United States Court of Appeals for the Federal Circuit

RAYTHEON TECHNOLOGIES CORPORATION,
Appellant

v.

GENERAL ELECTRIC COMPANY,
Appellee

ANDREW HIRSHFELD, PERFORMING THE FUNCTIONS AND DUTIES OF THE UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE,
Intervenor

2020-1755

Appeal from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. IPR2018-01442.

Decided: April 16, 2021

LAUREN ANN DEGNAN, Fish & Richardson P.C., Washington, DC, argued for appellant. Also represented by CHRISTOPHER DRYER, WALTER KARL RENNER; KENNETH WAYNE DARBY, Austin, TX; TIMOTHY RAWSON, San Diego,

CA; MICHAEL VALAIK, Bartlit Beck Herman Palenchar & Scott LLP, Chicago, IL.

BRIAN E. FERGUSON, Weil, Gotshal & Manges LLP, Washington, DC, argued for appellee. Also represented by DANIEL MUSHER, CHRISTOPHER PEPE; ANISH R. DESAI, New York, NY.

ROBERT J. MCMANUS, Office of the Solicitor, United States Patent and Trademark Office, Alexandria, VA, for intervenor. Also represented by THOMAS W. KRAUSE, FRANCES LYNCH, FARHEENA YASMEEN RASHEED.

Before LOURIE, CHEN, and HUGHES, *Circuit Judges*.

CHEN, *Circuit Judge*.

A typical 35 U.S.C. § 103 obviousness case often turns on whether an asserted prior art reference teaches a particular disputed claim limitation or whether a skilled artisan would have been motivated at the time of invention to combine the teachings of different references. There usually is no dispute about whether an asserted prior art reference is "self-enabling," i.e., whether a skilled artisan can make and use the subject matter disclosed in the reference. This appeal, however, requires us to consider when a reference needs to have a self-enabling disclosure for supporting an obviousness case. We have explained that there is no absolute requirement for a relied-upon reference to be self-enabling in the § 103 context, so long as the overall evidence of what was known at the time of invention establishes that a skilled artisan could have made and used the claimed invention. We have also previously expounded the principle that if an obviousness case is based on a non-self-enabled reference, and no other prior art reference or evidence would have enabled a skilled artisan to make the claimed invention, then the invention cannot be said to have been obvious.

In the present case, Raytheon[1] appeals a final *inter partes* review decision of the Patent Trial and Appeal Board (Board) finding claims 3 and 16 of U.S. Patent No. 9,695,751 ('751 patent) unpatentable as obvious in view of the Knip reference. In particular, the Board found that Knip discloses the claimed power density limitation for a geared gas turbine engine. During the proceeding, Raytheon submitted unrebutted evidence establishing that Knip's disclosure of highly aggressive performance parameters for a futuristic turbine engine was based on the use of nonexistent composite materials. In response, the petitioner, General Electric Company (GE), never put forth any evidence suggesting a skilled artisan could have made a turbine engine with the power density recited in the claims. Because the relied-upon prior art fails to enable a skilled artisan to make and use the claimed invention, we *reverse*.

BACKGROUND

A

Raytheon owns the '751 patent, which is directed to gas turbine engines. *See* '751 patent at Abstract. Gas turbine engines are commonly used for powering airplanes. At a high level, a gas turbine engine generally consists of a fan section, a compressor section, a combustor section, and a turbine section. *See id.* at col. 4 ll. 8–10. The compressor section typically includes a low-pressure and high-pressure compressor. *See id.* at col. 4 ll. 33–59. Similarly, the turbine section often consists of low- and high-pressure turbines. *See id.*

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[1] United Technologies Corporation (UTC) is the original assignee of the '751 patent. After the Board issued its final written decision, UTC merged with Raytheon Company to form Raytheon Technologies Corporation (Raytheon), the current owner of the '751 patent.

