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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* JORGE I. FARAH, KALPENDU J. PAREKH, and  
CONSTANTINE BALTAS

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Appeal 2020-000455  
Application 15/134,653  
Technology Center 3700

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Before MICHAEL L. HOELTER, BRETT C. MARTIN, and  
JEREMY M. PLENZLER, *Administrative Patent Judges*.

HOELTER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Pursuant to 35 U.S.C. § 134(a), Appellant<sup>1</sup> appeals from the Examiner's decision to reject claims 1, 2, 5, 7–9, 14–16, 18, 19, and 21–25, which constitute all the claims pending in this application. Claims 3, 4, 6, 10–13, 17, and 20 have been cancelled. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM IN PART.

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<sup>1</sup> We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as United Technologies Corporation. *See* Appeal Br. 1.

CLAIMED SUBJECT MATTER

The disclosed subject matter relates to “[a] gas turbine engine [which] typically includes a fan section, a compressor section, a combustor section and a turbine section.” Spec. ¶2. Apparatus claims 1 and 9, and method claim 16, are independent. Claim 1 is illustrative of the claims on appeal, and is reproduced below.

1. A gas turbine engine comprising:
  - a fan situated at an inlet of a bypass passage, the fan having a fan diameter,  $D_{fan}$ ;
  - a low pressure turbine section configured to drive the fan and a first compressor section, the low pressure turbine section having a greater number of stages than the first compressor section, wherein the high pressure turbine section includes two stages and the first compressor section includes three stages, and the low pressure turbine section having a maximum rotor diameter,  $D_{turb}$ ;
  - a high pressure turbine section configured to drive a second compressor section; and wherein a ratio of the maximum rotor diameter  $D_{turb}$  divided by the fan diameter  $D_{fan}$  is less than 0.6.

EVIDENCE

Name	Reference	Date
White	US 3,034,298	May 15, 1962
Lee et al. (“Lee”)	US 2008/0112791 A1	May 15, 2008

Joachim Kurzka, *Fundamental Differences Between Conventional and Geared Turbofans*, ASME, pp. 145–53 (2009) (“Kurzka”).

Mark H. Waters, et al., *Analysis of Turbofan Propulsion System Weight and Dimensions*, NASA Technical Memorandum (January, 1977) (“Waters”).

## REJECTIONS

Claims 2, 9, 14–16, 18, 19, and 23–25 are rejected under 35 U.S.C. § 112 (pre-AIA), first paragraph, as failing to comply with the enablement requirement.

Claims 2, 5, 9, 14–16, 18, 19, and 23–25 are rejected under 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite.

Claims 1, 2, 5, 9, 16, 18, and 19 are rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Kurzka, Waters, and Lee.

Claims 7, 8, and 21–25 are rejected under pre-AIA 35 U.S.C. § 103(a) as unpatentable over Kurzka, Waters, Lee, and White.

## ANALYSIS

*The rejection of claims 2, 9, 14–16, 18, 19, and 23–25 as failing to comply with the enablement requirement*

Each of these claims includes the limitation of “a bypass ratio of greater than 10,” a bypass ratio that “is greater than 6,” or the like. The Examiner concludes that because these limitations “are not bounded at an upper limit,” they therefore include “ratios ranging from the lower bounds to infinity.” Final Act. 2; *see also* Ans. 3. As a consequence, “[t]he disclosure as originally filed does not enable such large bypass ratios.” Final Act. 2.

In reaching this conclusion, the Examiner addresses such factors as breadth of the claims, nature of the invention, state of the prior art, and the level of ordinary skill in the art (the latter possessing “a master’s degree with an average of twenty years[ of] experience”). *See* Final Act 2–3 (referencing *In re Wands*, 858 F.2d 731 (Fed. Cir. 1988)). The Examiner also addresses the guidance outlined in *Scripps Clinic & Research Foundation v. Genetech, Inc.*, 927 F.2d 1565 (Fed. Cir. 1991) (*see* Final Act. 3–5), concluding that

Appellant's Specification "lacks such full, clear, concise and exact terms to enable any person skilled in the art . . . to make and use the invention without undue experimentation." Final Act. 5.

