than 15 ms is sufficiently fast to support Petitioner’s proposed modification, and Patent Owner cites nothing in the record to persuade us that Carlsohn’s express teaching is wrong. *See* PO Resp. 59–61. Carlsohn is clear in its teaching of a “less than 15 ms” processing time for its SpectroSort system. *See* Ex. 1002, 44.

Mr. Smith’s opposite conclusion, that “[e]ven today, the hyperspectral camera technology requires a slower belt speed 2.5 m/s versus 3.0 m/s for the multiplexed technology,” is conclusory and unsupported by evidence. Ex. 2022 ¶ 25. Mr. Smith’s declaration incorporates an image of unspecified origin, which he characterizes as illustrating a “recent version of an LLA Instruments NIR hyperspectral imaging camera [that] is not over the end of the conveyor belt.” *Id.* Even taking this image at face value, however, one example of one sorting system that has a hyperspectral imaging camera disposed upstream of the belt terminus does not establish that Carlsohn was wrong to describe its system as having a processing time of 15 ms.

Finally, Patent Owner argues that “a POSITA would not be motivated to consider Sinram, as its commercial embodiment *teaches away* from the use of a hyperspectral camera in identifying desired materials in a heterogeneous stream.” PO Resp. 61 (citing Ex. 2001 ¶¶ 55–57) (emphasis added).

We do not agree with Patent Owner’s final argument, as Patent Owner has not identified anything in Sinram (or Carlsohn, for that matter) that *criticizes, discredits, or otherwise discourages* moving Carlsohn’s

identification system closer to the terminus of the second end of the conveyor belt. *See In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004) (“The prior art’s mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed.”).

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by the teachings of Arleth and Sinram satisfies the limitations of claim 1 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

4. *Dependent Claims 2–5, 7, and 9–11*

In challenging dependent claims 2–5, 7, and 9–11 under Carlsohn, Arleth, and Sinram, Petitioner relies on the same argument and evidence discussed above under Ground 1. *See* Pet. 62–80.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s and Sinram’s teachings satisfies the limitations of claims 2–5, 7, and 9–11 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

5. *Dependent Claim 6*

Claim 6 depends from claim 4 and further recites, “wherein said computer comprises software configured to compare said images to images stored in a library of images.” Ex. 1001, 6:44–46.

To address claim 4, Petitioner submits that the combination of Carlsohn, Arleth, and Sinram renders claim 4 obvious for the same reasons that Carlsohn and Arleth renders claim 4 obvious. *See* Pet. 66.

As to claim 6, Petitioner reasons that “it would have been obvious to modify SpectroSort to capture and store images in a library as reference data such that its computer can compare the hyperspectral images captured during sorting.” *Id.* (citing Ex. 1008 ¶¶ 82–85). Dr. Arce testifies that “Sinram confirms that this would have been an obvious option,” citing Sinram’s “learn mode.” Ex. 1008 ¶ 84. Dr. Arce further testifies that

Obtaining the reference spectral data with the same device used to identify materials would mitigate the risk of the measured data and the reference data exhibiting differences attributable to using different equipment. Implementing such a “learning mode” in SpectroSort would have been straightforward and routine for a POSITA, as it would have called for using the same equipment and storing the obtained information in a library in SpectroSort’s computer.

Id. ¶ 85.

As to claim 6, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s and Sinram’s teachings satisfies the limitations of claim 6 for the reasons stated by Petitioner in the Petition,

which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

6. *Dependent Claims 12 and 13*

Claim 12 depends from claim 1 and further recites, “wherein said ejection system comprises a fluid jet.” Ex. 1001, 6:64–65. Claim 13 depends from claim 12 and further recites, “wherein said fluid jet is a water jet.” *Id.* at 6:66–67.

To address these claims, Petitioner reasons that “it would have been obvious to use Sinram’s nozzles 131 in SpectroSort’s air jet array” and that nozzles 131 “can produce a water jet.” *See* Pet. 73 (citing Ex. 1008 ¶ 87).

Dr. Arce testifies that Sinram’s nozzles 131 are “tapered to produce a strong air jet.” Ex. 1008 ¶ 87. Dr. Arce further testifies that a “POSITA would have been motivated to use nozzles 131 because ‘the extremities of the air jets 131 are [] tapered so as to increase thrust of air coming out of said air jets,’ which would ensure that SpectroSort’s air-jet array provides sufficient force to achieve material separation.” *Id.* ¶ 86 (alteration in original). Dr. Arce also addresses using water jets as an obvious alternative to air jets. *See id.* ¶ 87.

