

No. 98-201 C

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**EXXON RESEARCH AND
ENGINEERING CO.,**

Plaintiff,

v.

THE UNITED STATES,

Defendant,

Patent; Indefiniteness,
35 U.S.C. § 112, second
paragraph; Question of Law
without underlying questions
of fact; Fischer-Tropsch
technology.

* * * * *

Steven D. Glazer, James W. Quinn, David Lender, Peter Tu, Elizabeth S. Weiswasser,
New York, New York, and *Patrick J. Conlon,* Florham Park, New Jersey, for plaintiff.

Grace Karaffa, Commercial Litigation Branch, Civil Division, U.S. Department of
Justice, Washington, DC, for defendant, with whom were *Vito J. DiPietro,* Director, and
David W. Ogden, Acting Assistant Attorney General. *Thomas J. Byrnes, Richard T.*
Ruzich and Ken B. Barrett, U.S. Department of Justice, Washington, DC, of counsel.

OPINION

DAMICH, Judge.

The Plaintiff, Exxon Research and Engineering Co., alleges that the United States
infringed two patents, United States Patent Nos. 5,348,982 and 5,292,705. Both patents
concern the process for converting natural gas to premium quality hydrocarbons. More
specifically, the '705 patent concerns how to increase the efficiency of a catalyst used in a

*This published version corrects certain mistakes. The substance remains unchanged.

Fischer-Tropsch reaction.¹ The '982 patent concerns how to operate a slurry bubble column reactor most efficiently. The United States, through a motion for summary judgment, has challenged the validity of these patents because certain terms are indefinite. Because at least one term in each patent is indefinite, the Court grants the Defendant's motion.

Before analyzing each term that the government claims is indefinite, this opinion discusses the legal standards used in deciding a motion for summary judgment based on indefiniteness. This discussion explains that summary judgment is appropriate because there are no factual disputes and also explains what evidence the Court considered in its analysis. After these preliminary, but lengthy, comments, the decision considers the two patents, beginning with the '705 patent. Two terms are challenged in the '705 patent and ten terms are challenged for the '982 patent. (For some terms, the government offers more than one argument why the term is indefinite.) Although the discussion for each patent begins with a general description of the technology, a more detailed explanation of the technology is interspersed with the discussion of the particular terms.

I. Procedural Posture

The motion for summary judgment arose out of the Court's decision to consider the Defendant's assertion that the patents were indefinite separate from a hearing on claim construction. A claim construction hearing was scheduled for November 17, 1999. The parties submitted pre-hearing briefs in which the parties offered their constructions for disputed claim terms. During this briefing process, the Defendant determined that it could not propose a definition for certain terms because they were indefinite. Consequently, the Defendant argued that the patents were not valid.

Citing *KX Industries, L.P. v. Culligan Water Technologies, Inc.*, 46 F. Supp.2d 308, 340 (D. Del. 1999), and *Schering Corp. v. Amgen Inc.*, 18 F. Supp.2d 372, 379 n.13 (D. Del. 1998), Exxon maintained that the Court could not hear a challenge to validity, based on indefiniteness, during a claim construction proceeding. Exxon filed a motion to cancel the claim construction proceeding and to proceed to a liability trial in which validity, claim construction and infringement would be determined in a single hearing.

This Court rejected Exxon's proposal to cancel the claim construction hearing. Instead, the Court permitted the United States to file a motion for summary judgment as to whether the patents were invalid for being indefinite. The Court delayed the claim construction hearing, although the parties completed their briefing on this issue.

The Court reasoned that indefiniteness should be considered separate from claim construction on a motion for summary judgment, because, although both indefiniteness and claim construction are matters of law, unlike claim construction, a decision on indefiniteness could be dispositive. In other words, if some claims were held to be

¹Section III, below, describes Fischer-Tropsch technology in more detail.

indefinite, there would be no reason to construe other claims about which the issue of indefiniteness had not been raised.

II. Legal Standards and Evidence to Consider

A. Indefiniteness is a Question of Law without Underlying Questions of Fact

Markman v. Westview Instruments, 517 U.S. 370, 116 S. Ct. 1385, 134 L. Ed.2d 577, 38 USPQ2d 1461 (1996) is the foundation for the legal standards to be applied in ruling on claim construction. In that opinion, the Supreme Court affirmed the Federal Circuit's decision, *Markman v. Westview Instruments*, 52 F.3d 397, 34 USPQ2d 1321 (Fed. Cir. 1995) (en banc), that the construction of the terms in a patent is an issue of law for the court to decide. Subsequent decisions by the Federal Circuit have clarified aspects of both *Markman* decisions.