Gas turbine engines produce thrust by drawing air into the front of the engine, mixing it with fuel and burning the mixture, and ejecting exhaust gasses. *See id.* at col. 4 ll. 12–17. Turbofan engines, a particular type of gas turbine engine relevant here, utilize an air bypass duct to increase thrust by ejecting some of the air through a bypass nozzle. Turbofan engines can be "direct-drive" or "geared." In a direct-drive engine, the fan is directly connected to the low-pressure compressor and turbine such that all three turn at the same speed. Alternatively, "geared" engines include a gearbox, allowing the turbine and compressor to rotate at a different, i.e., higher, speed than the fan. *See id.* at col. 1 ll. 37–46. When a compressor or turbine can spin at a higher rotational speed, it can perform the same amount of work in fewer stages. Fewer stages, in turn, leads to reduced volume and weight of the turbine and the engine, resulting in greater efficiency.

The '751 patent generally claims a geared gas turbine engine with two turbines and a specific number of fan blades and turbine rotors and/or stages. The key distinguishing feature of the claims is the recitation of a "power density" range that the patent describes as being "much higher than in the prior art." *See id.* at col. 10 ll. 54–55. The '751 patent defines power density as the "sea-level-takeoff thrust" (SLTO thrust) divided by the engine turbine volume. *See id.* at col. 10 ll. 22–25 and claims 1, 15.

Claims 1–3 are reproduced in part below:

1. A gas turbine engine comprising:

a fan including a plurality of fan blades . . . ;

a compressor section;

a combustor in fluid communication with the compressor section;

> a turbine section in fluid communication with the combustor, the turbine section including a fan drive turbine and a second turbine . . . ; and
>
> a speed change system configured to be driven by the fan drive turbine to rotate the fan about the axis; and
>
> a power density at Sea Level Takeoff greater than or equal to 1.5 lbf/in^3 and less than or equal to 5.5 lbf/in^3 and defined as thrust in lbf measured by a volume of the turbine section in in^3 measured between an inlet of a first turbine vane in said second turbine to an exit of a last rotating airfoil stage in said fan drive turbine.
>
> 2. The gas turbine engine as recited in claim 1, wherein the fan drive turbine has from three to six stages.
>
> 3. The gas turbine engine as recited in claim 2, wherein said number of fan blades is less than 18 and the second turbine has two stages.

Id. at claims 1–3.

Independent claim 15 is substantively identical to claim 1 but requires the speed change system to have "a gear reduction." *See id.* at claim 15. And claim 16, which depends from claim 15, contains the same additional limitation as claim 3. *See id.* at claim 16.

B

GE petitioned for *inter partes* review of claims 1–4, 9–10, 15–16, and 23 of the '751 patent. *See* J.A. 102–89. GE's

petition relied on either Knip[2] or Gliebe[3] as a primary reference for its asserted unpatentability grounds. *See* J.A. 124–25. GE challenged claims 1–4, 9–10, and 15–16 as obvious in light of Knip alone and/or Knip in view of a secondary reference. *See id.* GE also challenged claims 1–2 and 15 as anticipated by or rendered obvious by Gliebe, alone, and claim 23 as rendered obvious by Gliebe and a secondary reference. *See id.*

Knip is a 1987 NASA technical memorandum that envisions superior performance characteristics for an imagined "advanced [turbofan] engine" "incorporating all composite materials." *See* J.A. 902. Although the construction of a turbofan engine incorporating such composite materials was undisputedly unattainable at that time (and, according to the record, continues to this day to be beyond reality), an imagined application of these "revolutionary" composite materials to a turbofan engine allowed the author of Knip to assume aggressive performance parameters for an "advanced engine," including then-unachievable pressure ratios and turbine temperatures. *See* J.A. 906. Knip predicts that the use of these composite materials would permit the resulting advanced engine to achieve significant reductions in engine volume and weight leading to "improvement in engine performance and thrust-to-weight-ratios." *See* J.A. 903, 908. Although Knip discloses numerous performance parameters associated with its futuristic engine, it does not explicitly disclose SLTO thrust, turbine volume, or power density.

In its petition, GE argued that both Knip and Gliebe disclose performance parameters of a kind that would

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[2] G. Knip, Analysis of an Advanced Technology Subsonic Turbofan Incorporating Revolutionary Materials (May 1987). J.A. 901–25.