As to claims 12 and 13, Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s and Sinram’s teachings satisfies the limitations of claims 12 and 13 for the reasons stated by Petitioner in the

Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

7. *Independent Claim 14*

In challenging independent claim 14, Petitioner relies largely on the same findings and reasoning relied on in challenging independent claim 1 and dependent claim 6. *See* Pet. 66–71.

a) *Limitation 14(p) - A method for sorting heterogeneous material*

Petitioner submits that Carlsohn’s SpectroSort system is a system for sorting heterogeneous material, referencing Limitation 1(a). Pet. 66 (citing Ex. 1002, 39–41, 44–46; Ex. 1008 ¶¶ 57–59, 70–71).

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth’s and Sinram’s teachings satisfies Limitation 14(p), to the extent that the preamble is limiting, for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

b) Limitation 14(a) - reflecting visible or infrared light from the surface of said heterogeneous material disposed on a conveyer from a light source

Petitioner submits that “[d]uring sorting, SpectroSort’s light source ‘provide[s] . . . illumination of the sample [on the conveyor],” referencing Limitations 1(a)–1(c). Pet. 66–67 (second to fourth alterations in original).

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth’s and Sinram’s teachings satisfies Limitation 14(a) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

c) Limitation 14(b) - [the light source] disposed proximate to a hyperspectral imager

Petitioner submits that “SpectroSort’s light source is disposed proximate to a hyperspectral imager: the SI system with its sensor units,” referencing Limitation 1(c). Pet. 67.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth’s and Sinram’s teachings satisfies Limitation 14(b) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

d) Limitation 14(c) - conveying said heterogeneous material at a predetermined rate beneath said hyperspectral imager

Petitioner submits that “SpectroSort’s belt conveys the heterogeneous material at a predetermined rate beneath the hyperspectral imager,” referencing Limitation 1(f). Pet. 67.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth’s and Sinram’s teachings satisfies Limitation 14(c) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

e) Limitation 14(d) - generating hyperspectral images containing both spectral and spatial data of said heterogeneous material by receiving a plurality of selected spectral bands of infrared and visible light corresponding to spectral signatures of target materials to be identified if present in said heterogeneous material as said heterogeneous material passes on said conveyer beneath said hyperspectral imager

Petitioner submits that “[d]uring sorting, SpectroSort generates hyperspectral images containing spectral and spatial data to form a hypercube,” referencing Limitation 1(b). Pet. 68.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn

in view of Arleth's and Sinram's teachings satisfies Limitation 14(d) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

f) Limitation 14(e) - comparing said hyperspectral images of said heterogeneous material to hyperspectral images of known materials

Petitioner submits that "Carlsohn compares each hypercube pixel's spectrum to reference data for material identification," citing claim 6. Pet. 69.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth's and Sinram's teachings satisfies Limitation 14(e) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

g) Limitation 14(f) - identifying said target materials

Petitioner submits that "[d]uring sorting, SpectroSort identifies target materials (e.g., certain polymer types, 'de-inking' or 'non-de-inking' paper, and/or (if so-modified) glass types," referencing Limitations 1(b) and 1(h). Pet. 69.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn

in view of Arleth's and Sinram's teachings satisfies Limitation 14(f) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

h) Limitation 14(g) - activating an ejection system with a computer

Petitioner submits that "[d]uring sorting, SpectroSort's computer activates an ejection system, which is an air-jet array," referencing Limitations 1(j) and 1(l). Pet. 69.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth's and Sinram's teachings satisfies Limitation 14(g) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

i) Limitation 14(h) - said computer being configured to physically isolate target material with said ejection system from said heterogeneous material

Petitioner references Limitation 1(k) and submits that

SpectroSort's computer is configured to physically isolate target materials, such as de-inking paper or certain polymer types from the heterogeneous material by controlling the air-jet array such that certain materials (if not acted on) fall to the "fraction 1" transport belt and others (if acted on) clear the separation edge to reach the "fraction 2" transport belt.

Pet. 70 (citations omitted).

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth's and Sinram's teachings satisfies Limitation 14(h) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

j) Limitation 14(i) - by locating said target material within said heterogeneous material

Petitioner submits that "[d]uring sorting, SpectroSort's computer uses the captured spatial data to determine material positioning on the belt based on the position of the hypercube's pixel(s) representing the materials," referencing Limitations 1(b) and 1(i). Pet. 70.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth's and Sinram's teachings satisfies Limitation 14(i) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

k) Limitation 14(j) - and [by] ejecting said target material with said ejection system at a preset time delay equal to a distance between said hyperspectral imager and said ejection system divided by a rate of conveying said heterogeneous material

Petitioner reasons that

it would have been obvious to configure SpectroSort's computer to delay actuation of the ejection system until a preset time equal to the distance between its hyperspectral imager (e.g., from the SI system, the VIS sensor unit, or the NIR sensor unit) and the

ejection system (measured along the direction the belt travels in) divided by the conveyor's speed, which meets the claim limitation.

