

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

METRASENS, INC. and METRASENS, LTD.,
Petitioner,

v.

KEITH A. KOPP,
Patent Owner.

IPR2022-01224
Patent 7,489,128 B2

Before ULRIKE W. JENKS, ROBERT A. POLLOCK, and
JAMIE T. WISZ, *Administrative Patent Judges*.

JENKS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

In this *inter partes* review, Metrasens, Inc. and Metrasens, Ltd. (collectively “Petitioner”) challenges claims 1–20 (“the challenged claims”) of U.S. Patent No. 7,489,128 B2 (Ex. 1001, “the ’128 patent”), assigned to Keith A. Kopp (“Patent Owner”). Paper 2 (“Pet.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, we determine that Petitioner has proved by a preponderance of the evidence that claims 1–20 of the ’128 patent are unpatentable (*see* 35 U.S.C. § 316(e) (2018) (“In an *inter partes* review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”)).

A. Procedural History

On July 1, 2022, Metrasens, Inc. and Metrasens, Ltd. (collectively “Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–20 of the ’128 patent. Paper 2 (“Pet.”). On October 11, 2022, Keith A. Kopp (“Patent Owner”) filed a Preliminary Response to the Petition. Paper 6. Pursuant to 35 U.S.C. § 314, we instituted *inter partes* review of challenged claims 1–20 of the ’128 patent on January 9, 2023 (Paper 7, “Decision” or “Dec.”).

After institution of trial, Patent Owner filed a Response (Paper 10, “PO Resp.”), to which Petitioner filed a Reply (Paper 13, “Reply”), and Patent Owner, in turn, filed a Sur-Reply (Paper 15, “Sur-Reply”).

Oral argument was held on October 19, 2023. A transcript of the oral argument is included in the record. (Paper 20, “Tr.”).

B. Real Parties-in-Interest

Petitioner identifies Metrasens, Inc. and Metrasens, Ltd. as the real parties-in-interest. Pet. 1. Patent Owner identifies Keith Kopp, as the real party-in-interest. Paper 5, 1.

C. Related Matters

Patent Owner has asserted the ’128 patent against Petitioner in a pending lawsuit styled *Kopp Development Inc. v. Metrasens, Inc.*, Civil Action No. 1-21-cv-01216 (ND.OH). Pet. 1; Paper 5, 1.

D. Asserted Grounds

Petitioner asserts that claims 1–20 of the ’128 patent are unpatentable on the following ground.¹ Pet. 21.

¹ Although Petitioner asserts a second ground of unpatentability with the order of *Votruba* and *Jaquet* reversed, where, as here, the relevant factual inquiries underlying an obviousness determination are otherwise clear, characterization of references as primary and secondary is merely a matter of presentation with no legal significance. *In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012); *In re Bush*, 296 F.2d 491, 496 (CCPA 1961). Consequently, we will consider the Petition as presenting a single ground of unpatentability over the combination of *Votruba*, *Jaquet*, *Finn*, and *Seton*. Nonetheless, in reaching our decision, we have considered all of the evidence and all of the arguments presented by the Petitioner and Patent Owner in both of the asserted grounds.

Claims challenged	35 U.S.C. § ²	References/Basis
1–20	103(a)	Votruba ³ , Jaquet, ⁴ Finn ⁵ , Seton ⁶

Petitioner also relies upon the Declaration of Daniel W. van der Weide, Ph.D. (Ex. 1003) to support its contentions.

E. The '128 Patent (Ex. 1001)

The '128 patent is titled “MRI Protector.” Ex. 1001, code (54). The '128 patent issued from Application No. 10/095,543 (“the '543 application”), filed Mar. 11, 2002. *Id.* at (21), (22).

The '128 patent relates to medical diagnostics and, specifically, to protection of personnel and equipment involved in magnetic resonance imaging (MRI) diagnosis. *Id.* at 1:5–7. The Specification of the '128 patent describes a detector for protecting both personnel and the MRI apparatus from the introduction of ferrous articles into the magnetic field of the MRI unit. *Id.* at 2:33–35. In one embodiment, the detector has Hall effect sensors that use the magnetic field of the MRI, and that are connected to a central processing unit (CPU) that warns when the presence of ferrous articles

² The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. The '128 patent was filed on March 11, 2002. Ex. 1001, codes (22). Accordingly, we apply the pre-AIA version of § 103(a).

³ US 4,990,850 issued February 5, 1991. Ex. 1006.

⁴ US 3,971,983 issued July 27, 1976. Ex. 1005.

⁵ Edward J. Finn et al., *Ferromagnetic Materials in Patients: Detection before MR Imaging*, *Radiology* 1985; 156:139–141. Ex. 1008.

⁶ H.C. Seton et al., *Gradiometer pick-up coil design for a low field SQUID-MRI system*, *Magnetic Resonance Materials in Physics, Biology and Medicine* 8 (1999) 116–120. Ex. 1010.

affects the magnetic field of the MRI, as depicted in Figure 1, reproduced below.

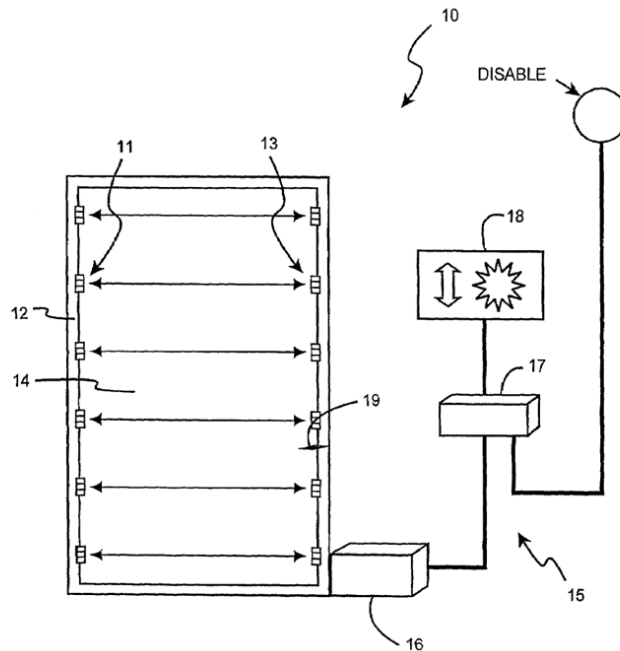


FIG. 1

Figure 1 is a diagrammatic representation of a detector. *Id.* at 3:7. Ferrous detector 10 includes an array of Hall effect sensors 11, 13 located near the access opening 14 of doorway 12 of a shielded room housing the MRI apparatus (not shown). *Id.* at 3:12–14. Sensors 11 and 13 are connected to CPU 15, which receives the output of the sensors. *Id.* at 3:19–22. The '128 patent explains that residual lines of magnetic force of the magnet in the MRI apparatus pass through access opening 14 generally normal to the scan of the Hall effect sensors. *Id.* at 3:23–25. Sensors 11 and 13 are sensitive to the magnetic force lines along one axis and produce a signal related to magnetic field strength. *Id.* at 3:25–28. As a ferrous object (not shown) approaches doorway 12, the residual magnetic field is disrupted. *Id.*

at 3:28–30. According to the '128 patent, the output of sensors 11 and 13 changes in response to the change in the magnetic field depending on the size, spatial location, and speed of the ferrous object. *Id.* at 3:30–33.

CPU 15 includes pre-amp/pre-processor 16 connected to sensors 11 and 13, which eliminates interference and establishes a usable signal which is amplified into a stabilized signal from the sensors to signal processor and alarm generator 17. *Id.* at 3:34–39. Signal processor/alarm generator 17 analyses the incoming signals and determines whether to generate an alarm. *Id.* at 3:39–42.

F. Challenged Claims

Petitioner challenges claims 1–20 of the '128 patent, of which claims 1 and 15 are independent. Independent claim 1, reproduced below is illustrative of the subject matter:

1. A protection arrangement for association with an operable MRI apparatus located within a room that has an access opening, the MRI apparatus providing a residual magnetic field that extends to a location of the opening, the arrangement including:

a detector for passively monitoring the residual magnetic field at the location of the opening, the detector includes an array of passive magnetic field sensors arranged about the periphery of the opening in a spaced arrangement such that each sensor is associated with a different portion of the access opening, the field changing in response to a presence of ferrous material at the opening, each of the sensors including means for outputting a signal indicative of the ferrous material responsive change in the magnetic field at the associated portion of the access opening; and

means for receiving the change indicative signals, for determining whether the change indicated by at least one of the change indicative signals exceeds a limit and for providing a

safety response that addresses the condition of ferrous material at the opening of the room within which the MRI apparatus is located upon determination of at least one threshold being exceeded.