Appellant also references *Scripps Clinic*, but focuses on the portion thereof stating:

Open-ended claims are not inherently improper; as for all claims their appropriateness depends on the particular facts of the invention, the disclosure, and the prior art. They may be supported if there is an inherent, albeit not precisely known, upper limit and the specification enables one of skill in the art to approach that limit.

*Scripps Clinic*, 927 F. 2d at 1572; Appeal Br. 4. Appellant contends the Examiner's analysis "is improperly guided by the presumption that the claims do not include an inherent upper limit." Appeal Br. 4. Instead, Appellant contends, "[t]he minimum amount of airflow required to operate the engine provides an inherent practical upper limitation to the claimed bypass ratio." Appeal Br. 5; *see also* Reply Br. 2. Appellant also contends that one skilled in the art "would understand that the blades 42 and the flowpaths must fit within the surrounding structure, again, making an infinite bypass area ratio unachievable." Appeal Br. 5; *see also* Reply Br. 1. Additionally, Appellant references MPEP § 2164.01 which states, "[t]he fact that experimentation may be complex does not necessarily make it undue, if the art typically engages in such experimentation." Appeal Br. 5.

Appellant also references a Board decision addressing a similar enablement rejection concerning a gas turbine engine, this decision stating:

Although we appreciate the Examiner's observation that the open-ended ranges recited in the claims are broad enough to theoretically encompass numerical values for pressure ratio, gear reduction ratio, and bypass ratio that may be beyond

current technological capabilities (*see* Ans. 2), **we agree with Appellants that one of ordinary skill in the art would recognize that “the upper limit for each of the claimed ranges is bounded by known practical structural and physical limits.”**

*Ex parte Kohlenberg*, Appeal No. 2017-00822 (App. No. 13/340,787, decided 6/8/2018) (emphasis added); Appeal Br. 6.

Although we are not bound by the holding in *Kohlenberg* (*see* Ans. 4), we find its analysis compelling, along with Appellant’s other contentions expressed above. Regarding the *Wands* factors noted by the Examiner, which address the breadth, nature, state of the art, and level of skill of the claimed subject matter, the apparatus addressed is a gas turbine engine, which is a highly complex machine. The Examiner finds that the level of predictability associated with such a device (another *Wands* factor) is “extremely low.” Final Act. 3. We disagree because these complex machines are highly engineered to exacting standards by very skilled persons (*see* above). Thus, although the design and construction of such a device may take years to complete (i.e., “a design cycle of at least 15 to 25 years”), this long duration does not necessarily reduce the predictability of the final product, as asserted by the Examiner. *See* Final Act. 3. Instead, allowing such skilled persons to work on the product for such a long time would actually seem to enhance its predictability. Consequently, this and the other *Wands* factors (*see also Scripps Clinic*) would appear to be contrary to the Examiner’s finding of no enablement.

Further, and specific to the Examiner’s discussion of undue experimentation (*see* Final Act. 2–5, Ans. 3–4), it is not clear how the determination of “a bypass ratio of greater than” a certain number is “undue” or would involve “undue experimentation” to calculate, even if doing so was

somewhat complex. *See* MPEP § 2164.01. Hence, an inherent limit is not the same as a possible theoretical limit the Examiner seems to address. *See* Appeal Br. 4.

Accordingly, and for the reasons expressed above, we do not sustain the Examiner’s rejection of claims 2, 9, 14–16, 18, 19, and 23–25 as failing to comply with the enablement requirement.