Pet. 71 (referencing in relevant part Limitation 1(j)).

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth's and Sinram's teachings satisfies Limitation 14(j) for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

l) Summary of Independent Claim 14

We are persuaded by Petitioner's argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by the teachings of Arleth and Sinram satisfies the limitations of claim 14 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

8. Dependent Claim 15

Claim 15 depends from claim 14 and further recites, "wherein said hyperspectral images comprise spectral and spatial data for articles within said heterogeneous material." Ex. 1001, 8:12–14.

To address this claim, Petitioner submits that "[t]he hyperspectral images SpectroSort captures include spectral and spatial data for paper, polymeric, and/or (if so-modified) glass . . . articles." Pet. 71–72 (citing Ex. 1002, 40–41, 44–46, Fig. 17.12; Ex. 1008 ¶¶ 57–59, 61–64, 69–70).

Carlsohn discloses using both “spectral imaging” and “spatial information” to sort paper, waste, and other materials. *See* Ex. 1002, 41.

As to claim 15, Patent Owner does not present additional arguments beyond those presented to its independent claim 14 (vis-à-vis claim 1). *See generally* PO Resp.

We are persuaded by Petitioner’s argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth’s and Sinram’s teachings satisfies the limitations of claim 15 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

9. *Dependent Claim 16*

Claim 16 depends from claim 14 and further recites, “wherein said heterogeneous material comprises waste material and recyclable material in combination.” Ex. 1001, 8:15–17.

To address this claim, Petitioner submits that “Carlsohn discloses that the heterogeneous materials SpectroSort can sort comprise waste and recyclable materials.” Pet. 72 (citing in part Ex. 1002, 39–41).

Carlsohn discloses that “[t]he main focus of SpectroSort is the sorting of paper and polymers in the industrial environments,” which are then “recycled in a lot of countries in the world.” Ex. 1002, 39–41, 44–46. Carlsohn further discloses SpectroSort as a “waste sorting system.” *See id.* at 41 (“The core module of CRTs waste sorting system SpectroSort . . .”).

As to claim 16, Patent Owner does not present additional arguments beyond those presented to its independent claim 14. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence, and find that Petitioner has established by a preponderance of the evidence that Carlsohn as modified by Arleth's and Sinram's teachings satisfies the limitations of claim 16 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

10. Summary of Ground 3

Based on the above, we determine Petitioner has proven by a preponderance of the evidence that claims 1–7 and 9–16 are unpatentable over Carlsohn in view of the teachings of Arleth and Sinram.

I. Ground 4 – Claim 8 Obvious over Carlsohn, Arleth, Ulrichsen, Mayhak, and Sinram

Claim 8 depends from claim 1. *See* Ex. 1001, 6:52. In addressing claim 8 as obvious over Carlsohn, Arleth, Ulrichsen, Mayhak, and Sinram, Petitioner relies on the combination of Carlsohn, Arleth, and Sinram for addressing independent claim 1, under Ground 3, and further relies on Ulrichsen and Mayhak for addressing the particular limitations of claim 8, under Ground 2.

Patent Owner does not present additional arguments beyond those presented to its independent claim 1. *See generally* PO Resp.

For the reasons discussed above, we are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that Carlsohn in view of Arleth, Ulrichsen, Mayhak, and Sinram satisfies claim 8 for the reasons stated by Petitioner in

the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

J. Grounds 5 and 6 – Claim 2 Obvious over Carlsohn, Arleth, and Kampf (Ground 5) and Carlsohn, Arleth, Sinram, and Kampf (Ground 6)

Ground 5 is based on Carlsohn, Arleth, and Kampf and Ground 6 is based on Carlsohn, Arleth, Sinram, and Kampf. *See* Pet. 5–6.

1. Kampf (Ex. 1005)

Kampf is a U.S. Patent Application titled “Method for the Automatic Analysis of Refuse Containing Polymers and an Automatic Analytical Device for this Purpose.” Ex. 1005, code (54). Kampf describes a system and method for analyzing refuse objects containing polymers, such as carpets, in a recycling plant. *See id.* at code (57), Fig. 1.

2. Analysis

Claim 2 depends from claim 1 and further comprises “a conveyor to deliver said heterogeneous material to said system.” Ex. 1001, 6:33–35.

Petitioner presents this *alternative* challenge to claim 2 “[t]o the extent PO argues that claim 2 requires a conveyor in addition to one driving claim 1’s belt, it would have been obvious to include one in Grounds 1 and 3 in view of Kampf.” Pet. 80.