Ex. 1001, 4:9–31. Claim 15, the only other independent claim, is also directed to a protection arrangement, and includes similar limitations to those of claim 1, but does not use the “means” terms. *Id.* at 5:39–6:15.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

The level of ordinary skill in the art is a “lens” through which we view the prior art and the claimed invention. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). The person of ordinary skill in the art is a hypothetical person presumed to have known the relevant art at the time of the invention. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). In determining the level of ordinary skill in the art, we may consider certain factors, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *Id.*

Petitioner contends that a person of ordinary skill in the art “would have had at least an undergraduate degree in electrical engineering or equivalent thereof, and at least approximately 2-4 years of practical work experience in the design and development of magnetic sensors and MRI magnetic fields.” Pet. 9–10 (citing Ex. 1003 ¶ 18). Alternatively, Petitioner contends that a person of ordinary skill in the art would have had “an M.S. degree in electrical engineering and at least 2-3 years of experience with

magnetic sensors and MRI magnetic fields.” *Id.* at 10. Also, according to Petitioner, such a person “would have at least a general understanding of functional requirements of metal detectors including a variety of different sensors and magnetic fields caused by an MRI apparatus.” *Id.*

Patent Owner does not offer an alternate definition and agrees that Petitioner’s definition is reasonable. Patent Owner suggests that “one equivalent to an electrical engineering degree would be a degree in physics.” PO Resp. 2.

The level of skill in the art is a reference point for gauging what would have been obvious based on the reference disclosures. *See Okajima*, 261 F.3d at 1355. In other words, the lens of the level of ordinary skill in the art does not change a prior art’s disclosure, though it may change one’s understanding of what is disclosed. Patent Owner, however, does not explain how its definition provides a reference point that would meaningfully alter the Petition’s assertions of obviousness. We do not discern a meaningful difference between the definition of a person of ordinary skill in the art encompassing an electrical engineering degree or a physics degree with several years of experience in magnetic sensors and MRI.

For purposes of this decision, we analyze the asserted prior art with respect to the level of skill set forth by Petitioner, but there would be no difference in the outcome of this Decision if we were to substitute a physicist for an electrical engineer as suggested by Patent Owner.

B. Claim Construction

We construe claim terms according to the standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc);

37 C.F.R. § 42.100(b) (2023). Under *Phillips*, we give claim terms “their ordinary and customary meaning.” *Phillips*, 415 F.3d at 1312. “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.” *Id.* at 1313. “Importantly, the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification.” *Id.*

Petitioner offers a discussion of claim constructions for the following terms and phrases: “residual magnetic field,” “array of passive magnetic field sensors,” and “periphery.” Pet. 11–14. Petitioner also asserts that the following terms are means-plus-function terms: “means for outputting a signal...,” “means for receiving the change indicative signals,” “means for determining ... a limit,” “means for providing a safety response ...,” “means for providing a warning alarm,” “means for providing an audible alarm,” “means for providing a visual alarm,” “means for disabling operation of the MRI apparatus,” “means to deactivate the detector,” “means for analyzing the change indicative signal,” “means for determining whether to provide the safety response based upon the analysis,” and “signal processor/safety response generator.” *Id.* at 14–21.

Patent Owner offers constructions or provides comments for the following terms: “residual magnetic field,” “an array of passive magnetic field sensors,” “the periphery,” “means for outputting a signal,” “means for receiving the change indicative signals,” “means for determining” (claim 1), “means for providing a safety response,” “means for providing a warning alarm,” “means for providing an audible alarm,” “means for providing a

visual alarm,” “means for disabling,” “means for analyzing,” “means for determining” (claim 11), and “signal processor/safety response generator.” PO Resp. 2–9.

“The Board is required to construe ‘only those terms ... that are in controversy, and only to the extent necessary to resolve the controversy.’” *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (quoting *Vivid Techs., Inc. v. Am. Sci. Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Except for the claim terms discussed below, we determine that no other claim terms require express construction for purposes of resolving the controversy.

1) residual magnetic field

According to Petitioner, a person of ordinary skill in the art (“POSA”) would have understood “the term ‘residual magnetic field’ used in the ’128 Patent to mean ‘the non-uniform magnetic field of the MRI apparatus passing through the open doorway and that is outside the magnetic field involved with imaging.’” Pet. 11 (citing Ex. 1003, ¶ 39 (citing Ex. 1001, 2:54–58, 3:23–30; Ex. 1002, 48–50). “The ’128 specification refers to the detector being off when the doorway is closed (3:62-63); therefore the door must be open.” Reply 5.

Patent Owner contends that “a magnetic field may extend and permeate (i.e., penetrates, spreads through). Such permeation may include permeation through air, walls, doors, etc. (e.g., material or matter). The particular permeation is, of course, dependent upon the respective permeability of the material or matter (e.g., attenuation of the field).” PO Resp. 2–3. “Logically, ‘residual magnetic field’ means the portion of field outside of the portion used for imaging.” Sur-reply 3.

According to the specification of the '128 patent, “the residual magnetic field [is the field] that exists in the vicinity of an MRI apparatus.” Ex. 1001, 2:55–57.

The residual lines of magnetic force of the magnet in the MRI apparatus pass through the access opening 14 generally normal to the scan of the Hall effect sensors. The passive sensors in the series 11 and 13 are sensitive to the magnetic force lines along one axis and produce a signal related to magnetic field strength. As a ferrous object (not shown) approaches the access doorway 12, the residual magnetic field is disrupted.

Id. 3:23–30. “The potential dangers associated with MRI machines include the presence, within the apparatus and surrounding area, of a strong magnetic field.” *Id.* 1:42–44. According to the '128 patent, “[u]sually, the MRI device is located within a shielded room for improved results and also to lessen the impact of the device on surrounding operations.” *Id.* 1:54–56.

Based on these disclosures in the '128 patent, we determine that the term “residual magnetic field” refers to the magnetic field that radiates outwardly from the MRI apparatus. This is substantially similar to Petitioner’s construction which acknowledges a “non-uniform magnetic field of the MRI apparatus passing through the open doorway.” Pet. 11. In order for the residual field to pass through an open doorway it would need to radiate outwardly from the MRI apparatus. The result in this Decision, however, would be the same even if we were to accept Patent Owner’s proposed modifications to the meaning of “residual magnetic field.”

2) array of passive magnetic field sensors

According to Petitioner, “[t]he phrase ‘an array of passive magnetic field sensors’ should be construed to mean ‘spaced apart Hall effect sensors, not being configured as gradiometers.’” Pet. 11, 13 (citing Ex. 1003 ¶¶ 38,

40). “The specification describes the passive magnetic sensors as being Hall effect sensors[] only. EX1001, 1:56-59; EX1003, ¶ 38. Fig. 1 of the ’128 Patent illustrates Hall effect sensors 11 and 13 disposed along the entirety of the sides of the doorway.” *Id.* at 12. According to Petitioner, “[t]he ’128 specification only describes Hall effect sensors, not other examples of ‘passive magnetic field sensors,’ like inductive, SQUID, etc.” Reply 7.

Patent Owner contends that “the independent claims cannot be limited to Hall effect sensors.” PO Resp. 5; Sur-reply 4–5. “The Applicant [during prosecution] only argued that the particular implementation taught in Jaquet would not function correctly in the steep spatial magnetic gradient of the MRI residual (i.e., fringe or non-imaging) field.” PO Resp. 26.

The ’128 patent describes that “Hall effect sensors are passive detectors which monitor an established magnetic field and detect changes in the magnetic field produced by introduction of a ferrous object into the field.” Ex. 1001, 2:4–7.

U.S. Pat. No. 4,990,850 issued Feb. 5, 1991 to Votruba [(Ex. 1006)] discloses a device to scan patients before nuclear magnetic resonance (NMR) procedures to determine if ferrous objects are present in or on the patient. The device includes both magnets and Hall effect sensors to monitor the magnetic field. The signal of the sensors varies as the magnetic field changes with the introduction of a, ferrous object into the field. *Id.* 2:18–25.

During prosecution of the ’128 patent, Patent Owner stated that, “[i]t should also be appreciated that movement of portions of the MRI equipment (e.g., magnet movement) during imaging also contribute to the nonuniform [field] in that the residual magnetic field, spatially and temporally. Such contributions to the change appear to be very specific to the particular

construction, operation, etc., of individual MRI equipment.” Ex. 1002, 50. “[T]he magnetic field produced by an MRI within the local area (i.e., a room) is many times larger than the Earth’s magnetic field with the local area.” *Id.* at 51.

Patent Owner further informed the Examiner that, “[T]he gradiometers of the Jaquet ’983 patent are not going to work, regardless of the assertion that they can merely be placed in the MRI field generally (i.e., as offered in the rejection based upon the Jaquet patent alone) or in the MRI field of Votruba (i.e., as offered in the rejection based upon the Jaquet patent in view of the Votruba patent or the Votruba/Roybal patents).” Ex. 1002, 52–53. Patent Owner further asserted that:

The Jaquet device is based upon the use of a plurality of gradiometers. A clearly understood principle to anyone of ordinary skill in the art is that gradiometers only function properly in a uniformed magnetic field. The gradiometer principle is based on the fact that, in a uniform field, two identical and perfectly aligned sensors will give identical outputs which can be subtracted from one another to give a zero output, effectively eliminating the apparent presence of the field.

Id. at 325, *see also id.* at 329 (“The gradiometer principle is based on the fact that, in a uniform field, two identical and perfectly aligned sensors will give identical outputs which can be subtracted from one another to give a zero output, effectively eliminating the apparent presence of the field.”).