*The rejection of claims 2, 5, 9, 14–16, 18, 19, and 23–25  
as being indefinite*

The Examiner provides two reasons why these claims are indefinite. *See* Final Act. 6–7. The Examiner initially focuses on only those claims that include a “greater than” limitation (i.e., claims 2, 9, 14–16, 18, 19, 23–25). *See* Final Act. 6–7. The Examiner states “‘greater than’ is indefinite as it is not bounded at its upper limit.” Final Act. 6, 7. The Examiner additionally focuses on the entire group of rejected claims as reciting “a method of using the apparatus.” *See* Final Act. 6–7. The Examiner reasons these claims are indefinite because such claims contain a “greater than” or a “less than” limitation (or both), and as such, “[a] single claim which claims both an apparatus and the method steps of using the apparatus is indefinite.” Final Act. 6, 7 (referencing *In re Katz Interactive Call Processing Patent Litigation*, 639 F.3d 1303 (Fed. Cir. 2011)); *see also* Ans. 4.

Appellant also addresses both reasons relied upon by the Examiner. *See* Appeal Br. 6–8. Regarding the Examiner’s open-ended rationale, Appellant states that the lack of an upper bound “does not render the claims indefinite; at most they are broad.” Appeal Br. 6; *see also* Reply Br. 2 (referencing *In re Fisher*, 427 F.2d 833 (CCPA 1970) (“the absence of a limitation ‘does not render the claim indefinite’”). Further, consistent with

the discussion above regarding enablement, Appellant states, “there are practical and inherent physical upper limits to the claimed bypass ratios” thereby not rendering them indefinite. Appeal Br. 7. Appellant also references *Exxon Research & Eng’g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001) (abrogated on other grounds, 134 S. Ct. 2120 (2014)) (see Appeal Br. 7) wherein our reviewing court stated, with respect to that case, “[t]he claims do not contain any limitation on maximum particle size, and no limitation is required as a matter of definiteness.” *Id.* at 1382.

Additionally, we are guided by MPEP § 2173 which states, “[t]he primary purpose of this requirement of definiteness of claim language is to ensure that the scope of the claims is clear so the public is informed of the boundaries of what constitutes infringement of the patent.” *See also* Ans. 4. Here, the lack of an upper boundary is no indication the public is unable to ascertain whether a certain ratio is “greater than” a recited number or not.

Regarding the Examiner’s alternate ‘method and apparatus’ rationale, with respect to Appellant’s apparatus claims, Appellant states that such “claims in the present application recite a structural system capability and not an active method step.” Appeal Br. 8. In other words, “*Katz* is not applicable here, as there is no recited user action *or any method step in the claims.*” Appeal Br. 8 (emphasis added). With respect to Appellant’s method claims, our reviewing court has provided guidance that “[m]ethod claim preambles often recite the physical structures of a system in which the claimed method is practiced.” *Microprocessor Enhancement Corp. v. Texas Instruments Inc.*, 520 F.3d 1367, 1374–75 (Fed. Cir. 2008). In any event, we are not persuaded that the recitation of either or both a “greater than” or a “less than” limitation renders that limitation a method step, thereby



warranting the guidance by our reviewing court discussed in *Katz*. *See also* Reply Br. 2.

Accordingly, and based on the record presented, we do not sustain the Examiner’s rejection of claims 2, 5, 9, 14–16, 18, 19, and 23–25 as being indefinite.

*The rejection of claims 1, 2, 5, 9, 16, 18, and 19  
as unpatentable over Kurzka, Waters, and Lee*

Appellant argues these claims (i.e., claims 1, 2, 5, 9, 16, 18, and 19) together. *See* Appeal Br. 8–9. We select claim 1 for review, with the remaining claims standing or falling with claim 1. *See* 37 C.F.R. § 41.37(c)(1)(iv).

Claim 1 recites, “the first compressor section includes three stages” and also, “the low pressure turbine section having a greater number of stages than the first compressor section.”<sup>2</sup>

The Examiner primarily relies on the teachings of Kurzka (referencing column 4 of Table 2 thereof) but indicates that Kurzka does not teach “using 3 first compressor stages, wherein there are more LPT stages than first compressor stages.”<sup>3</sup> Final Act. 8–9. The Examiner relies on Paragraph 55

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<sup>2</sup> Regarding the scope of the recited “first compressor section,” Appellant’s specification provides guidance that “[a]ir entering the compressor section is compressed and delivered into the combustion section.” Spec. ¶ 2. We thus understand “first compressor section” as being where air is compressed prior to its use for combustion.