Comparing the court's role in determining whether a claim is indefinite to the court's role in construing the terms in a patent, the Federal Circuit states "whether a claim is indefinite under § 35 U.S.C. 112, ¶ 2 is also a question of law." *Personalized Media v. Int'l Trade Comm'n*, 161 F.3d 696, 702-03, 48 USPQ2d 1880, 1886 (Fed. Cir. 1998) (citing *North Am. Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 1579, 28 USPQ2d 1333, 1339 (Fed. Cir. 1993)). See also *Atmel Corp. v. Info. Storage Devices, Inc.*, 198 F.3d 1374, 1378, 53 USPQ2d 1225, 1227 (Fed. Cir. 1999).

Within the context of discussing claim construction, the Federal Circuit has explained that there are no questions of fact. "[T]he [Supreme] Court held [in *Markman*] that the totality of claim construction is a legal question to be decided by the judge. Nothing in the Supreme Court's opinion supports the view that the Court endorsed a silent, third option — that claim construction may involve subsidiary or underlying questions of fact." *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1455, 46 USPQ2d 1169, 1173 (Fed. Cir. 1998) (en banc). Since *Atmel*, 198 F.3d at 1378, 53 USPQ2d at 1227, and *Personalized Media*, 161 F.3d at 705, 48 USPQ2d at 1888, state that the court decides the issue of indefiniteness in its role as the construer of claims, the teaching from *Cybor Corp.* is applicable to indefiniteness. Therefore, there are no underlying questions of fact to be resolved.

In this regard, several cases suggesting underlying factual determinations may preclude the entry of summary judgment for the Defendant are all distinguishable. For example, as cases in which a ruling on indefiniteness depended on certain factual findings, Exxon cites *Beachcombers v. Wildewood Creative Products, Inc.*, 31 F.3d 1154, 1158-59, 31 USPQ2d 1653, 1656-57 (Fed. Cir. 1994); *Miles Lab., Inc. v. Shandon Inc.*, 997 F.2d 870, 875, 27 USPQ2d 1123, 1126 (Fed. Cir. 1993); and *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1556, 220 USPQ 303, 315 (Fed. Cir. 1983). All cases,

however, were decided before *Markman*. To the extent that these three cases conflict with *Markman*, the cases are no longer good law.

Curiously, the United States, which had argued convincingly that indefiniteness was a matter of law, filed a statement of “Proposed Findings of Uncontroverted Facts.” See R.C.F.C. 56(d)(1). This statement consisted of fifteen paragraphs, each of which asserted that an exhibit, submitted in support of its motion for summary judgment, was “true.” But an examination of the statement revealed that the Defendant did not assert anything that could be interpreted as a “fact,” as that term would be understood in a non-patent sense. See *Cybor Corp.*, 138 F.3d at 1462, 46 USPQ2d at 1180 (Plager, J., concurring) (stating “None of this [claim interpretation] involves ‘fact-finding’ in the sense of the traditional fact-law dichotomy.”). For example, the Defendant did not assert, as a fact, that a hypothetical person with ordinary skill in the art would have a doctorate degree in chemical engineering.²

As the non-movant, Exxon filed a response. Exxon did not dispute any statements made by the United States. Exxon also submitted its own “Proposed Findings of Uncontroverted Facts.” Exxon’s submission consisted of twelve paragraphs, each of which asserted that for a particular term, the government failed to meet its burden of clear and convincing evidence. Similar to the United States, Exxon did not assert any “facts,” such as the level of skill for a person in the art.³ Accordingly, the submissions do not offer any “facts.”

The Court holds that no factual dispute precludes the entry of summary judgment. For each term, the experts’ opinions differ as to the understanding of a person with ordinary skill in the art. Usually, they are diametrically opposite. These disputes do not rise to a “genuine issue of material fact” because the opinions do not concern a “fact.” “As stated in *Markman*, ‘[w]hen legal ‘experts’ offer their conflicting views of how the patent should be construed, or where the legal expert’s view of how the patent should be construed conflicts with the patent document itself, such conflict does not create a question of fact nor can the expert opinion bind the court or relieve the court of its obligation to construe the claims according to the tenor of the patent.’” *Modine Manufacturing Co. v. United States Int’l Trade Comm’n*, 75 F.3d 1545, 1550, 37 USPQ2d 1609, 1611 (Fed. Cir. 1996) (alterations in the original). Furthermore, the Court has determined that an evidentiary hearing is not necessary because the Court is not assessing the credibility of the witnesses. See *Cybor Corp.*, 138 F.3d at 1456, 46 USPQ2d at 1174, citing *Markman*, 517 U.S. at 389, 116 S. Ct. at 1395. Accordingly, a decision by summary judgment on whether the terms are indefinite is appropriate.