We have reviewed the parties’ contentions with respect to the “array of passive magnetic field sensors” and agree with Patent Owner that evidence in the prosecution history leading to the ’128 patent does not persuade us that *all* gradiometers are disavowed. Rather the prosecution

history suggests that the gradiometers of Jaquet that are tuned to using the uniform magnetic field of the earth are not able to deal with the non-uniform magnetic field associated with an MRI.

Based on the disclosures in the '128 patent (Ex. 1001) and prosecution history (Ex. 1002) we find that one of ordinary skill would understand the term “array of passive magnetic field sensors” to exclude the gradiometers taught by Jaquet, but would include other gradiometers, including those based on Hall effect sensors.

C. Obviousness of Claims 1–20 over Votruba, Jaquet, Finn, and Seton

Petitioner contends that claims 1–20 are unpatentable as obvious over Votruba, Jaquet, Finn, and Seton. Pet. 35–67. Patent Owner opposes. *See generally* PO Resp.

1. Overview of Votruba

Votruba is titled “Metal Detector with Two Magnetic Field Transducers Connected in Opposing Relationship and their Sensing Directions Orthogonal to the Magnetic Field” and relates to “detecting the presence of ferromagnetic materials.” Ex. 1006, code (54), 1:11–12. Votruba discloses that Hall effect transducers have been used for monitoring magnetic fields. *Id.* at 1:24–25. Votruba explains that Hall effect transducers provide an electrical signal which typically varies directly with the magnitude of the magnetic field component in one direction along a predetermined sensing axis. *Id.* at 1:25–29. Votruba discloses that as an improvement over the prior art, the transducers are mounted in pairs using “a first transducer which produces a signal which is directly related to the magnetic field component in a first sensing direction,” and “a second

transducer disposed adjacent the first transducer, for producing a signal directly related to the magnetic field component in a second sensing direction opposite to the first sensing direction.” *Id.* at 1:58–64. In such an arrangement, Votruba explains, “a magnetic field component in the first sensing direction will increase the first signal and decrease the second signal, whereas a magnetic field component in the opposite or second direction will decrease the first signal but increase the second signal.” *Id.* at 1:65–2:2.

In one embodiment, Votruba discloses a transducer assembly that is mounted “in proximity to a separate machine 45 which generates a magnetic field” and that is adjustable to position the transducer assembly 24 so that “sensing directions are orthogonal to the magnetic field prevailing in the vicinity of the machine 45.” *Id.* at 7:11–25. According to Votruba, if “machine 45 generates significant, wide-ranging ‘fringe’ fields extending to considerable distances from the machine,” the transducer assembly can be “mounted on the wall of a room enclosing a medical NMR scanner and can detect the field distortion caused by ferromagnetic material approaching the room from the outside.” *Id.* at 7:32–41.

2. Overview of Jaquet

Jaquet is titled “Ferromagnetic Metal Detector Utilizing Gradiometers Positioned on Opposite Sides of the Detection Area with Overlapping Sensitivity” and relates to a “passive ferromagnetic detection station in which the location or position of a ferromagnetic object carried through the station may be indicated or displayed.” Ex. 1005, code (54), 1:10–13. In Jaquet, a gradiometer “generates an output signal indicative of a change in the earth’s magnetic field in response to the presence of a ferromagnetic

object within the sensitivity pattern of the gradiometer.” *Id.* at 3:19–23. An exemplary detection station is depicted in Figure 1, reproduced below.

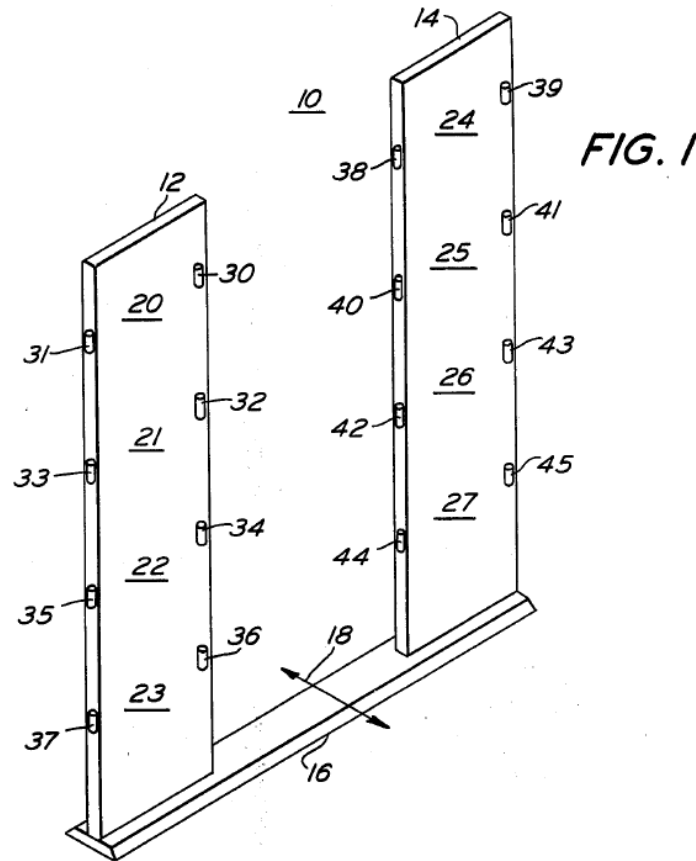


Figure 1 is a perspective drawing of a magnetometer and gradiometer array of a station. *Id.* at 3:63–64. Station 10 has first and second panels 12, 14 mounted on base 16, and in use, a person would “pass between first member 12 and second member 14 in the directions of double-headed arrow 18.” *Id.* at 4:35–41. The panels include a plurality of gradiometers 20–27, which have magnetometers 30–45 arranged such that gradiometer 20 has magnetometers 30 and 31 connected in opposition so that “the signal outputs of magnetometers 30 and 31 are subtracted from one another.” *Id.* at 4:44–50. Each of the other magnetometers are arranged in similar opposing

pairs. *Id.* at 4:50–55. The patterns or areas of sensitivity to magnetic fields of gradiometers 20, 21, 24 and 25 are shown in Figure 8, reproduced below.

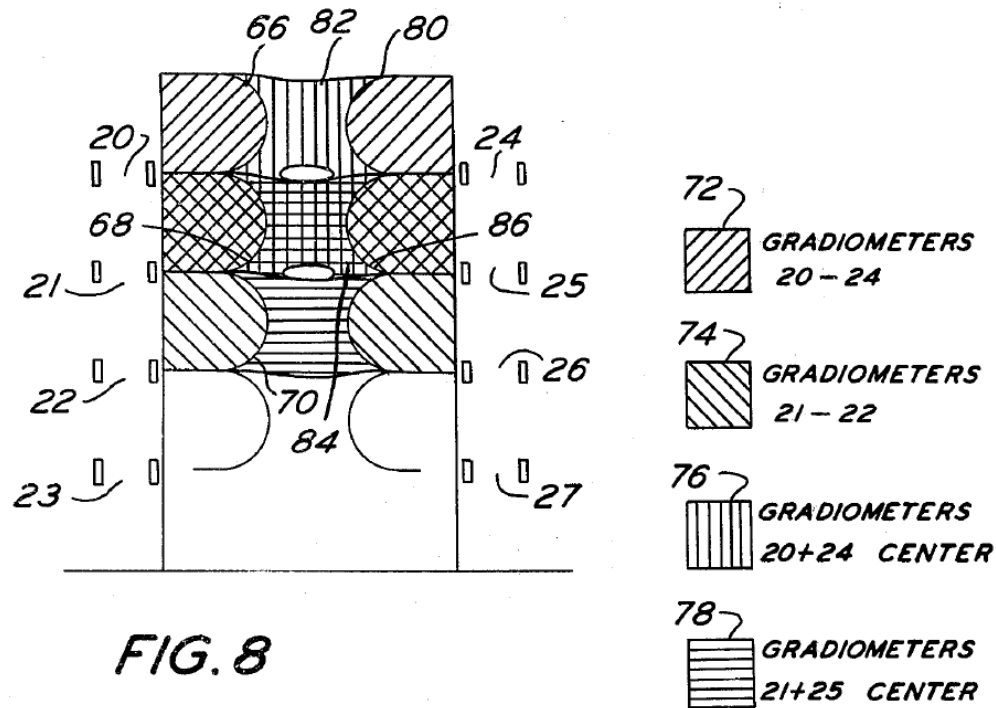


Figure 8 is a diagram showing one arrangement of overlapping patterns or areas of sensitivity to magnetic fields of the gradiometers. Ex. 1005, 4:16–18. Jaquet explains, “[t]he sensitivity or the output signal of each magnetometer 30–45 is proportional to the inverse of the distance raised to the third power between the magnetic phenomena or change to be detected and each respective magnetometer.” *Id.* at 5:6–10. Thus, according to Jaquet, “the output signal of gradiometer 20 in response to a set or fixed magnitude of variation in the magnetic field caused by a ferromagnetic object decreases very rapidly in proportion to the distance of the ferromagnetic object from gradiometer 20.” *Id.* at 5:15–19.