<sup>3</sup> We note, however, that column 1 of Table 2 of Kurzka discloses employing “3” booster stages and “5” LPT stages. Kurzka, page 152. We further note that Kurzka teaches, “[t]he single stage fan is followed by a number of booster stages with a combined pressure ratio of 2.8.” Kurzka, page 147. Hence, we understand air enters the booster stages and is further compressed, consistent with the recited “first compressor section.”

of Lee for teaching “increasing the number of turbine stages in a gas turbine engine.” Final Act. 9.

Appellant contends, “Lee does not teach increasing the number of turbine stages” and “[t]he Examiner has not identified any part of Lee that teaches increasing turbine stage counts.” Appeal Br. 9; *see also* Reply Br. 2. To be clear, Paragraph 55 of Lee states, “the turbine stages decrease pressure and temperature of the combustion gas for extracting energy therefrom.” *See also* Ans. 4. Based on this teaching of turbine stages extracting energy from the combustion gas, the Examiner explains, “increasing the number of turbine stages will further [permit] **extracting more energy from the combustion gas.**” Ans. 4. Appellant challenges this increase in the number of turbine stages because of the additional weight this will entail. *See* Appeal Br. 9; Reply Br. 2–3. However, Kurzka teaches that “the weight penalty for the 9 stage LPT is not as large as might be expected.” Kurzka, page 148; *see also* Ans. 5. Thus, if the weight penalty for a nine-stage LPT is not so large, then it follows that the weight penalty for a fewer number of stages (but more than 3) would be even less. In view of such teachings, we are not persuaded that “Kurzk[a] teaches away” from increasing turbine stage count as Appellant contends. Appeal Br. 9 (“Kurzk[a] notes that there is a weight penalty for higher stage counts” and “weight increase is against convention[al] wisdom”); *see also* Ans. 5, 6.

Accordingly, and based on the record presented, we are not persuaded the Examiner relied on “impermissible hindsight reconstruction” or that “[t]he Examiner has not made a *prima facie* case of obviousness” as Appellant argues. Appeal Br. 9; Reply Br. 3. We sustain the Examiner’s

rejection of claims 1, 2, 5, 9, 16, 18, and 19 as unpatentable over Kurzka, Waters, and Lee.

*The rejection of claims 7, 8, and 21–25  
 as unpatentable over Kurzka, Waters, Lee, and White*

Appellant does not present separate arguments to rebut this rejection. See Appeal Br. 9–10. Appellant, instead, states, “[t]he addition of the teachings of White does not overcome the above noted deficiencies with respect to Kurzka, Waters, and Lee and base claim 1.” Appeal Br. 10. Accordingly, we also sustain the Examiner’s rejection of claims 7, 8, and 21–25 as being obvious over Kurzka, Waters, Lee, and White.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
2, 9, 14–16, 18, 19, 23–25	112 ¶ 1	Enablement		2, 9, 14–16, 18, 19, 23–25
2, 5, 9, 14–16, 18, 19, 23–25	112 ¶ 2	Indefinite		2, 5, 9, 14–16, 18, 19, 23–25
1, 2, 5, 9, 16, 18, 19	103(a)	Kurzka, Waters, Lee	1, 2, 5, 9, 16, 18, 19	
7, 8, 21–25	103(a)	Kurzka, Waters, Lee, White	7, 8, 21–25	
<b>Overall Outcome<sup>4</sup></b>			1, 2, 5, 7–9, 16, 18, 19, 21–25	14, 15

<sup>4</sup> 37 C.F.R. § 41.50(a)(1) states: “The affirmance of the rejection of a claim on any of the grounds specified constitutes a general affirmance of the decision of the examiner on that claim.”

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED IN PART