Petitioner relies on Kampf for teaching the additional conveyor, citing Figure 1 of Kampf, which we reproduce, below:

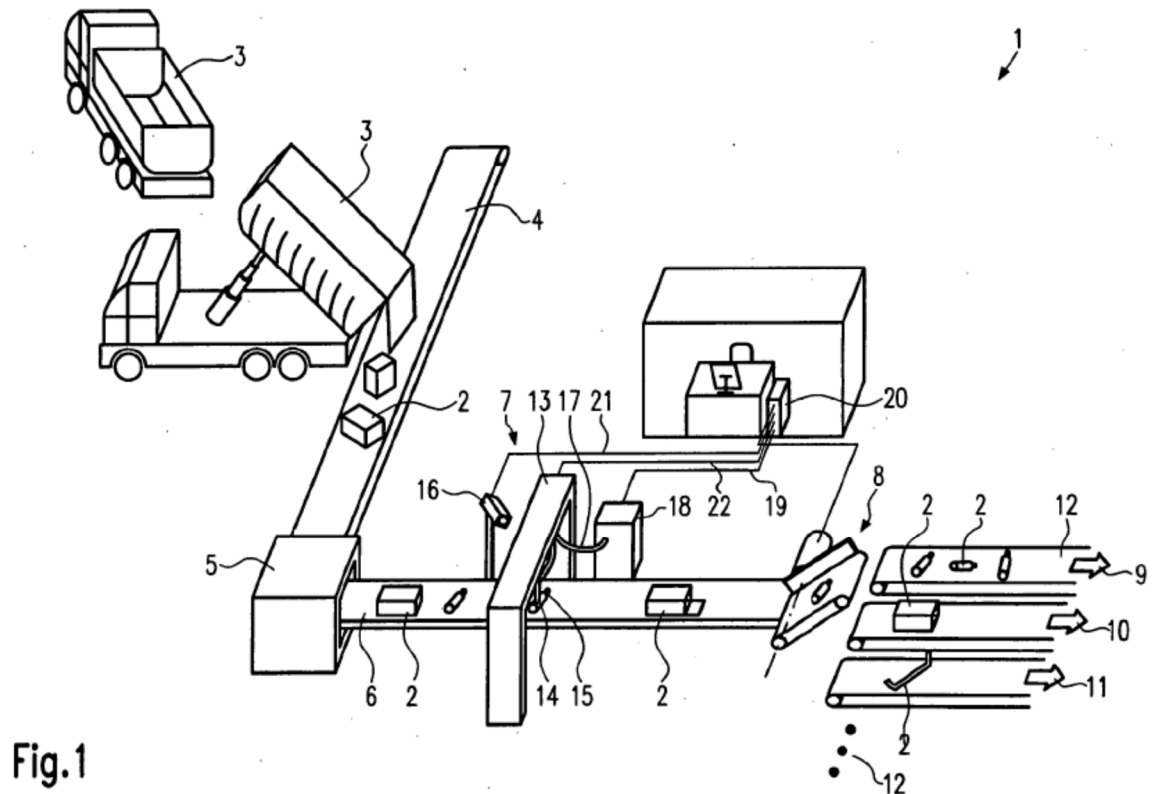


Fig.1

Figure 1 shows a first embodiment of Kampf's refuse recycling plant with an automatic analytical device. Ex. 1005 ¶ 36. Kampf discloses system 1 including conveyor 4 that receives unsorted material from trucks 3 and delivers it to conveyor 6 for sorting. *Id.* ¶ 43.

Petitioner reasons that a skilled artisan would have included an additional conveyor to Carlsohn's SpectroSort's system "to rapidly deliver waste material to the [SpectroSort system's] conveyor." Pet. 81 (citing Ex. 1008 ¶ 97).

Patent Owner does not offer any additional arguments specifically addressing the combination with Kampf. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that:

(1) Carlsohn in view of Arleth and Kampf (Ground 5) and Carlsohn in view

of Arleth, Sinram, and Kampf (Ground 6) satisfy claim 2 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

K. Grounds 7 and 8 – Claims 12 and 13 over Carlsohn, Arleth, and Cowling2 (Ground 7) and Carlsohn, Arleth, Sinram, and Cowling2 (Ground 8)

Ground 7 is based on Carlsohn, Arleth, and Cowling2, and Ground 8 is based on Carlsohn, Arleth, Sinram, and Cowling2. *See* Pet. 6.