3. Overview of Finn

Finn is an article titled “Ferromagnetic Materials in Patients: Detection before MR Imaging” and discloses that “surgical clips and other metallic materials embedded within patients have ferromagnetic properties” that could present a hazard in an MRI, and investigates several types of magnetometers and metal detectors as possible pre-imaging screening devices. Ex. 1008, 1. In particular, Finn investigated magnetometers, which measure “magnetic fields and can detect materials with magnetic properties only in the presence of a magnetizing field,” and specifically, used “the SQUID (Superconducting Quantum Interference Device)” magnetometer. *Id.* Finn observed that when a particular clip, namely, a Schwartz clip, “was hung from a piece of thread and carried into the area of the imager, forces and torques could be sensed even at the doorway to the MR room, a distance of 3.5 m (11.5 ft) from the imager portal.” *Id.* at 140. Finn also investigated a DC Magnetometer, and determined that “[o]n its most sensitive scale, the magnetometer successfully detected the ferromagnetic clips at 12.5 cm but did not detect the nonmagnetic clips.” *Id.* Based on the investigation, Finn concluded that “all patients known to have metallic material within the body should be screened with a suitable detector before MR imaging is performed, to ensure that the embedded material is nonmagnetic.” *Id.* at 141.

4. Overview of Seton

Seton is an article titled “Gradiometer pick-up coil design for a low field SQUID-MRI system.” Ex. 1010. 116. Seton collected various images of the human forearm using: “a) room temperature surface coil and preamplifier b) 4.2 K axial gradiometer and SQUID preamplifier and c) 4.2 K figure-of-eight gradiometer and SQUID preamplifier,” and

determined that “the SQUID-based receiver improves on the SNR [(signal-to-noise ratio)] of the room temperature coil’s arm image.” *Id.* at 119–120.

5. Claim 1

Petitioner contends that the combination of Votruba, Jaquet, Finn, and Seton teaches all the limitations of claim 1. Pet. 35–67. Patent Owner opposes. PO Resp. 9–59.

a. Petitioner’s Contentions

1) Preamble

The preamble of claim 1 of the ’128 patent recites:

A protection arrangement for association with an operable MRI apparatus located within a room that has an access opening, the MRI apparatus providing a residual magnetic field that extends to a location of the opening.

Ex. 1001, 4:9–13.

Petitioner contends that Votruba teaches this portion of the claim. Pet. 36 (citing Ex. 1006, 1:9–23, 7:10–43, Figs. 1, 3, 4), 40–42 (citing Ex. 1003 ¶¶ 35–36, 71, 78–82; Ex. 1005, Fig. 1; Ex. 1006, Fig. 1; Ex. 1010, 1).

Neither party argues that the preamble is non-limiting, therefore, we do not need to decide this question because Patent Owner does not contest that the preamble is taught by Votruba.

To the extent the preamble is limiting, we agree with Petitioner that Votruba discloses it. Specifically, Votruba discloses a transducer assembly that is mounted “in proximity to a separate machine 45 which generates a magnetic field” and that transducer assembly 24 is adjustable to be positioned for sensing “the magnetic field prevailing in the vicinity of the machine 45.” Ex. 1006, 7:11–25. Votruba states that the transducer assembly

can be “mounted on the wall of a room enclosing a medical NMR scanner and can detect the field distortion caused by ferromagnetic material approaching the room from the outside.” *Id.* at 7:32–41. Given that a person would enter a room from an access opening, Votruba discloses a protection arrangement for “an MRI apparatus located within a room that has an access opening,” and that detects a magnetic field of the MRI. Petitioner’s declarant, Dr. van der Weide testifies that a “residual magnetic field” is “the non-uniform magnetic field of the MRI apparatus passing through the open doorway and that is outside the magnetic field involved with imaging.” Ex. 1003 (citing Ex. 1001, 2:54–58, 3:23–30; Ex. 1002, 48–50).

2) *Detector*

Claim 1 next recites:

a detector for passively monitoring the residual magnetic field at the location of the opening, the detector includes an array of passive magnetic field sensors arranged about the periphery of the opening in a spaced arrangement such that each sensor is associated with a different portion of the access opening, the field changing in response to a presence of ferrous material at the opening, each of the sensors including means for outputting a signal indicative of the ferrous material responsive change in the magnetic field at the associated portion of the access opening.

Ex. 1001, 4:14–24.

Petitioner contends that the combination of Votruba, Jaquet, and Finn teaches this portion of the claim.

Specifically, Petitioner contends that “*Votruba* and *Jaquet* both describe using gradiometers to detect the magnetic field (i.e., sensors 32 and 36 in *Votruba* are configured as a gradiometer, and the sensors 30 and 31 in *Jaquet* are configured as a gradiometer).” Pet. 41 (citing Ex. 1003 ¶ 81); *see*

also Pet. 37 (“*Jaquet* discloses a metal detector including an array of gradiometers on opposite longitudinal sides of an opening.” (citing Ex. 1005, 1:10–27)). Petitioner’s declarant, Dr. van der Weide testifies that “*Votruba* discloses a transducer assembly 40’ mounted on a wall of an MRI room for detecting ferromagnetic objects. The assembly 40’ includes a transducer assembly 24’ comprised of Hall effect sensor pairs configured as gradiometers.” Ex. 1003 ¶ 76 (citing Ex. 1006, 7:10–41). “*Votruba* discloses a detector for passively monitoring the residual magnetic field at the location of the opening” of the room housing the MRI. Ex. 1003 ¶ 78 (citing Ex. 1006, 7:37–40, Fig. 3 and 4).

Petitioner asserts that *Jaquet*’s “array of sensors/gradiometers 20–27 are provided in a spaced arrangement such that each sensor is associated with a different portion of the access opening.” Pet. 37 (citing Ex. 1005 4:33–65). Petitioner asserts that *Jaquet*’s “field also changes in response to a presence of ferrous material at the opening.” *Id.*

Petitioner’s expert, Dr. van der Weide avers that “*Votruba* and *Jaquet* both describe using gradiometers to detect the magnetic field (i.e., sensors 32 and 36 in *Votruba* are configured as a gradiometer, and the sensors 30 and 31 in *Jaquet* are configured as a gradiometer).” Ex. 1003 ¶ 81.

According to Petitioner, “Patent Owner disavowed using gradiometers in the claimed protection arrangement to distinguish his invention from the prior art,” but that because “Finn discloses using both gradiometers and non-gradiometers in an MRI field to detect ferromagnetic items,” Finn addresses Patent Owner’s disavowal. Pet. 37–38 (citing Ex. 1008, 1).

Petitioner’s declarant, Dr. van der Weide testifies that “Finn includes a teaching, suggestion or motivation to use the DC non-gradiometer sensor

instead of the more expensive flux-gate gradiometer sensor. Finn also includes a teaching, suggestion or motivation [that] both the gradiometer and non-gradiometers can be alternatively used in an MRI environment.”

Ex. 1003 ¶ 89 (citing Ex. 1008, 2 (Table 2)). Specifically, Finn describes that “[t]he clips also were studied in the vicinity of a large block of magnetic material. Identification was still possible, although the continuous wave instrument required readjustment. The pulsed instrument, however, needed no balancing of the ambient magnetic field, although the effective range was somewhat reduced.” Ex. 1008, 2. Finn “found that both metal detectors and magnetometers will detect small ferromagnetic objects, whether or not they are embedded within a patient.” *Id.* at 3.

3) *Warning*

Finally, claim 1 recites:

means for receiving the change indicative signals, for determining whether the change indicated by at least one of the change indicative signals exceeds a limit and for providing a safety response that addresses the condition of ferrous material at the opening of the room within which the MRI apparatus is located upon determination of at least one threshold being exceeded.

Ex. 1001, 4:25–31.

Petitioner contends that the combination of Votruba, Jaquet, and Finn teaches this portion of the claim. Pet. 38–39, 42–44. In particular, Petitioner points to Jaquet as disclosing “a signal processing means 92 [for] receiving the outputs of the gradiometers included in the gradiometer array 90,” comparing the signals, and including a threshold trigger. Pet. 42 (citing Ex. 1003 ¶ 84). Petitioner contends that “*Votruba* also discloses a means for receiving the change indicative signals . . . for determining whether the

change indicated by at least one of the change indicative signals exceeds a limit.” *Id.* at 43 (citing Ex. 1006, 2:38–46).

Specifically, Jaquet teaches “a passive detection system in which no active electromagnetic fields are generated, the apparatus . . . does not interfere with sensitive electronic circuitry contained in heart pacemakers worn by a number of persons today.” Ex. 1005, 2:58–63. By not generating an active magnetic field, Jaquet teaches that the power consumption of the apparatus is minimal. *Id.* at 2:5–8.

Votruba explains that devices known as Hall effect transducers have previously been used for monitoring magnetic fields. “A Hall effect device provides an electrical signal which typically varies directly with the magnitude of the magnetic field component in one direction along a predetermined sensing axis.” Ex. 1006, 1:24–29. Votruba teaches an improved apparatus for monitoring a magnetic field.

[T]he apparatus includes mounting means arranged to hold the transducers so that the sensing directions are substantially perpendicular to the direction of the magnetic field prevailing when the magnetic field is in a reference or rest state. As the magnetic field component perpendicular to the sensing directions of the transducers does not produce a significant signal, the signal from each sensing element will be substantially zero while the magnetic field is in its reference or rest state. . . . Stated another way, the signals representing the change in the field will not be masked by a larger steady state signal. Thus, the signal processing means may include an amplifier with very high gain, to provide a large change in the output signal for even a small change in the direction of the magnetic field. As the output of the signal processing means represents the difference between the first and second signals, the first and second signals produced by the transducers upon any change in the field direction will reinforce one another. One

of the signals will increase whereas the other will decrease upon any change in the magnetic field direction from the rest state.