[3] P. Gliebe, Ultra-High Bypass Engine Aeroacoustic Study (Oct. 2003). J.A. 792–900.

permit a skilled artisan to derive the power density of their respective engines from those disclosed parameters. *See* J.A. 140–45, 180–83. According to GE, those power densities render obvious or anticipate the claimed power density range, proving the challenged claims unpatentable. In the alternative, GE argued that because power density is a "result-effective variable," *see* J.A. 145–53, "even if Knip did not disclose a turbine section volume and/or SLTO thrust that resulted in a power density within the claimed range, it would have nevertheless been obvious to a [skilled artisan] to modify the thrust and/or turbine volume for Knip's engine to optimize the power density." J.A. 726; *see also* J.A. 709.

After the Board instituted the *inter partes* review of the challenged claims, Raytheon disclaimed claims 1–2, 4, 9–10, 15, and 23, to "streamline" the issues, *see* Oral Arg. at 1:28–50, 3:57–4:24. The disclaimer mooted all grounds relying on Gliebe, leaving only dependent claims 3 and 16, which were challenged exclusively on Knip-based grounds. *See* J.A. 124–25. Despite its disclaimer, Raytheon relied solely on limitations within claims 1 and 15—i.e., the claimed power density range—to argue the patentability of dependent claims 3 and 16 over Knip.[4] *See, e.g.,* J.A. 4804.

Raytheon made two main arguments to the Board in support of claims 3 and 16's patentability. First, it argued that GE's expert employed a flawed methodology in deriving the power density of Knip's advanced engine from the parameters that Knip disclosed. *See id.* Second, Raytheon

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[4] Disclaimed claims are treated as if they never existed, *see Sanofi-Aventis U.S., LLC v. Dr. Reddy's Laboratories, Inc.*, 933 F.3d 1367, 1373 (Fed. Cir. 2019), and disclaimer does not legally constitute "an admission that the subject of the disclaimer appears in the prior art," *National Fruit Products Co., v. C.H. Musselman Co.*, 8 F. Supp. 994, 995 (M.D. Pa. 1934).

argued that Knip's disclosure failed to enable a skilled artisan to make the claimed invention. *See* J.A. 4847–68. According to Raytheon, the aggressive parameters disclosed in Knip, and therefore, its power density, relied on "revolutionary" materials unavailable as of the priority date of the '751 patent. J.A. 4855–58.

In response, GE did not dispute that Knip's contemplated revolutionary materials were unavailable at the time the '751 patent was filed. *See* J.A. 6442. Nor did GE argue that the aggressive parameters disclosed by Knip, parameters GE used to calculate power density, were achievable through some other means. *See* J.A. 6440–43. Rather, GE argued that the issue of whether Knip enabled its advanced engine was "irrelevant" to the "question whether a [skilled artisan] reviewing Knip could make the ['] *751 Patent's engine* (using any already available materials) without undue experimentation." *See* J.A. 6442 (emphasis in original).

C

In its Final Written Decision, the Board determined that GE had met its burden of proving that claims 3 and 16 are unpatentable as obvious. *See General Elec. Co. v. United Techs. Corp.*, IPR2018–01442, 2020 WL 859443, at *1 (P.T.A.B. Feb. 20, 2020). The Board treated enablement as a threshold issue, recognizing that it "could be dispositive of any analysis based on Knip in this proceeding." *Id.* at *6. The Board ultimately concluded that Knip was "enabling," *see id.* at *10, because it provided enough information to allow a skilled artisan to "determine a power density as defined in claim 1, and within the range proscribed in claim 1," *id.* at *29.

Having found Knip "enabling," the Board concluded that Knip rendered claims 3 and 16 obvious to a skilled artisan. *See id.* at *29–30. Like its enablement analysis, the Board's overall conclusion focused on the narrow question of whether Knip provided enough disclosure to enable a

skilled artisan to calculate what would be the power density of Knip's advanced engine. *See id.* at *29 ("We credit [GE's expert's] analysis [], which showed persuasively that [a skilled artisan] would have used the engine cycle and turbine volume measurement parameters expressly provided in Knip, along with certain reasonable assumptions and estimates as to missing parameters, and obtained SLTO thrusts resulting in values within the claimed range as set forth in claim 1."). The Board further supported its obviousness conclusion in view of Knip by concluding that, even if Knip's power density did not fall within the claimed power density range, power density is a result-effective variable. *See id.* at *23–27.

