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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* ROBERT FRANK HOSKIN and
BALACHANDAR NAIDU[1]

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Appeal 2019-001841
Application 13/945,786
Technology Center 3700

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Before: JILL D. HILL, LEE L. STEPINA, and ARTHUR M. PESLAK, *Administrative Patent Judges*.

STEPINA, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1–6, 21–31, and 33–35. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

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[1] The Appeal Brief identifies General Electric Company, Appellant, as the real party in interest. Appeal Br. 2.

## CLAIMED SUBJECT MATTER

The claims are directed to a system for regulating emissions produced by a gas turbine engine system. Spec. ¶¶ 1, 2. Sole independent claim 1, reproduced below with emphasis added, illustrates the claimed invention.

> 1. A system, comprising:
>
> a gas turbine engine configured to produce exhaust gas with a first level of an emissions compound;
>
> a selective catalytic reduction system configured to produce processed exhaust gas from the exhaust gas by reducing a level of the emissions compound from the first level of the emissions compound in the exhaust gas to a second level of the emissions compound in the processed exhaust gas, wherein the selective catalytic reduction system is designed with a maximum capacity sufficient to handle a maximum demand of emissions reduction for the gas turbine engine; and
>
> a control system, comprising:
>
> a first controller configured to regulate operation of the selective catalytic reduction system; and
>
> a second controller configured to regulate operation of the gas turbine engine;
>
> wherein the control system is configured to change operation of the gas turbine engine resulting in an available, unused capacity of the selective catalytic reduction system for reducing the level of the emissions compound in the exhaust gas from the first level to the second level, wherein the available, unused capacity is a portion of the maximum capacity, wherein the control system is configured to coordinate operation of the selective catalytic reduction system and the gas turbine engine based on the available, unused capacity of the selective catalytic reduction system to simultaneously:
>
> *control one or more parameters of the gas turbine engine to improve at least one operational feature of the gas turbine engine while causing an increase in the first level of the emissions compound in the exhaust gas produced by the gas turbine engine*; and regulate injection of a reductant into the selective catalytic reduction system to handle the increase in the first level using the available, unused capacity of the selective

> catalytic reduction system and to achieve a first desired value for the second level of the emissions compound.

Appeal Br. 22 (Claims App.).

## REFERENCES

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

| | | |
|---|---|---|
| Watanabe | US 4,751,054 | June 14, 1988 |
| Ziminsky | US 7,441,398 B2 | Oct. 28, 2008 |
| Wang | US 8,469,141 B2 | June 25, 2013 |
| Wills | US 2009/0272101 A1 | Nov. 5, 2009 |
| Zhang | US 2013/0098056 A1 | Apr. 25, 2013 |
| Kagolanu | US 2014/0202166 A1 | July 24, 2014 |

## REJECTIONS

I. Claims 1–6, 21–31, and 33–35 are rejected under 35 U.S.C. § 112(b) as being indefinite. Final Act. 2.

II. Claims 1, 3, 4, 21–28, and 33 are rejected under 35 U.S.C. § 103 as unpatentable over Wills, Watanabe, and Kagolanu. Final Act. 4.

III. Claims 2, 5, 6, 29–31, 34, and 35 are rejected under 35 U.S.C. § 103 as unpatentable over Wills, Watanabe, Kagolanu, Zhang, Ziminsky, and Wang. Final Act. 17.

## OPINION

*Rejection I – Indefiniteness*

*Claim 1*

The Examiner finds that the limitation "configured to . . . control one or more parameters of the gas turbine engine to improve at least one operational feature of the gas turbine" renders the claim indefinite because

the phrase "improve at least one operational feature" is subjective. Final Act. 2 (quoting Appeal Br. 22 (Claims App.)). According to the Examiner, "the specification does not provide a reasonably clear and exclusive definition for what is considered an improvement, leaving the subjective claim language without an objective boundary." *Id.* at 3.

Appellant argues that the Specification provides examples of an improvement, and "the boundaries of what is considered an improvement to at least one operational feature of the gas turbine engine would be understood by one of ordinary skill in the art when independent claim 1 is read in light of the specification." Appeal Br. 7; *see also* Reply Br. 6–7.