1. Cowling2 (Ex. 1019)

Cowling2 is a U.S. Patent Application titled “Separating Device and Sorting Apparatus with Two-Dimensionals [sic] Array of Nozzles and Method of Sorting Objects.” Ex. 1019, code (54). Cowling2 describes a sorting apparatus for sorting objects in a stream, such as a stream of waste, according to size, shape, object-material, and color. *See id.* ¶ 1.

2. Analysis

Claim 12 depends from claim 1 and further recites, “wherein said ejection system comprises a fluid jet.” Ex. 1001, 6:64–65. Claim 13 depends from claim 12 and further recites, “wherein said fluid jet is a water jet.” *Id.* at 6:66–67.

Petitioner submits this *alternative* challenge to claims 12 and 13 in the event that Patent Owner argues that Carlsohn’s SpectroSort’s air-jet array and Sinram’s nozzles do not satisfy the claims. Pet. 82.

Petitioner relies on Cowling2's teaching of a waste sorting system that uses air or water jets for separating waste material. *Id.* (citing in part Ex. 1019 ¶¶ 1, 2, 6, 7, 35). We reproduce Cowling2's Figure 1, below:

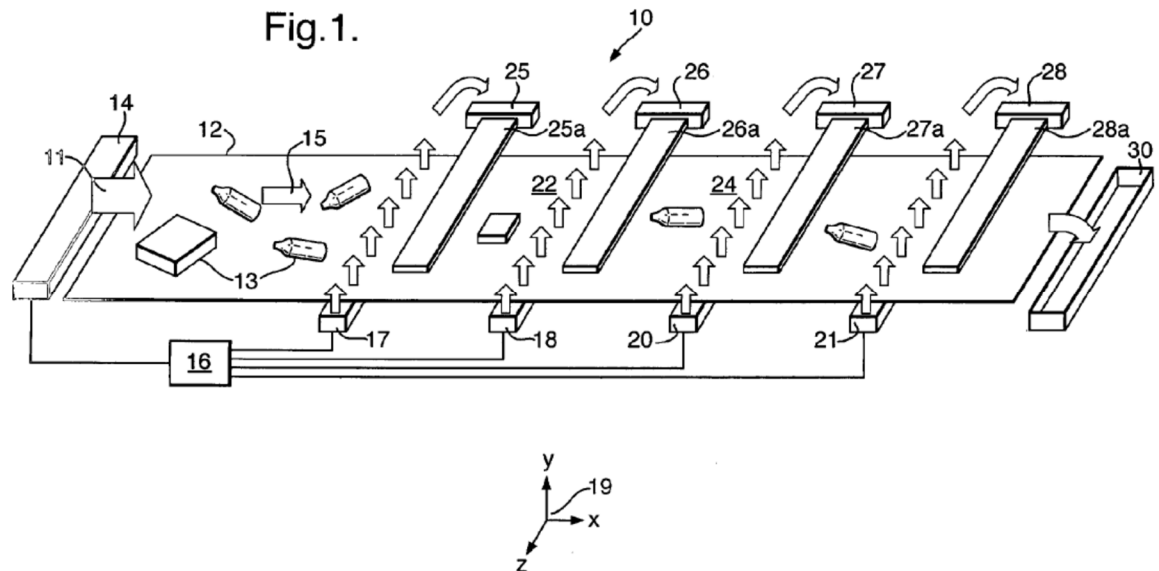


Figure 1 depicts Cowling2's sorting apparatus. Ex. 1019 ¶ 29. In particular, Figure 1 shows apparatus 10 with a conveyor belt and air-separation units 17, 18, 20, and 21, each having upwardly-directed nozzles. *Id.* ¶ 35. Cowling2 explains, "The direction and air speed of the air jets is sufficient to blast the plastics material object off the upper surface 12 of the conveyor belt and onto the orthogonal belt 26a and thence into the receptacle 26." *Id.* ¶ 37.

Cowling2 further discloses that "water jets may be [utilized] . . . where the nature of the objects so dictates." *Id.* ¶ 7.

Petitioner reasons that a skilled artisan would have modified SpectroSort's system by incorporating Cowling2's water jets, as "water jets would have imparted larger forces to facilitate material separation, particularly for 'larger and/or heavier objects SpectroSort is designed to handle.'" Pet. 83.

Patent Owner does not offer any additional arguments specifically addressing the combination with Cowling2. *See generally* PO Resp.

We are persuaded by Petitioner's argument and evidence and find that Petitioner has established by a preponderance of the evidence that: (1) Carlsohn in view of Arleth and Cowling2 (Ground 7) and Carlsohn in view of Arleth, Sinram, and Cowling2 (Ground 8) satisfy claims 12 and 13 for the reasons stated by Petitioner in the Petition, which we adopt as our own findings, as further supported by the testimony of Dr. Arce.