Raytheon appealed to this court. We have jurisdiction under 28 U.S.C. § 1295(a)(4)(A).

DISCUSSION

Raytheon's appeal presents a single issue: whether the Board erred in finding Knip "enabling" of the claimed invention. According to Raytheon, the Board improperly focused only on whether Knip enables a skilled artisan to calculate the power density of Knip's contemplated, futuristic engine, rather than also considering whether Knip enables a skilled artisan to make the claimed invention. Raytheon argues that, when viewed under the proper legal standard, nothing in the record demonstrates that Knip enables a skilled artisan to make the claimed invention. We agree.

A

"Whether a prior art reference is enabling is a question of law based upon underlying factual findings." *Minn. Mining & Mfg. Co. v. Chemque, Inc.*, 303 F.3d 1294, 1301 (Fed. Cir. 2002). We review the Board's legal conclusions *de novo* and its underlying factual determinations for substantial evidence. *See In re Gartside*, 203 F.3d 1305, 1316 (Fed. Cir. 2000).

To render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention. *See In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005). In general, a prior art reference asserted under § 103 does not necessarily have to enable its own disclosure, i.e., be "self-enabling," to be relevant to the obviousness inquiry. *See Symbol Techs., Inc. v. Opticon, Inc.*, 935 F.2d 1569, 1578 (Fed. Cir. 1991) ("While a reference must enable someone to practice the invention in order to anticipate under § 102(b), a non-enabling reference may qualify as prior art for the purpose of determining obviousness under § 103."); *Beckman Instruments Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989) ("Even if a reference discloses an inoperative device, it is prior art for all that it teaches."). For example, a reference that does not provide an enabling disclosure for a particular claim limitation may nonetheless furnish the motivation to combine, and be combined with, another reference in which that limitation is enabled. *See Apple Inc. v. Int'l Trade Comm'n*, 725 F.3d 1356, 1365–66 (Fed. Cir. 2013). Alternatively, such a reference may be used to supply claim elements enabled by other prior art or evidence of record. *See Comcast Cable Commc'ns Corp. v. Finisar Corp.*, 571 F. Supp. 2d 1137, 1145 (N.D. Cal. 2008), *aff'd sub nom. Comcast Cable Commc'ns, LLC v. Finisar Corp.*, 319 F. App'x 916 (Fed. Cir. 2009).[5]

But even though a non-enabling reference can play a role in an obviousness analysis, the evidence of record must still establish that a skilled artisan could have made the claimed invention. As the Sixth Circuit aptly explained:

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[5] *Comcast* presents an example where a prior art reference that was not enabled at the time of the publication became enabled at a later date through advances in technology. *See id.*

> The enabling disclosure concept [for a prior art reference] is a commonsense factor in making a determination of obviousness, for if neither any item of prior art, nor the background knowledge of one with ordinary skill in the art, would enable one to arrive at an invention, that invention would not be obvious. But to argue, as does [the patentee], that the sufficiency of each prior art teaching must be tested under the strict standard requiring an enabling disclosure is to shift the emphasis from obviousness in light of the prior art, taken as a whole, to the sufficiency of each prior art teaching separately considered.

Minn. Mining & Mfg. Co. v. Blume, 684 F.2d 1166, 1173 n.10 (6th Cir. 1982); *see also Beckman*, 892 F.2d at 1551 (citing *Minn. Mining* with approval).

In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon. *See Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 (Fed. Cir. 1985) ("The test of whether a particular compound described in the prior art may have been relied upon to show that the claimed subject matter at issue would have been obvious is whether the prior art provided an enabling disclosure with respect to the disclosed prior art compound."); *In re Hoeksema*, 399 F.2d 269, 274 (CCPA 1968) ("[I]f the prior art of record fails to disclose or render obvious a method for making a claimed compound . . . it may not be legally concluded that the compound itself is in the possession of the public [or obvious]."). In this context the reference must necessarily enable the relied-upon portion of its own disclosure—the same standard applied to anticipatory references. *In re Antor Media Corp.*, 689 F.3d 1282, 1290 (Fed. Cir. 2012) ("[A] prior art reference need not enable its full disclosure; it only needs to enable the portions of its disclosure alleged to anticipate the claimed invention.").