The Examiner responds that, although the Specification provides some examples of improvements to operational features, other "potential improvements exist," and thus the Specification does "not limit the scope of the claims." Ans. 3.

In the Summary of Claimed Subject Matter of Appellant's Appeal Brief, Appellant relies on "FIGS. 1 and 3; paragraphs [0016], [0021], [0023], [0032], [0039], and [0040]," in support of the limitation "improve at least one operational feature of the gas turbine engine." Appeal Br. 4. Paragraph 16 of Appellant's Specification discloses that "fuel system operation may be adjusted … or other operating parameters of the gas turbine system may be adjusted or improved to reduce combustion dynamics (e.g., acoustic and/or pressure oscillations) and thereby reduce mechanical and thermal fatigue to combustor and/or turbine hardware." Spec. ¶ 16. Paragraph 21 discloses that "at less than full gas turbine engine 12 loads, the additional or unused NOx reduction capacity of the SCR system 30 may be utilized to improve combustor 24 operation and life by reducing the usage of other emissions

control measures in the combustors." Spec. ¶ 21. Paragraphs 23, 32, and 40 do not appear to disclose any "improvement." Paragraph 39 discloses that "the control system 46 may be configured to utilize available NOx reduction capacity of the SCR system 30 to reduce NOx emission levels, such that other emissions control measures may be reduced to improve performance, efficiency, longevity, and/or power output of the gas turbine engine 12." Spec. ¶ 39.

Although Appellant's Specification discloses improvements to certain quantities, the Specification does not characterize these as related to an "operational feature," indeed, this term is absent from the Specification and original claims.

Paragraph 16 discloses that one improvement is "to reduce combustion dynamics (e.g., acoustic and/or pressure oscillations) *and thereby reduce* mechanical and thermal fatigue to combustor and/or turbine hardware." *Id.* Based on the lack of the term "operational feature" in the Specification, it is unclear whether the reduction in "combustion dynamics (e.g., acoustic and/or pressure oscillations)" is an operational feature that is improved or that the feature this reduction *consequently* improves is considered the operational feature.

Paragraph 16 also discloses that "[a]dditionally, performance, power output, and efficiency of the turbine system may be improved." Spec. ¶ 16. Because paragraph 16 discloses improvements in the operating parameters to provide an effect, it is unclear whether the phrase "may be improved" refers to improvements to the operating parameters, or whether "performance, power output, and efficiency of the turbine system," are operational features that may be improved. Paragraph 39 similarly states "other emissions

control measures may be reduced to improve performance, efficiency, longevity, and/or power output of the gas turbine engine 12," and does not link this disclosure to "operational features." Spec.¶ 39. Paragraph 39 discloses adjusting operating parameters of the gas turbine engine 12 "while reducing mechanical and thermal fatigue to combustor hardware, increasing lean blow out margins, reducing turndown load, reducing other emissions compounds (e.g., CO), and so forth," but again does not link this disclosure to "operational features." *Id.*

The statement in paragraph 21, that "the SCR system 30 may be utilized to improve combustor 24 operation and life by reducing the usage of other emissions control measures in the combustors," appears to disclose that "combustor 24 operation and life" is the improved characteristic, and that "reducing the usage of other emissions control measures in the combustors," is an operational feature that is controlled to achieve the improvement. As such, paragraph 21 appears to disclose the same thing as paragraph 16, just in a different manner. That is, the paragraph 16 disclosure of reducing mechanical and thermal fatigue to combustor and/or turbine hardware, causes improved combustor operation and life. Thus, paragraph 21 does not shed any additional light on the meaning of the term "operational feature" or what an improvement of an operational feature may be.

Accordingly, the Specification does not provide a skilled artisan with adequate guidance on how the term "operational feature" should be construed.

Looking to the claims, claim 2 recites, in part, control of one or more gas turbine engine parameters

> *to improve* the at least one operational feature of the gas turbine engine, *comprising* control of the one or more parameters to increase a life of hardware or parts of the gas turbine engine, increase a lean blowout margin of the gas turbine engine, reduce combustor trips or flame out in the gas turbine engine, or reduce a load turndown of the gas turbine engine.

Appeal Br. 23 (Claims App., emphasis added).