² The Defendant’s exhibits include declarations from experts who opine on the level of skill for an ordinary person in the art.

³ Exxon also submitted declarations from its experts who opined on this topic.

B. Test for Indefiniteness

Section 112, second paragraph, of the Patent Act requires the patent to be definite. “The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.” 35 U.S.C. §112, second paragraph.

“The test for definiteness is whether one skilled in the art would understand the bounds of the claim when read in light of the specification. If the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention, § 112 demands no more. The degree of precision necessary for adequate claims is a function of the nature of the subject matter.” *Miles Lab., Inc. v. Shandon, Inc.*, 997 F.2d 870, 875, 27 USPQ2d 1123, 1126 (Fed. Cir. 1993) (internal citations omitted).

The Federal Circuit’s test is consistent with the Supreme Court’s discussion about indefiniteness. “A zone of uncertainty which enterprise and experimentation may enter only at the risk of infringement [sic] claims would discourage invention only a little less than unequivocal foreclosure of the field.” *United Carbon Co. v. Binney Co.*, 317 U.S. 228, 236, 63 S. Ct. 165, 170, 87 L. Ed. 32, 55 USPQ 381, 385 (1942). The Federal Circuit has also recognized that indefiniteness should be considered from the perspective of a potential competitor. *See Morton Int’l, Inc. v. Cardinal Chemical Co.*, 5 F.3d 1464, 1470, 28 USPQ2d 1190, 1195 (stating “[s]ince the evidence shows that the claims at issue here are not sufficiently precise to permit a potential competitor to determine whether or not he is infringing, we also agree with the district court’s determination that the claims are invalid for failure to satisfy the ‘definiteness’ requirement of section 112, second paragraph.”); *See also Athletic Alternatives, Inc. v. Prince, Mfg., Inc.*, 73 F.3d 1573, 1581, 37 USPQ2d 1365, 1372 (Fed. Cir. 1996). In determining whether a person with ordinary skill in the art would understand the boundary of the claim, this Court is guided by the policy expressed in these cases. The person with ordinary skill in the art would examine the claim with a goal of practicing or not-practicing the invention.

In asserting that the claim is indefinite, the Defendant bears the burden of overcoming the presumption that all patents are valid as set forth in 35 U.S.C. § 282.⁴

⁴ The government asserts that after the moving party presents a prima facie case of invalidity, the non-movant must come forward with evidence sufficient to rebut the prima facie case. The government cites *Sinsky v. Pharmacia Ophthalmics, Inc.*, 982 F.2d 494, 498, 25 USPQ2d 1290, 1293 (Fed. Cir. 1992) and *Cable Electric Products, Inc. v. Genmark, Inc.*, 770 F.2d 1015, 1022, 226 USPQ 881, 884-85 (Fed. Cir. 1985), *overruled on other grounds*, *Midwest Industries, Inc. v. Karavan Trailers, Inc.*, 175 F.3d 1356, 50 USPQ2d 1672 (Fed. Cir. 1999) (en banc) for these propositions. Despite the government’s argument, these cases do not shift the burden of proof when a motion for summary judgment based on indefiniteness is filed. In *Sinsky*, the case involved invalidity based on public use, not indefiniteness. In *Cable*, the Federal Circuit addressed the duty imposed on a non-movant by Rule 56 to create a “factual question.” Any issue about a factual question, however, is irrelevant because indefiniteness, as

North Am. Vaccine, Inc. v. American Cyanamid Co., 7 F.3d 1571, 1579, 28 USPQ2d 1333, 1339 (Fed. Cir. 1993) describes this burden as requiring “clear and convincing” evidence.⁵

C. Method of Analysis

Following *Personalized Media* and *Bell & Howell*, the Court first examines the intrinsic evidence to determine whether the terms are indefinite. Next, if the intrinsic evidence fails to provide a definite meaning for the term, then the Court examines the extrinsic evidence.

The starting point for the Court’s analysis is the language in the patent claim and the specifications. *Miles Lab., Inc. v. Shandon, Inc.*, 997 F.2d 870, 875, 27 USPQ2d 1123, 1125-26 (Fed. Cir. 1993).