III. PETITIONER’S MOTION TO EXCLUDE

Petitioner filed a Motion to Exclude Evidence. Paper 34 (“Mot.” or “Motion”). Patent Owner filed an Opposition to the Motion (Paper 35, “Opp.” or “Opposition”) and Petitioner filed a Reply to the Opposition (Paper 37, “Reply Opp.”).

A. Analysis

As the moving party, Petitioner has the burden of proof to establish that it is entitled to the requested relief. *See* 37 C.F.R. § 42.20(c).

Petitioner moves to exclude certain parts of Mr. Smith’s declaration testimony (Ex. 2022, “Declaration” or “Dec.”). Mot. 1. In particular, Petitioner seeks to exclude paragraphs 6, 12, 15–21, 25 and Exhibits E, F, and G from the Declaration. *Id.*

1. Exhibit E, Paragraph 12

Mr. Smith testifies that “[t]here is nothing about [Carlsohn’s title] that would indicate to a POSITA that this book would contain anything relevant to hyperspectral imaging.” Ex. 2022 ¶ 12. Mr. Smith further testifies, “I have attached as Exhibit E a list of articles that are pre-2008 regarding some aspect of ‘color image processing,’” which is the title of the Carlsohn Book. *Id.* Exhibit E is a list of 48 documents with the heading, “Documents on Color Image Processing that Don’t Have Anything on Hyperspectral Imaging.” Ex. 2022, 19–21.

Petitioner seeks to exclude “Exhibit E and its accompanying declaration testimony . . . because they do not tend to show that public accessibility of Carlsohn (Exhibit 1002) was more or less probable” under Federal Rules of Evidence (“FRE”) 401. Mot. 4. Petitioner submits that Mr.

Smith’s “opinion does not tend to prove or disprove that Carlsohn would have been publicly accessible to the public” (*id.*) and that “[t]here are too many inferential jumps required here to meet the threshold for relevance” (*id.* at 5 (citation omitted)).

Petitioner also seeks to exclude Exhibit E and its accompanying testimony under FRE 702 as unreliable expert testimony. *See* Mot. 10–11 (citing in part *Daubert v. Merrill Dow Pharm.*, 509 U.S. 579, 595 (1993)). Petitioner submits that “Mr. Smith did not provide enough information about his knowledge or search methodologies to evaluate whether he is qualified to render an opinion, nor whether the limited queries he employed were sufficient, or reliable.” *Id.* at 11.

In addition to FRE 401 and 702, Petitioner seeks to exclude Exhibit E and its accompanying testimony under FRE 703, explaining that “the proponent of the opinion may disclose [Exhibit E] to the jury only if [its] probative value in helping the jury evaluate the opinion substantially outweighs [its] prejudicial effect.” Mot. 14 (quoting FRE 703).

As to Exhibit E and its accompanying testimony (Ex. 2022 ¶ 12), we deny Petitioner’s Motion. Petitioner’s arguments go to weight, not admissibility, and the Board is capable of assessing the weight to be given the testimony without excluding it.

Regarding relevance, and as correctly argued by Patent Owner, Exhibit E and paragraph 12 are relevant to refute Dr. Arce’s testimony as to whether Carlsohn was publicly accessible before the critical date of the invention. *See* Opp. 2–3. Indeed, this is a central issue in our proceeding. *See, e.g.*, PO Resp. 24–35; *see also supra* § II.D.

As to reliability, the policy considerations for excluding expert testimony, such as those implemented by the gatekeeping framework established by the Supreme Court in *Daubert*, are less compelling in bench proceedings such as *inter partes* reviews. Unlike a lay jury, the Board by statutory definition has competent scientific ability (35 U.S.C. § 6) and has significant experience in evaluating expert testimony. *See Nestle Healthcare Nutrition, Inc. v. Steuben Foods, Inc.*, IPR2015-00249, Paper 76 at 23 (PTAB June 2, 2016); *see also* Tr. 28:14–29:16. Accordingly, the danger of prejudice in this proceeding is considerably lower than in a conventional district court trial in front of a lay jury.

Accordingly, we deny Petitioner’s motion to exclude Exhibit E and paragraph 12 of Mr. Smith’s declaration (Ex. 2022).