Claim 5 recites control of one or more gas turbine engine parameters "to *improve* the at least one operational feature of the gas turbine engine, *comprising* control of the one or more parameters to reduce at least one of combustion dynamics, acoustic or pressure oscillations, vibrations, or fatigue in the gas turbine engine," and claim 6 recites similar control "*to improve* the at least one operational feature of the gas turbine engine, *comprising* control of the one or more parameters to increase the life of hardware or parts of the gas turbine engine." *Id.* (emphasis added).

Taking each of the above underlined limitations of claims 2, 5, and 6 to be an "operational feature," it is still unclear what is considered an *improvement to* the operational feature.

For example, according to claim 5, improving an operational feature appears to include, reducing (i) combustion dynamics, (ii) acoustic oscillations, or (iii) pressure oscillations. However, paragraph 16 of the Specification states that "the gas turbine system may be adjusted or improved to reduce combustion dynamics (e.g., acoustic and/or pressure oscillations)." Spec. ¶ 16. Thus, contrary to the language of claim 5, this portion of the Specification discloses that acoustic and pressure oscillations *are combustion dynamics*, not alternatives.

Appellant asserts that "if the claim is subject to construction, i.e., it is not insolubly ambiguous, it is not invalid for indefiniteness." Appeal Br. 5 (citing *Honeywell Int'l, Inc. v. Int'l Trade Comm'n*, 341 F.3d 1332, 1338–39 (Fed. Cir. 2003). However, whether a claim is "insolubly ambiguous" is not the standard to determine indefiniteness. A claim fails to comply with 35 U.S.C. § 112, second paragraph, "when it contains words or phrases whose meaning is unclear." *In re Packard*, 751 F.3d 1307, 1310, 1322 (Fed. Cir. 2014) (Plager, J., concurring) (Approving, for pre-issuance claims, the standard from MPEP § 2173.05(e) (Nov. 2013).); *see also Ex parte McAward*, Appeal 2015-006416, 2017 WL 3669566, at 5 (PTAB Aug. 25, 2017) (precedential) (Adopting the approach for assessing indefiniteness approved by the Federal Circuit in *Packard*.). Our reviewing court instructs us that an applicant "is in the best position to resolve the ambiguity in the patent claims, and it is highly desirable that patent examiners demand that applicants do so in appropriate circumstances so that the patent can be amended during prosecution rather than attempting to resolve the ambiguity in litigation." *Halliburton Energy Servs. v. M-I LLC*, 514 F.3d 1244, 1255 (Fed. Cir. 2008).

In light of the lack of clarity in the meaning of the term "operational feature," we agree with the Examiner that the above-noted portions of the Specification "merely provide specific, non-limiting examples of improvements[,] the specification does not provide a special definition for 'improve' and it is abundantly clear that these exemplary improvements do not limit the scope of the claims." Ans. 3.

We do not find persuasive Appellant's argument that the term "improvement" is merely broad, not indefinite. Appeal Br. 8; *see also* Reply

Br. 6. Other than the above-noted "reduced combustion dynamics" (which is unclear as to whether this includes acoustic or pressure oscillations (compare Spec. ¶ 16 and claim 5)), Appellant broadly defines "improvement" as that which is improved. This contention is contradicted by Appellant's argument against the prior art rejection. Specifically, in addressing the rejection of claim 1 as unpatentable over Wills, Watanabe, and Kagolanu, Appellant argues that "controlling combustion conditions to allow reduced NOx mass flow variation in the exhaust out of the of the gas turbine engine," as disclosed by Kagolanu, does not qualify as an improvement of an operational feature. Reply Br. 16. Thus, in contesting the rejection over Wills, Watanabe, and Kagolanu, Appellant urges the use of a *narrow* definition of the term "control one or more parameters of the gas turbine engine to improve at least one operational feature of the gas turbine engine." Specifically, Appellant asserts that this term excludes changes to combustion conditions that allow reduced NOx flow variation. Appellant does not explain how the term "improve at least one operational feature" in claim 1 can be both broad enough to be consistent with Appellant's Specification, and, at the same time, narrow enough to exclude the disclosure in Kagolanu the Examiner finds meets the broadest reasonable interpretation of this term.