Ex. 1006, 2:16–45.

Petitioner contends that “*Jaquet* discloses a signal processing means 92 receiving the outputs of the gradiometers included in the gradiometer array 90.” Pet. 42 (citing Ex. 1003 ¶ 84). Petitioner contends that Votruba also teaches measuring the difference between two sensors and that “zero output [between the sensors] is used to determine no ferromagnetic body is near the sensors.” Pet. 38 (citing Ex. 1006, 5:34–41). Petitioner contends that Votruba suggests “using passive magnetic sensors at a doorway of an MRI apparatus” to avoid safety hazards and prevent loss of MRI data. Pet. 45 (citing Ex. 1006, 7:41–44; Ex. 1003 ¶ 87).

Petitioner contends that “*Votruba* describes gradiometers placed at a doorway of an MRI room. *Jaquet* discloses an array of sensors around the doorway to increase detection zones. *Finn* discloses passive magnetic sensors configured both as gradiometers and non-gradiometers to detect ferromagnetic items before a patient enters an MRI room. *Finn* further discloses the benefit of non-gradiometers as a cheaper alternative to gradiometers.” Pet. 38–39 (citing Ex. 1006, 5:34–41; Ex. 1005, 30–41; Ex. 1008, 1). Petitioner relies on Seton for establishing that “gradiometers working with MRI systems prior to 2001, and prior to the ’128 Patent.” Pet. 38 (citing Ex. 1010, 1).

Petitioner’s expert, Dr. van der Weide testifies that “*Jaquet* discloses a signal processing means 92 receiving the outputs of the gradiometers included in the gradiometer array 90.” Ex. 1003 ¶ 84. Similarly, “*Votruba* also discloses a means for receiving the change indicative signals (see the

IC₁ in Fig. 2 receiving the outputs of the sensors 32 and 36), for determining whether the change indicated by at least one of the change indicative signals exceeds a limit.” Ex. 1003 ¶ 85 (citing Ex. 1006, 2:38–46).

b. Patent Owner’s Contentions

Patent Owner contends that:

(1) Votruba does not teach a gradiometer, gradiometer mode, or multiple gradiometers (*see* PO Resp. 9–14 (Error 1), *id.* at 15 (Error 2), *id.* at 22–23 (Error 4), *id.* at 46 (“there is just a single sensor pair”));

(2) “none of the cited documents teach/disclose modification of the Jaquet arrangement to operate within the spatially and temporally dynamic residual MRI field” (*id.* at 58);

(3) Finn does not teach using a flux gate gradiometer (*id.* at 29–42 (Error 9), *id.* at 49 (Finn’s “detections of ferromagnetic items DID NOT occur IN an MRI field”));

(4) Seaton does not have a gradiometer in a residual magnetic field. (*id.* at 43–46 (Error 10), *id.* at 51);

(5) Patent Owner did not disavow the use of gradiometers in the claimed protection arrangement (*id.* at 26–27 (Error 7), *id.* at 48).

c. Analysis

We have reviewed Patent Owner’s contentions in light of the Petition, exhibits, and the expert declaration by Dr. van der Weide. We are persuaded, for the reasons stated in the Petition and Reply, which findings we adopt as our own, that Petitioner’s arguments and evidence have shown by a preponderance of evidence that each limitation of claim 1 of the challenged ’128 patent is unpatentable as obvious over the combination of Votruba,

Jaquet, Finn, and Seton. *See* Pet. 35–52. We address Patent Owner’s contentions below.

1) Alleged Deficiency of Votruba

Patent Owner contends that Votruba does not teach a gradiometer or gradiometer mode (*see* PO Resp. 9–14 (Error 1), *id.* at 15 (Error 2); Sur-reply 7 (“Votruba does not present the topic of: ‘gradiometer.’”)). Patent Owner contends that “[a] gradiometer is an instrument for measuring the gradient of an energy field. Gradient is defined as an increase/decrease in the magnitude (e.g., magnetic flux density) observed from one point to another. The typical units are: Tesla or Gauss per meter (distance!).” Sur-Reply 10; Ex. 2001 (“gradiometer: an instrument for measuring the gradient of a physical quantity (such as the earth’s magnetic field)”). We do not find Patent Owner’s argument availing.

According to the ’128 patent, Votruba discloses a device that uses Hall effect sensors to detect metal objects.

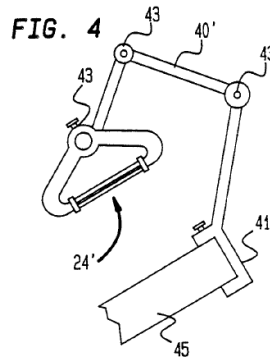
U.S. Pat. No. 4,990,850 issued Feb. 5, 1991 to Votruba discloses a device to scan patients before nuclear magnetic resonance (NMR) procedures to determine if ferrous objects are present in or on the patient. The device includes both magnets and Hall effect sensors to monitor the magnetic field. The signal of the sensors varies as the magnetic field changes with the introduction of a, ferrous object into the field.

Ex. 1001, 2:18–25.

The ’128 patent explains that the intent is to create a device that has Hall effect sensors but does not have a magnet associated with the device. *See* Ex. 1001, 2:26–29.

According to Petitioner, Figure 4 of Votruba discloses a device that has a Hall effect sensor pair and no associated magnet with the device itself.

Votruba describes the detection device including assembly 40' having transducer 24' and mounted on the wall 45 of the MRI room for detecting a ferromagnetic material. EX1006, 1:9-23, 7:37-43, Figs. 4, 1, 3. The transducer assembly 24' has Hall effect sensor pairs configured as gradiometers. *Id.* at 7:10-41. *Votruba*, Fig. 4 [reproduce below]:



[The above figure shows the transducer assembly 24' and mounting bracket 41'.] A zero output is used to determine no ferromagnetic body is near the sensors. EX1006 at 5:34-41.

Pet. 36.

Votruba explains that

the apparatus [shown in Figure 4 above] does not include any permanent magnet or other device for generating a magnetic field. The transducer assembly mounting 40' includes a clamp or similar device 41 for mounting the transducer assembly in proximity to a separate machine 45 which generates a magnetic field, such as a magnetic resonance scanner. The mounting 40' also includes adjustable elements such as pivotal joints 43 for positioning the transducer assembly 24' so that the sensing directions are orthogonal to the magnetic field prevailing in the vicinity of the machine 45. In operation, the transducer assembly is operated and the output signal is nulled in substantially the same way as discussed above[.] The output signal from the transducer assembly will indicate a change in direction of the magnetic field regardless of whether this change is caused by presence

of ferromagnetic material in the vicinity of machine 45 or by some change in operation of the machine 45 itself. Where machine 45 generates significant, wide-ranging “fringe” fields extending to considerable distances from the machine, the transducer assembly 24' can be mounted at a significant distance from the machine. For example, the transducer assembly can be mounted on the wall of a room enclosing a medical NMR scanner and can detect the field distortion caused by ferromagnetic material approaching the room from the outside. Thus, apparatus according to this aspect of the invention can sound an alarm before a safety hazard occurs and before valuable data from an ongoing NMR scan is lost.

Ex. 1006, 7:10–44.

Thus, Votruba teaches a device using Hall effect sensors that relies on the “fringe” magnetic field prevailing in the vicinity of the NMR machine instead of an internal magnet. Ex. 1006, 7:10–44; Ex. 1003 ¶ 30 (“A Hall effect magnetic sensor may also be used to measure the MRI fringe field (see EX1006, Fig. 1; two Hall effect sensors 32 and 36).”).

Petitioner’s expert, Dr. van der Weide, explains that when Hall effect sensors are configured the way they are in Votruba’s Figure 1 or Figure 4, the sensors work as gradiometers.

Further, the magnetic sensors can be configured in two ways. A first configuration is the gradiometer mode. The gradiometer mode includes pairing together two magnetic sensors, and then combining the outputs of both magnetic sensors (e.g., subtracting one output from another in differential mode to eliminate common-mode interference from room lighting or other sources). When the two magnetic sensors are orientated in opposite directions, the combined value is zero or a predetermined threshold value when there is no ferromagnetic material present. The gradiometer mode is advantageous because the pair of magnetic sensors work together to provide a

very accurate and detailed gradient of the magnetic field (the gradient is the magnitude of the magnetic field based on distance). The change in the gradient can then be used to determine if a ferromagnetic object has entered the detection area. The second magnetic sensor configuration is to simply use each sensor output individually without pairing the sensors together. In addition, all types of the magnetic sensors can be configured into the first or second configuration (i.e., as a gradiometer or as a non-gradiometer). The configuration does not depend on the type of magnetic sensor. For example, two Hall effect sensors can be paired together and configured as a gradiometer. EX1006 teaches two Hall Effect sensors in a gradiometer mode to detect an MRI[□] fringe field. Alternatively, the Hall effect sensors can be used individually: the DC magnetic sensor in Finn (EX1008, 2, Table 2) is not configured in a gradiometer mode and yet also measures an MRI magnetic field.