2. Exhibits F, G, and Paragraphs 15–21

Exhibit F is “Google Search Pages” and Exhibit G is “Yahoo Search Pages.” Ex. 2022, 22–202. As to Exhibit F, Mr. Smith testifies that a “Google search was made to search for web pages dated in the year of 2007 and a separate search made for each of the terms above that Dr. Arce said he would use to learn about hyperspectral imaging and waste material sorting.” Ex. 2022 ¶ 15. Mr. Smith testifies that “[t]here was not a single search result that returned the Carlsohn[] reference” (*id.* ¶ 16 (emphasis omitted)) and that this search “would be duplicable by anybody with an internet connection” (*id.* ¶ 17). As to Exhibit G, Mr. Smith presents similar testimony regarding the Yahoo search. *See id.* ¶¶ 18–19. Mr. Smith further testifies that these search results “demonstrate[] that reasonable diligence from a POSITA would not have found the Carlsohn reference prior to the critical date.” *Id.* ¶ 20.

Petitioner moves to exclude Exhibits F, G and the accompanying testimony under FRE 401. Mot. 6. Petitioner submits that this evidence “provides an incomplete view of what a POSITA could access to ascertain the prior art” (*id.*) and “the absence of the reference in the limited search results provided[] does not negate the fact that the publication could be discoverable by other means” (*id.* at 7 (citation omitted)).

Petitioner also seeks to exclude Exhibits F, G and their accompanying testimony under FRE 403 because the “probative value of the evidence is substantially outweighed by the risk of unfair prejudice or confusion of the issues.” *Id.* at 8 (citation omitted). Petitioner explains that “[t]he real question is not whether preliminary, single-term searches on generic search engines would lead a POSITA to the reference; rather, the question is ‘whether an interested searcher would have been sufficiently capable of finding the reference and examining its contents.’” *Id.* at 9 (citation omitted).

Petitioner further seeks to exclude Exhibits F, G, and their accompanying testimony under FRE 702 and 703. *Id.* at 10, 14. In support of this position, Petitioner submits that “Mr. Smith did not establish qualification as an expert in prior-art searching or in the field of optics” (*id.* at 12) and “there is no evidence that experts in the field would reasonably rely on truncated results from a single-query search to form an opinion about the accessibility of Carlsohn” (*id.* at 14).

As to Exhibits F, G, and their accompanying testimony, Petitioner’s motion is denied. As with Exhibit E and its accompanying testimony, Petitioner’s arguments go to weight, not admissibility, and the Board is

capable of assessing the weight to be given the testimony without excluding it.

Regarding relevance, and as pointed out by Patent Owner, Exhibits F, G, and their accompanying testimony are relevant to rebut Dr. Arce's testimony pertaining to a POSITA's use of Internet searches for accessing Carlsohn. *See* Opp. 5 (citing Ex. 2022 ¶¶ 13–21); *see also supra* § II.D.3. Specifically, Dr. Arce testified on cross examination that he would “probably” use the Internet in searching for hyperspectral imaging. *See* Ex. 2024, 68:15–20 (“Q. Would you use these same search terms if you were a POSITA searching on the internet in hyperspectral imaging? A. If I was a POSITA in this particular area? Q. Correct. In 2008. A. Probably, yeah.”).

As to reliability, and as explained above, the policy considerations for excluding expert testimony are less compelling in *inter partes* reviews than in jury trials because the Board has significant experience in evaluating expert testimony. *See Nestle*, IPR2015-00249, Paper 76 at 23.

Accordingly, we deny Petitioner's motion to exclude Exhibits F, G, and their accompanying testimony (paragraphs 15–21) of Mr. Smith's declaration (Ex. 2022).

3. Paragraphs 6, 25

Petitioner argues that Paragraphs 6 and 25 of Exhibit 2022 are inadmissible as irrelevant under FRE 401 and unfairly prejudicial under FRE 403 “because a 2016 reference cannot establish the state of the art in 2007.” *See* Mot. 7, 10; *see also id.* at 3 (summarizing Exhibit 2022 ¶¶ 6, 25 as including “Testimony concerning the current state of the art with reference to Geralyn Miller, *Sorting it Out: How Imaging Systems Are Improving the*

Way We Recycle, Possibility (Sept. 27, 2016)” (the “2016 Article”)); *see also* Reply Opp. 7 (“Paragraphs 6 and 25 of Exhibit 2022 are inadmissible under FRE 401 and 403 because Mr. Smith’s interpretation of a 2016 reference cannot establish the state of the art in 2007, and the risk of undue prejudice outweighs their probative value.”).

Petitioner’s argument has merit. Mr. Smith appears to rely on the 2016 Article in his testimony at paragraphs 6 and 25 of Exhibit 2022. For example, in paragraph 6 of Mr. Smith’s testimony, Mr. Smith quotes the following statement from the 2016 Article:

Standard SWIR InGaAs cameras for plastic sorting have a sensitivity up to 1.7 μ m, but hydrocarbon absorption bands are more distinct between 1.9-2.4 μ m than below 1.7 μ m. This requires hyperspectral mercury cadmium telluride (InGaAs sensors can’t detect the subtle differences between office paper, newspaper and cardboard. MCT) sensors, which are sensitive up to 2.5 μ m. The InGaAs sensors used to sort plastics work well at room temperature, but MCT sensors have to be cooled to -80°C, making them more expensive. For sorting paper, their extended hyperspectral range justifies the premium.