For the reasons discussed above, we agree with the Examiner that the term "to improve at least one operational feature," under the broadest reasonable interpretation of claim 1, when read in light of the Specification, is vague and unclear, and a person having ordinary skill in the art would not be able to discern the metes and bounds of the claimed invention in light of this claim language. Appellant fails to provide a satisfactory response that apprises us of error in the Examiner's rejection. Accordingly, we sustain the

rejection of claim 1 under 35 U.S.C. § 112, second paragraph, as indefinite for failing to particularly point out and distinctly claim Appellant's invention. Claims 2–6, 21–31, and 33–35 depend from claim 1, and are indefinite for the same reasons.

*Claims 2, 5, 6, and 33–35 (additional bases for indefiniteness rejection)*

The Examiner determines that claims 2, 5, 6, and 33–35 are also indefinite because claim 1 recites that the control system controls one or more parameters of the gas turbine engine to improve an operational feature, and it is not apparent whether the same recitation appearing in the dependent claims "impose[s] additional limits on the dependent claims." Ans. 3. For Example, claim 6 first recites "wherein the control system is configured to control the one or more parameters of the gas turbine engine to improve the at least one operational feature of the gas turbine engine," which duplicates some of the language from claim 1. Appeal Br. 22, 23 (Claims App.). Claim 6 then recites "comprising control of the one or more parameters to increase the life of hardware or parts of the gas turbine engine." *Id.* at 23.

The Examiner states that it is unclear whether the limitations in the above-noted dependent claims are an additional improvement or further defines the improvement. *Id.*; *see also* Ans. 4.

Appellant argues that because the improvement phrase is followed by "comprising," it is clear that "the claimed control of one or more parameters of the gas turbine engine comprises controlling the parameters to achieve the subsequently recited feature." Appeal Br. 9; *see also* Reply Br. 8.

Appellant has the better position. We agree with the Examiner that these dependent claims include much redundant language. However,

because the repeated limitation "the control system is configured to control the one or more parameters of the gas turbine engine to improve the at least one operational feature of the gas turbine engine," is followed by "comprising" (which we interpret as "including, but not limited to"), we agree with Appellant that one of ordinary skill in the art would understand that the entire phrase before "comprising" merely refers back to the claim 1 recitation of this phrase in order to recite what control of the one or more parameters will achieve in the dependent claims. Thus, the limitations in claims 2, 5, 6 and 33–35 *further define* the control system, and we do not agree with the Examiner's additional reason for rejecting these claims as indefinite.

*Claim 22*

The Examiner finds that claim 22 is indefinite for an additional reason, namely, the Examiner determines the limitation "control at least one operating parameter of the gas turbine engine to achieve the new second desired value" is unclear because it is not apparent whether this refers back to the one or more parameters of claim 1 or an additional operating parameter distinct from those of claim 1. Final Act. 3–4.

Because claim 22 recites "at least one," whether the recited parameter is the same or different is immaterial because both are within the scope of the claim. In other words, this aspect of claim 22 is merely broad (although the indefiniteness issue discussed regarding claim 1 applies to claim 22 as it does to claims 2, 5, 6 and 33–35).

*Claim 6*

The Examiner finds that because the limitation "the life" lacks sufficient antecedent basis, i.e., the first instance of the word "life" is preceded by the word "the," the claim is indefinite beyond the reasons for that discussed for claim 1. Final Act. 4.

We agree with Appellant that, because hardware parts "inherently include a life" (Appeal Br. 11), use of the word "the" before the first instance of the word "life" in claim 6 is not unclear. Accordingly, the Examiner erred in determining that claim 6 is indefinite for lack of antecedent basis.

*Claims 29–31*

First, the Examiner determines that claims 29–31 are additionally unclear (1) because it is not apparent whether the phrase "at least one operational feature" is intended to refer to the previous recitation of claim 1, or an additional instance. Final Act. 4.

Second, the Examiner determines (2) that the phrase "while causing the increase in the first level" is in conflict with the phrase "at least partially caused by," because it is not clear whether the limitation causes, or only partially causes the effect. *Id.*

As to issue (1), Appellant argues that one of ordinary skill in the art would understand that the limitations at issue in claims 29–31 refer to the previous instance "of claim 1, based at least in part on the correspondence between the two phrases." Appeal Br. 11; *see also* Reply Br. 10.