Ex. 1003 ¶ 31, *see also id.* ¶ 69; Reply. 14–15.

Patent Owner contends that Votruba requires a specific configuration to operate (PO Resp. 15–21 (Error 3)); Votruba does not contain plural gradiometers (*id.* at 12–17 (Error 4)), *id.* at 46 (“there is just a single sensor pair”)); Tr. 24:6–8.

We are not persuaded by Patent Owner’s argument. It is well settled that “[n]on-obviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. . . . [The reference] must be read, not in isolation, but for what it fairly teaches in combination with the prior art as a whole.” *See In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *See Soft Gel Techs., Inc. v. Jarrow Formulas, Inc.*, 864 F.3d 1334, 1341 (Fed. Cir. 2017) (“[N]on-obviousness cannot be established by attacking

references individually where the rejection is based upon the teachings of a combination of references.”) (citations omitted).

According to Petitioner, “*Votruba* teaches the use of passive magnetic sensors at a doorway of an MRI apparatus. *Jaquet* teaches arranging the passive magnetic sensors, which are configured as gradiometers, around the doorway in spaced apart manner.” Pet. 44. Thus, Petitioner is relying on the teaching of *Votruba* to establish that Hall effect sensors can be used to detect ferromagnetic material in the fringe magnetic field of an MRI. Pet. 36 (citing Ex. 1006, 1:9–23, 5:34–41, 7:10—43, Figs. 4, 1, 3). And Petitioner is relying on *Jaquet* for the configuration of the detectors around an opening. Pet. 37 (citing Ex. 1005, 1:10–27, 4:33–65, 4:66–5:1, Figs. 1, 8). Based on these combined teachings, Petitioner concludes that “[a] POSA would have been motivated to combine *Jaquet* and *Votruba* to improve the sensitivity of the sensors around the doorway.” Pet. 44; *see also id.* at 46–47 (“The detection zones 49-63 in *Jaquet* are understood by the POSA to increase the location accuracy of detecting ferromagnetic objects. . . . Thus, *Jaquet* includes a teaching, suggestion and/or motivation for using the arrangement of sensors in a doorway opening of an MRI apparatus as suggested by *Votruba*.” (citing Ex. 1003 ¶ 81, Ex. 1005, Fig. 7)). Because Petitioner is not relying on *Votruba* for arranging multiple sensors around the doorway, we are not persuaded by Patent Owner’s assertion that *Votruba* does not contain plural sensors.

Patent Owner contends that *Votruba* does not have two sensors located at a distance from each other in a magnetic spatial gradient. PO Resp. 23–24 (Error 5), *id.* at 47 (“It is very clear that the two elements 32 and 36 are not spaced at distance from each other so as to sense a gradient

over such distance”); Sur-Reply 10 (“Petitioner/Dr.vdW [Dr. van der Weide] miss/ignore, the clear fact that sensors 32, 36 are adjacent to each other.”); Tr. 25:19–24, 26:22–23. Patent Owner argues that it is the distance between the sensors that is at issue. Tr. 28:9–11 (“It’s not distance from the magnet. It’s distance between the two sensors. That is the distance that is involved with a gradiometer.”).

We are not persuaded by Patent Owner’s argument that there is no distance between the sensor elements 32 and 36 of Votruba. *See* Tr. 27:22–26 (“Obviously, they can’t occupy the same space. I mean, that’s simple physics, but they are adjacent. It is explained that they are adjacent, and more importantly, it is explained in Votruba that they are to sense the same part of the field, not different parts of the field, same part of the field.”).

We recognize that the figures cannot be relied upon for specific values, but figures are routinely relied upon for the relative information shown regarding the placement of components. *See, e.g. In re Skvorecz*, 580 F.3d 1262, 1270 (Fed. Cir. 2009) (“A person skilled in the mechanical arts would understand the specification including the drawings as showing the offsets and the lateral displacement of each wire leg.”).

Here, we agree with Petitioner, that “Figures 1, 3–4 of Votruba clearly show physical separation between the sensors. If there really was ‘no distance between the elements,’ then both elements would see the same field, which would result in perfect cancellation of any external magnetic field, rendering the invention useless. The only way Votruba’s invention can work is if the elements 32 and 36 are separated, as shown.” Reply 16; Ex. 1006, Fig. 1 (Elements 32 and 36); *see also* Ex. 2002, 1:44–45 (“The

Hall detectors [of Votruba] are arranged adjacent to one another and positioned so that they detect *nearly the same field*.” (emphasis added)).

Petitioner additionally supports its assertion with the unrebutted expert testimony of Dr. van der Weide. *See* Ex. 1003; ¶¶ 31, 77, 85; *see* Reply 14–16.⁷ Dr. van der Weide explains that “[t]he gradiometer mode [of Votruba] includes pairing together two magnetic sensors, and then combining the outputs of both magnetic sensors (e.g., subtracting one output from another in differential mode to eliminate common-mode interference from room lighting or other sources).” Ex. 1003 ¶ 31. Dr. van der Weide goes on to explain that “[t]he gradiometer mode is advantageous because the pair of magnetic sensors work together to provide a very accurate and detailed gradient of the magnetic field (the gradient is the magnitude of the magnetic field based on distance).” *Id.* Dr. van der Weide’s testimony is supported by US Patent No. 5,689,184 describing that “[t]he Hall detectors [of Votruba] are arranged adjacent to one another and positioned so that they detect *nearly the same field*.” Ex. 2002, 1:44–45 (emphasis added). Being in nearly the same field supports Petitioner’s position that the Hall effect sensors of Votruba are not occupying the same space and, therefore, they are separated by some distance. Patent Owner agrees that it is physically impossible to occupy the same space – hence the sensors are spaced apart even if adjacent. *See* Tr. 27:22–26 (“Obviously, they can’t occupy the same space. I mean, that’s simple physics, but they are adjacent.”).

⁷ We note that Patent Owner had an opportunity to depose Dr. van der Weide but choose not to do so. *See* Tr. 30:9–22.

We recognize that there is no obligation for Patent Owner to provide an expert submission. *Fanduel, Inc. v. Interactive Games LLC*, 966 F.3d 1334, 1344 (Fed. Cir. 2020) (“no expert submissions are required.”). We have reviewed Dr. van der Weide’s unrebutted testimony in light of the entire record and find the testimony credible. *See Imperium IP Holdings (Cayman), Ltd. v. Samsung Elecs. Co.*, 757 F. App’x 974, 979–80 (Fed. Cir. 2019) (noting that, while a factfinder has “wide leeway to assess evidence and credibility,” it must “have some reasonable basis” for rejecting uncontroverted expert testimony). Just because the standard unit of a magnetic field is defined as a unit per meter as argued by Patent Owner (*see* Tr. 25:19–25:2), does not necessarily mean that sensors that measure the magnetic field need to be meters apart. This argument is not supported by the plain language of the claim or any other evidence in the record. *See Estee Lauder Inc. v. L’Oreal, S.A.*, 129 F.3d 588, 595 (Fed. Cir. 1997) (“[A]rguments of counsel cannot take the place of evidence lacking in the record.”). We do not discern anything in the complete record before us to suggest that the sensors cannot be femtometers apart and still measure a gradient in a magnetic field.

Here, there is sufficient evidence in the record to support the position that the two Hall effect sensors of Votruba are adjacent and may even be close together in space – but because they do not occupy the *same* space they are necessarily separated by *some* distance. *See* Ex. 1006, Figs. 1, 4; Ex. 2002, 1:44–45 (“The Hall detectors [of Votruba] are arranged adjacent to one another and positioned so that they detect nearly the same field.”); *see also* Tr. 27:22–26 (“Obviously, they can’t occupy the same space. I mean, that’s simple physics, but they are adjacent.”). What we do not have in the

record is any evidence of the minimal distance required in order to measure a magnetic gradient. *See* Tr. 25:19–20 (“a gradiometer requires gradient that requires it’s measured over a distance.”); Sur-Reply 10 (“A gradiometer is an instrument for measuring the gradient of an energy field. Gradient is defined as an increase/decrease in the magnitude (e.g., magnetic flux density) observed from one point to another. The typical units are: Tesla or Gauss per meter (distance!).”).

Votruba’s Figure 3 is reproduced below:

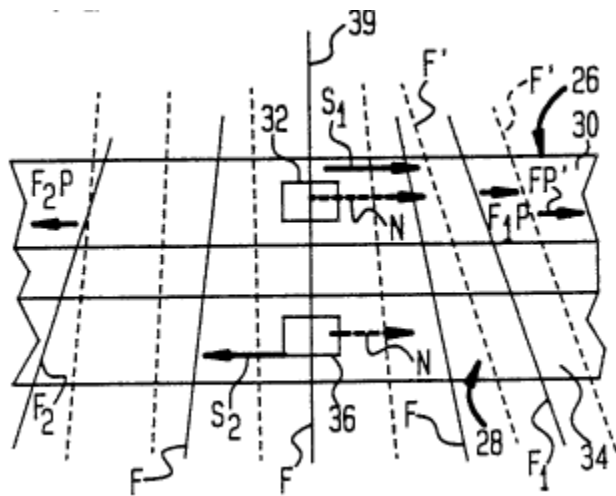


Figure 3 shows the transducers 30 and 34 adjacent to one another, “so that the centers of the bars lie on a common plane 39 perpendicular to the lengthwise directions of the bars.” Ex. 1006, 4:22–26; *see* Tr. 27:18–21 (“Council. I’m looking at figure three of exhibit 1006, and it shows sensors 32 and 36 and a definite space between them. Given your argument that we can’t take the distance. Doesn’t this suggest that it’s any space, any amount of distance?”). According to Votruba, “[b]ecause bars 30 and 34 are disposed adjacent to one another, each will be subjected to *substantially the same net field*. As shown in FIG. 3, the net field N is co-directional with sensing direction S_1 , but counterdirectional to sensing direction S_2 .”