B

We agree with Raytheon that the Board legally erred in its prior art enablement analysis. Here, the only prior art or other evidence GE relied on to establish that one of skill in the art would have been able to make a turbofan engine with the claimed power density was the Knip reference. But rather than determining whether Knip enabled a skilled artisan to make and use the claimed invention, *see Kumar*, 418 F.3d at 1368, the Board focused only on "whether [a skilled artisan] is provided with sufficient parameters in Knip to determine, without undue experimentation, a power density . . . ." *See Gen. Elec.*, 2020 WL 859443, at *7. This error propagates throughout the Board's enablement analysis, *see id.* at *7–10, which fails to address whether Knip enables the claimed invention.

The Board defended its overly cramped inquiry by noting that the claims at issue do not require the advanced materials recited by Knip. *See id.* at *7. Thus, according to the Board, whether Knip's advanced engine had been or could be implemented "is not the proper consideration." *See id.* (rejecting Raytheon's argument that Knip's advanced engine must be "physically achievable based on the reference's disclosure itself"); *id.* at *9 ("[E]nablement does not require that Knip's advanced engine was actually implemented." (citing *Beckman*, 892 F.2d at 1551)). On appeal, GE echoes the Board's statements and goes further, claiming that "it is irrelevant whether Knip actually enables a [skilled artisan] to build the specific engine contemplated by Knip." *See* Appellee's Br. at 45. That position may have carried the day if GE had presented other evidence to establish that a skilled artisan could have made the claimed turbofan engine with the recited power density. But no such other evidence was presented.

Thus, Knip's self-enablement (or lack thereof) is not only relevant to the enablement analysis, in this case it is dispositive. GE does not contend that the '751 patent's

turbofan engine is enabled by other prior art or evidence of record. Instead, GE relies solely on Knip's disclosure. *See, e.g.*, Appellee's Br. at 48, 51. At oral argument, counsel for GE asserted that the Board determined, based on GE's expert's analysis, that Knip's engine could have been in fact "successfully constructed, and therefore is enabled with respect to the claimed invention." *See* Oral Arg. at 27:19–29:00 (citing J.A. 42–44, 781). We disagree that the Board made such a finding. Moreover, GE neglected to mention that what its expert "constructed" was a computer model simulation of Knip's imagined engine, *see* J.A. 781, not a physical working engine. GE's expert never suggested that a skilled artisan could have actually built such an engine.

In contrast, Raytheon presented extensive, unrebutted evidence of non-enablement. Raytheon submitted and relied on a declaration from Dr. Williams, a professor of materials science, detailing the unavailability of the revolutionary composite material contemplated by Knip. *See* J.A. 4853–68, 6291–311. Additionally, Raytheon submitted evidence that the exceptional temperature and pressure parameters cited in Knip had not been achieved through other means as of the priority date. *See* J.A. 4856–58 (citing the supplemental declaration of Dr. Spakovsky (J.A. 4913–22)). Raytheon's unrebutted evidence that Knip fails to enable a skilled artisan to physically make Knip's advanced engine is conclusive, given that this was the only evidence GE presented for why a skilled artisan could achieve the claimed power density.

In sum, we conclude that GE failed to provide an evidence-based case for how the turbofan engine claimed in the '751 patent having a particular power density is enabled by Knip's disclosure. Thus, the Board's finding that Knip is "enabling" is legal error.

C

GE's back-up argument that the Board's decision can be affirmed on the basis of its result-effective variable

finding suffers from the same enablement-based flaw. Even if the Board were correct that power density and other performance characteristics are variables a skilled artisan would want to optimize, GE's argument is predicated on a skilled artisan "modify[ing] the thrust and/or turbine volume for Knip's engine to optimize the power density." *See* J.A. 726. If a skilled artisan cannot make Knip's engine, a skilled artisan necessarily cannot optimize its power density.

CONCLUSION

We have considered GE's remaining arguments and find them unpersuasive. For the reasons set forth above, we reverse the Board's decision finding claims 3 and 16 of the '751 patent unpatentable as obvious.

REVERSED