As to issue (2), Appellant contends that because the increase in the first level may be at least partially caused by the features of each claim of claims 29–31, "it is to be understood that the increase in the first level may be partially caused by the adjustment to one feature of claims 29–31, and

partially caused by the adjustment to another feature of claims 29–31." *Id.*; *see also* Reply Br. 11.

The Examiner responds that because "the" does not precede the pertinent language in the dependent claims (which would indicate that claim 1 provides antecedent basis), two distinct instances are recited.

As for the second issue, the Examiner considers the phrases "while causing" and "at least partially caused by" to be a broad limitation combined with a narrower limitation in a way that renders the claims indefinite.

As to issue (1), Appellant has the better position. Claim 1 recites, in part, "control one or more parameters of the gas turbine engine to improve at least one operational feature of the gas turbine engine." Appeal Br. 22 (Claims App.). Claims 29–31 each recites, in part, "control the one or more parameters of the gas turbine engine to improve at least one operational feature of the gas turbine engine by." *Id.* at 26–27. The Examiner only looks at the last part of this phrase, whereas the whole phrase needs to be considered. When the entire "control" phrase is considered, it is clear that "the" after "control" refers to the entire phrase that follows until "by," and the phrase that follows "by" is the particular parameter that is being controlled to improve the operational feature.

As to issue (2), the Examiner has the better position. Although we appreciate Appellant's argument that "the increase in the first level may be partially caused by the adjustment to one feature of claims 29–31, and further, partially caused by the adjustment to another feature of claims 29–31" (Reply Br. 11), the language of claim 29 is internally inconsistent. Specifically, the phrase "at least reducing water or steam injection into the gas turbine engine while causing the increase in the first level of the

emissions compound" implies either that (i) the reduction in water or steam injection causes an increase in the first level of emissions (i.e., the increase is wholly caused by the reduction), or (ii) that the reduction and increase merely occur at the same time. Next, the phrase "regulate the injection of the reductant into the selective catalytic reduction system to handle *the increase in the first level* at least *partially* caused by the reduction in the water or steam injection" (*id.* (emphasis added)) spells out that the same "increase the first level" only partially caused by the reduction and that an additional increase without an identified cause is present. Accordingly, we agree with the Examiner on this issue.

*Rejections II–III*

Some of the limitations at issue in the rejection of claims 1–6, 21–31, and 33–35 as indefinite are the same as those argued by Appellant in traversing the rejection of these claims as unpatentable over the prior art. *See* Appeal Br. 16–17; *see also* Reply Br. 15–16. Specifically, as discussed above, the Examiner finds that " controlling combustion conditions to allow reduced NOx mass flow variation in the exhaust out of the of the gas turbine engine constitutes the improvement to the operational feature of the gas turbine engine, which permits an advantageous reduce in ammonia slip of the SCR system." Ans. 16. Appellant argues, *inter alia*, that Kagolanu's "producing a constant mass of NOx is not the same as *improving at least one operational feature of the gas turbine engine while causing an increase in the first level of the emissions compound*," and that "reducing ammonia slip … [is] not an improved operational feature of *a gas turbine engine* as generally presently claimed." Appeal Br. 17. In view of our determination

that claims 1–6, 21–31, and 33–35 are indefinite, it follows that the prior art rejection of these claims must fall because the rejection is based necessarily on speculative assumptions as to the meaning of the claims. *See In re Steele*, 305 F.2d 859, 862–63 (CCPA 1962). It should be understood, however, that our decision in this regard is *pro forma* and based solely on the indefiniteness of the claimed subject matter, and does not reflect on the adequacy of the prior art evidence applied in support of the rejection.

## DECISION

We affirm the Examiner's rejection of claims 1–6, 21–31, and 33–35 under 35 U.S.C. § 112(b) as indefinite.

We reverse the Examiner's rejection of claims 1, 3, 4, 21–28, and 33 under 35 U.S.C. § 103 as unpatentable over Wills, Watanabe, and Kagolanu.

We reverse the Examiner's rejection of claims 2, 5, 6, 29–31, 34, and 35 under 35 U.S.C. § 103 as unpatentable over Wills, Watanabe, Kagolanu, Zhang, Ziminsky, and Wang.

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

AFFIRMED