Ex. 1006, 6:12–16 (emphasis added); *see also* Ex. 2002, 1:44–45 (“The Hall detectors [of Votruba] are arranged adjacent to one another and positioned so that they detect nearly the same field.” (emphasis added)). Votruba explains that “[s]uch balanced operation tends to promote accurate cancellation of spurious signals caused by environmental effects.” Ex. 1006, 6:61–63. Here, evidence that the sensors experience “substantially” or “nearly,” but not exactly, the same magnetic field reasonably supports Petitioner’s contention that the detectors are spaced apart.

We also agree with Petitioner, that “simply because the term ‘gradiometer’ is not used does not mean the sensors in Votruba are not configured as a gradiometer. For example, an apparatus that has a membrane that responds to sound waves and a transducer to convert the membranes’ displacements into output voltages is a microphone by definition; the absence of the word ‘microphone’ in the description does not change that fact.” Reply 16; *see also* Ex. 1003 ¶¶ 30, 31, 69, 76.

2) *Alleged Deficiency of Jaquet*

Patent Owner contends that “none of the cited documents teach/disclose modification of the Jaquet arrangement to operate within the spatially and temporally dynamic residual MRI field.” PO Resp. 58; Sur-reply 18 (Error 5). “The only assertion on the topic is a generic assertion from Dr. van der Weide (EX1003), at paragraph 29, ‘the POSA is capable of selecting the appropriate magnetic sensor to measure a field strength range including both the Earth’s magnetic field and the additional MRI residual or fringe field at the doorway of the MRI suite.’” PO Resp. 59.

We are not persuaded by Patent Owner’s assertion that there is no support for Petitioner’s contention that a POSA would know how to the

select a magnetic sensor to function in a particular environment. In addition to Dr. van der Weide's unrebutted testimony, we note that Jaquet is directed to "[a] passive ferromagnetic detection station in which the position of the ferromagnetic object carried by a person may be indicated." Ex. 1005, (57). Jaquet's "invention monitors the earth's magnetic field and detects any disturbances in the earth's magnetic field caused by the presence of a ferromagnetic object." *Id.* at 1:50–56, *see also id.* 3:19–24 ("Each of the gradiometers generates an output signal indicative of a change in the earth's magnetic field in response to the presence of a ferromagnetic object within the sensitivity pattern of the gradiometer."). Jaquet explains that the apparatus "does not generate an active magnetic field" because it relies on earth's magnetic field. *Id.* at 2:5–6. Jaquet acknowledges that "general magnetic detection walkthrough station has been known [in the prior art]. However, most of the prior art magnetic detection walk-through stations required the generation of an active magnetic field." *Id.* at 2:20–24. Jaquet, therefore, teaches that magnetic detection can also be achieved in a generated magnetic field. Recognizing that magnetic walk-through detection systems can use either the earth's magnetic field as taught by Jaquet or a generated magnetic field as was known in the prior art supports Dr. van der Weide's testimony that a POSA is able to select the appropriate detector for a given environment. *See* Ex. 1003 ¶ 29 ("a magnetic sensor capable of sensing the MRI residual field and the Earth's magnetic field can readily be selected.").

Petitioner relies on Jaquet for teaching an array of passive magnetic sensors arranged on opposite longitudinal sides of an opening. Pet. 37 (citing Ex. 1005, 1:10–27), *see also id.* at 41 ("Gradiometer sensors 20-27 are

provided in a spaced arrangement such that each sensor is associated with a different portion of the access opening, and the field changes in response to a presence of ferrous material at the opening. EX1003, ¶¶ 79, 71”), 44. In other words, Petitioner is relying on the location of the placement of Jaquet’s sensors for substituting the Hall effect sensor of Votruba. *See* Pet. 41 (“*Votruba* and *Jaquet* both describe using gradiometers to detect the magnetic field (i.e., sensors 32 and 36 in *Votruba* are configured as a gradiometer, and the sensors 30 and 31 in *Jaquet* are configured as a gradiometer). EX1003, ¶ 81.”), 47 (“*Jaquet* teaches it would be advantageous to detect individual zones so the detection device can more accurately pinpoint the location of the ferromagnetic object and make it easier to properly address the potential for causing an accident. EX1005, 1:28-50.”), 49–50 (“*Votruba* contained an arrangement which differed from the claimed arrangement (claim 1 of ’128 Patent) by substitution of an array of sensors around a doorway, and whether the sensors worked independently (i.e., to function and to alert independently) or not (i.e., to be paired and to alert upon a change in the gradient, i.e., as a gradiometer)”). EX1003, ¶¶ 23, 24, 31, 90). “[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007), citing *United States v. Adams*, 383 U.S. 39, 50–51 (1966).

3) *Alleged Deficiency of Finn*

Patent Owner contends that Finn does not teach using a flux gate gradiometer. PO Resp. 29–42 (Error 9), *id.* at 49 (Finn’s “detections of ferromagnetic items DID NOT occur IN an MRI field.”). Patent Owner

contends that “[t]he mere fact that Finn is discussing two separate studies does not mean that content (i.e., operating an MRI) of one study is to be imported into the second, separate study.” PO Resp. 54; Tr.40: 4–6 (“Finn is not teaching using fluxgate gradiometer. While the medical clips are at the opening of the MRI imager itself, nor in an MRI field at all.”).

Finn explains that in “the magnetic resonance (MR) imaging of patients who have surgical or nonsurgical material embedded within their bodies,” “[c]oncern is raised because these materials may be ferromagnetic and may be acted on by the strong and fluctuating magnetic fields of the MR imager.” Ex. 1008, Abstract. Finn teaches that “[n]ot all stainless steel clips were found to be nonmagnetic.” *Id.* Table 1 of Finn shows “the magnetic forces and torques for the 11 clips when brought into the magnetic fields of the NIH scanner and SQUID [(Superconducting QUantum Interference Device)]” *Id.* at 140. Table 1 of Finn shows that some but not all surgical clips are acted on by the magnetic field of the instruments. *Id.*

Finn also studied metal detectors and magnetometers for their ability to discriminate between magnetic and nonmagnetic materials. Ex. 1008, 1. Table 2 of Finn compares a ferromagnetic staple with the most magnetic clip, clip 2 (the Schwartz clip) in the presence of a metal detector or magnetometer. *Id.* at 140 (Table 2). According to Finn, “[a] metal detector consists of a tuned electronic circuit; the resonant frequency of the circuit is chosen to give the best sensitivity for the specific metal or metals under scrutiny.” *Id.* “A magnetometer measures magnetic fields and can detect materials with magnetic properties only in the presence of a magnetizing field.” *Id.* Petitioner’s declarant, Dr. van der Weide explains that “Table 2 [of Finn] describes flux-gate gradiometer . . . , Direct Current (DC) sensor,

and a SQUID sensor, where DC and SQUID sensors are not configured as gradiometers. Passive magnetic sensors not configured as gradiometers used to detect ferrous objects in an MRI residual magnetic field are described in Table 2.” Ex. 1003 ¶ 73. Dr. van der Weide avers that

Finn discloses using cheaper detectors, such as DC detectors, not configured as gradiometers, as an acceptable alternative to gradiometers such as the more expensive flux-gate. . . . Finn summarizes the use of Coil, Continuous wave, and Pulsed metal detectors as well as flux-gate, Direct current and SQUID magnetometers to detect presence of and effect of the MR field on test clips that represent what might be implanted in a patient’s body (Table 2)

Ex. 1003 ¶ 74 (citing Ex. 1008, 2).

Finn “found that both metal detectors and magnetometers will detect small ferromagnetic objects, whether or not they are embedded within a patient.” Ex. 1008, 3. Additionally, Finn describes that

[t]he clips also were *studied in the vicinity of a large block of magnetic material*. Identification was still possible, although the continuous wave instrument required readjustment. The pulsed instrument, however, needed no balancing of the ambient magnetic field, although the effective range was somewhat reduced.

Ex. 1008, 2 (emphasis added). Finn, therefore, reasonably supports Petitioner’s contention that metal detectors and magnetometers can function in a residual magnetic field, such as for example in the magnetic field of an MRI.

Petitioner, however, does not solely rely on Finn to establish that detectors function in the magnetic field of an MRI. Petitioner looks to Seton to establish that detectors such as a SQUID can work within the magnetic

field of an MRI. *See* Pet. 38, 42 (citing Ex. 1010, 1; Ex. 1003 ¶ 36); Ex. 1003 ¶ 91.