Ex. 2022 ¶ 6 & n.2 (providing a hyperlink to and quoting the 2016 Article). As correctly argued by Petitioner, Mr. Smith’s citation to the 2016 Article is not helpful in establishing the state of the art in 2007. *See, e.g.*, Reply Opp. 7.

Nevertheless, we find that paragraphs 6 and 25 of Exhibit 2022 do not rely exclusively on the 2016 Article, and include testimonial evidence that is relevant to issues addressed in this Decision.

As to paragraph 6, Mr. Smith also cites to the Specification of the ’346 patent in testifying that a “POSITA reading the . . . claim limitation [] would understand that this would require at least some appropriate range in

order for identification to be accomplished.” Ex. 2022 ¶ 6 (citing Ex. 1001, 4:28–32). We find that this particular testimony is relevant in determining an issue addressed in our Decision, specifically, whether the proper construction of the claims requires a camera “configured to receive spectral data up to at least 1700 nm,” as Patent Owner contends. *See* PO Resp. 6; *see also supra* § II.C.1. Accordingly, we decline to exclude paragraph 6 of Exhibit 2022 as irrelevant under FRE 401.

Regarding paragraph 25, this paragraph also includes testimony that does not rely on the 2016 Article. For example, Mr. Smith testifies, “As discussed at length in my first declaration, it is the differences between the operation of Sinram and Carlsohn that would allow Sinram to be used at the end of the conveyor belt, namely the difference in the amount of data that must be possessed for a Sinram/LLA multiplexed technology verses hyperspectral technology.” Ex. 2022 ¶ 25. This testimony is relevant to an issue addressed in this Decision, namely, whether “a POSITA would not be motivated by Sinram to move the Carlsohn hyperspectral identification system over the second end of the belt,” as Patent Owner argues. *See* PO Resp. 51; *see also supra* § II.H.3. Accordingly, we decline to exclude paragraph 25 of Exhibit 2022 as irrelevant under FRE 401.

We also do not find that the probative value of the testimony (Ex. 2022 ¶¶ 6, 25) is substantially outweighed by the danger of unfair prejudice and confusion under FRE 403. As similarly explained above, the danger of confusion and unfair prejudice in this proceeding is considerably lower than in a conventional district court trial in front of a lay jury.

Accordingly, we deny Petitioner’s motion to exclude paragraphs 6 and 25 of Mr. Smith’s declaration (Ex. 2022).

B. Summary

We deny Petitioner's Motion to Exclude.

IV. PATENT OWNER'S MOTION TO EXCLUDE

Patent Owner filed a Motion to Exclude Exhibit 1039. Paper 43.

We do not rely on Exhibit 1039 in this Final Written Decision.

Accordingly, we dismiss Patent Owner's motion as moot. *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide 79–80 (Nov. 2019) (“In the Board's experience, consideration of the objected-to evidence is often unnecessary to resolve the patentability of the challenged claims, and the motion to exclude is moot.”).

V. CONCLUSION

Weighing the evidence of the disclosure of the references, the competing testimony, and the reasoning to combine the references, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–16 of the '346 patent are unpatentable.

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–5, 7, 9–12	103	Carlsohn, Arleth	1–5, 7, 9–12	
8	103	Carlsohn, Arleth, Ulrichsen, Mayhak	8	
1–7, 9– 16	103	Carlsohn, Arleth, Sinram	1–7, 9–16	
8	103	Carlsohn, Arleth, Ulrichsen, Sinram Mayhak	8	
2	103	Carlsohn, Arleth, Kampf	2	
2	103	Carlsohn, Arleth, Sinram, Kampf	2	
12, 13	103	Carlsohn, Arleth, Cowling2	12, 13	
12, 13	103	Carlsohn, Arleth, Sinram, Colwing2	12, 13	
Overall Outcome			1–16	

VI. ORDER

Accordingly, it is:

ORDERED that claims 1–16 of the '346 patent have been shown to be unpatentable;

FURTHER ORDERED that Petitioner's Motion to Exclude is denied;

FURTHER ORDERED that Patent Owner's Motion to Exclude is dismissed; and

FURTHER ORDERED that any party seeking judicial review must comply with the notice and service requirements of 37 C.F.R. § 90.2.¹²

¹² Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this Decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

IPR2020-00899
Patent 9,950,346 B2

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