Finally, Patent Owner contends that “the Declaration of Dr. van der Weide is presented based upon a false assumption that the two, separate studies of Finn occurred simultaneously (i.e., the detectors were operated within the MRI field).” PO Resp. 55.

We disagree with Patent Owner’s contention that Dr. van der Weide’s declaration is based on false assumptions. *See* Ex. 1003 ¶¶ 73–74. As already explained above, Finn “found that both metal detectors and magnetometers will detect small ferromagnetic objects, whether or not they are embedded within a patient.” Ex. 1008, 3. Additionally, Finn describes that “[t]he clips also were *studied in the vicinity of a large block of magnetic material.*” Ex. 1008, 2 (emphasis added). Finn, therefore, reasonably supports Petitioner’s contention that metal detectors and magnetometers can function in a residual magnetic field, such as for example in the magnetic field of an MRI.

4) *Alleged Deficiency of Seton*

Patent Owner contends that Seton does not have a gradiometer in a residual magnetic field. PO Resp. 43–46 (Error 10), *id.* at 51 (“nowhere does Seton state that the Seton gradiometer is out in a residual magnetic field of the Seton MRI apparatus and nowhere does Seton state that the Seton gradiometer is monitoring the residual magnetic field.”); *see* Tr. 41:5–9 (“Seton at section 2.1 is clear to state that the coils are mounted at the exact center of the imaging volume. The conditions at that location are totally different than out in the fringe field of an MRI machine. The magnetic field at this location is very uniform and is well shielded from interference.”).

JUDGE JENKS: . . . Are you saying that there is no magnetic field inside the MRI where Seton's gradiometer is sitting?

MR. KACHMARIK: Not at all. But it is a very different field.

JUDGE JENKS: It's a magnetic field, right?

MR. KACHMARIK: Yes, yes.

JUDGE JENKS: Whether it's inside the machine or outside the machine. And the gradiometer still works. I think that's all [] petitioner is relying on Seton for.

Tr. 41:17–24.

Here, Petitioner relies on Seton to teach “gradiometers working with MRI systems prior to 2001, and prior to the '128 Patent.” Pet. 38, 42 (citing Ex. 1010, 1; Ex. 1003 ¶ 36); Ex. 1003 ¶¶ 91, 191–197 (the combination would not “fry” or make the arrangement inoperable). Petitioner does not rely on the specific type of gradiometer disclosed by Seton or the location of the gradiometer with respect to the MRI. Rather, the Petition relies on the combination of Votruba and Jaquet for the detectors and their location, which as discussed above we already determined to be reasonable.

Petitioner's expert further explains that “*Seton* is one example that at the time of the '128 Patent, a POSA can configure a gradiometer or non-gradiometer to properly work for an MRI suite. While *Seton* describes use of gradiometer sensors as well as DC and SQUIDS non-gradiometer sensors in an MRI environment to improve the signal to noise ratio (SNR) during low-field imaging.” Ex. 1003 ¶ 75.

5) Disavowal of all Gradiometers

Petitioner contends that “Mr. Kopp unequivocally and unambiguously disavowed the use of gradiometers in the claimed protection arrangement to

distinguish his invention from the prior art. Accordingly, ‘an array of passive magnetic field sensors’ should be construed as ‘spaced apart Hall effect sensors, not being configured as gradiometers’ EX1003, ¶ 38.” Pet. 13.

Patent Owner contends that arguments made during prosecution were not directed to all gradiometers, but only to the gradiometer associated with Jaquet’s device (*id.* at 25–26 (Error 6)); that Patent Owner did not disavow the use of gradiometers in the claimed protection arrangement (*id.* at 26–27 (Error 7), *id.* at 48): and that Patent Owner did not mislead the Examiner (*id.* at 27–29 (Error 8)).

For the reasons discussed above (II.B.2), we are not persuaded by Petitioner’s contention that the disclosure of the ’128 patent (Ex. 1001) and prosecution history (Ex. 1002) support the position that *all* gradiometers are disavowed, instead we find that only those gradiometers that use the earth’s uniform magnetic field such as those disclosed by Jaquet are disavowed.

d. Summary claim 1

Having considered the arguments and evidence based on the full record, we determine that Petitioner has sufficiently established by a preponderance of the evidence that the combination of Votruba, Jaquet, Finn, and Seton renders the device of claim 1 obvious. Specifically, we agree with Petitioner that “a POSA would have been motivated to combine the prior art to achieve the claimed invention with a reasonable expectation of success . . . to have used the arrangement of passive magnetic sensors as taught by Jaquet in an opening of an MRI room as taught by Votruba (i.e., the array of sensors per Jaquet for the two sensors in Votruba).” Pet. 49 (citing Ex. 1003 ¶ 90). Therefore, Petitioner has shown by a preponderance

of the evidence that claim 1 of the '128 patent is unpatentable as obvious over Votruba, Jaquet, Finn, and Seton.

6. Claims 2–14

Claims 2–14 depend directly or indirectly from claim 1. Ex. 1001, 4:32–5:38. Petitioner points out where each of the limitations of dependent claims 2–14 are disclosed by the references. Pet. 59–65. Petitioner supports its assertions with the testimony of Dr. van der Weide. *Id.* Patent Owner argues the claims as a group and does not provide arguments for claim 2–14 separate from those discussed above for claim 1. PO Resp. 9–59.

We are persuaded, for the reasons stated in the Petition and Reply, which findings we adopt as our own, that Petitioner's arguments and evidence have shown by a preponderance of evidence that each limitation of claims 2–14 of the challenged '128 patent is unpatentable as obvious over Votruba, Jaquet, Finn, and Seton. *See* Pet. 59–65; Reply 10–30.

7. Claim 15

Independent claim 15 recites “[a] protection arrangement for association with an operable MRI apparatus located within a room that has an access opening, the MRI apparatus providing a residual magnetic field that extends to a location of the opening.” Ex. 1001, 5:39–42.

Next claim 15 recites:

an array of passive magnetic field sensors, mounted about the periphery of the opening in a spaced arrangement such that each sensor is associated with a different portion of the access opening, each sensor for monitoring the residual magnetic field at the associated portion of the access opening, the field changing in response to a presence of ferrous material at the opening, the array of passive magnetic field sensors provides signals indicative of the ferrous material responsive change in the magnetic field.

Ex. 1001, 5:43–6:8.

Finally, claim 15 recites:

a signal processor/safety response generator receives the change indicative signals, determines whether the change indicated by at least one of the change indicative signals exceeds a limit and indicates a need for a safety response, and provides a safety response that addresses the condition of ferrous material at the opening of the room within which the MRI apparatus is located.

Ex. 1001, 6:9–15.

Petitioner points out where each of the limitations of claim 15 is disclosed by the references, and contends “[s]imilar comments apply to claim 15 as that discussed above regarding claim 1.” Pet. 52–59. Petitioner supports its assertions with the testimony of Dr. van der Weide. *See id.*

Patent Owner does not provide separate arguments for claim 15 relying instead on the arguments discussed above for claim 1. PO Resp. 9–59.

We are persuaded, for the reasons stated in the Petition and Reply, which findings we adopt as our own, that Petitioner’s arguments and evidence have shown by a preponderance of evidence that each limitation of claim 15 of the challenged ’128 patent is unpatentable as obvious over Votruba, Jaquet, Finn, and Seton. *See* Pet. 52–59; Reply 10–30.

8. *Claims 16–20*

Claims 16–20 depend from claim 15. Ex. 1001, 6:16–45. Petitioner points out where each of the limitations of dependent claims 16–20 are disclosed by the references. Pet. 65–67. Petitioner supports its assertions with the testimony of Dr. van der Weide. *Id.* Patent Owner argues the claims as a group and does not provide arguments for claim 16–20 separate from those discussed above for claim 1. PO Resp. 9–59.

We are persuaded, for the reasons stated in the Petition and Reply, which findings we adopt as our own, that Petitioner’s arguments and evidence have shown by a preponderance of evidence that each limitation of claims 16–20 of the challenged ’128 patent is unpatentable as obvious over Votruba, Jaquet, Finn, and Seton. *See* Pet. 65–67; Reply 10–30.

III. CONCLUSION⁸

For the foregoing reasons, we conclude that Petitioner has established by a preponderance of the evidence that claims 1–20 of the ’128 patent are unpatentable.

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not shown Unpatentable
1–20	103	Votruba, Jaquet, Finn, Seton	1–20	
Overall Outcome			1–20	

⁸ 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).

IV. ORDER

Accordingly, it is

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1–20 of the '128 patent are unpatentable pursuant to 35 U.S.C. § 314(a);

FURTHER ORDERED that, because this is a final written decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-01224
Patent 7,489,128 B2

For PETITIONER:

Eugene T. Perez
David A. Bilodeau
Michael T. Smith
BIRCH, STEWART, KOLASCH & BIRCH, LLP
etp@bskb.com
dab@bskb.com
michael.t.smith@bskb.com

For PATENT OWNER:

Ronald M. Kachmarik
William J. Cooper
COOPER LEGAL GROUP LLC
rkachmarik@cooperlegalgroup.com
wcooper@cooperlegalgroup.com