“Extrinsic evidence may not be relied upon during claim construction when the intrinsic evidence unambiguously defines the disputed claim language. *See Bell & Howell Document Management Prods. Co. v. Altek Sys.*, 132 F.3d 701, 706, 45 USPQ2d 1033, 1038 (Fed. Cir. 1997).” *Personalized Media*, 161 F.3d at 706, 48 USPQ2d at 1889. *Bell & Howell*, on which *Personalized Media* relies, states: “reliance on extrinsic evidence to interpret claims is proper only when the claim language remains genuinely ambiguous after consideration of the intrinsic evidence, . . . i.e., when the intrinsic evidence is insufficient to enable the court to construe disputed claim terms.” *Bell & Howell*, 132 F.3d at 706, 45 USPQ2d at 1038 (Fed. Cir. 1997) (citation and internal quotation marks omitted).

In examining the evidence, whether intrinsic or extrinsic, “the determination whether a claim is invalid as indefinite ‘depends on whether those skilled in the art would understand the scope of the claim when the claim is read in light of the specification.’” *Atmel*, 198 F.3d at 1378, 53 USPQ2d at 1227-28 (Fed. Cir. 1999) (quoting *North Am. Vaccine*, 7 F.3d at 1579, 28 USPQ2d at 1339).

The Court must answer this question in light of the evidence properly before it. This evidence is discussed in the following section.

D. Evidence Submitted by the Parties

explained above, is strictly a legal question.

Thus, the Defendant has the burden to show that the patent is invalid for indefiniteness.

⁵ The burden of proof raises an interesting question, which appears to not have been addressed yet by the Federal Circuit: in asserting that a patent is indefinite, an assertion that requires the court to answer a question of *law*, how can the moving party present “evidence” that rises to the level of “clear and convincing” evidence. Despite this academic observation, this Court understands that 35 U.S.C. § 282 establishes a presumption of validity that the Defendant must overcome.

In support of and in opposition to the motion for summary judgment, the parties submitted many exhibits. The primary documents, of course, are the patents themselves. The parties also submitted excerpts from the prosecution history for the '982 patent.⁶

Each party submitted declarations from an expert witness in the pertinent field.⁷ The experts opined as to whether (or not) a person skilled in the art would understand whether a particular term was definite. In addition, these declarations educated the Court about the background technology. See *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1309, 51 USPQ2d 1161, 1168 (Fed. Cir. 1999) (describing the use of expert testimony in claim construction). Although the experts (predictably) disagreed as to whether the terms were indefinite, this dispute does not rise to a genuine issue of material fact that precludes summary judgment because indefiniteness is an issue of law, not fact.

In addition, Exxon repeatedly offered as "evidence" information whose source was not the patent itself. This evidence fell within two categories: (1) evidence that the government understood the term because the government used the term in discovery and (2) evidence that the term is definite because it was used in other patents held by the government and/or in other patents held by the government's experts. Both types of evidence are only marginally relevant, if at all.

1. Comparing the government's use of a contested term in discovery and argument

Exxon asserted that various terms are not indefinite because the government used them in discovery. This assertion has both a legal and a factual component to it.

⁶ Neither party submitted evidence from the prosecution history of the '705 patent. At oral argument, the parties confirmed that the prosecution history of the '705 patent is not relevant for indefiniteness.

⁷ The Defendant filed a motion to strike the declarations of the Plaintiff's expert witnesses. Based upon *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 149, 152, 119 S. Ct. 1167, 1175, 1176, 143 L. Ed.2d 238 (1999), and *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 113 S. Ct. 2786, 125 L. Ed.2d 469 (1993), the Defendant argued that the Plaintiff did not establish that its experts were qualified to express an opinion. The Defendant further argued that the Court, as gatekeeper, should exclude these declarations.

The Court denied the motion to strike for the Plaintiff's technological experts. The Court held that the experts presented a minimal level of qualification. The Court also ruled that the Defendant's challenges to admissibility would be considered in weighing the expert's opinion.

The Defendant's motion to strike was also directed at a declaration of Joseph Colaianni, whom Exxon presented as an expert in patent law procedure. The Court granted this aspect of the motion to strike because the Court believed it did not require expert testimony about the process of prosecuting patents.

As a legal matter, for the proposition that the Defendant's use of a term in discovery weighs against a finding of indefiniteness, Exxon relies on *Kingsdown Medical Consultants Ltd. v. Hollister*, 863 F.2d 867, 872 n.4, 9 USPQ2d 1384, 1388 (Fed. Cir. 1988) and *Rosemount, Inc. v. Beckman Instruments, Inc.*, 727 F.2d 1540, 1547, 221 USPQ 1, 7 (Fed. Cir. 1984).⁸ The Court questions the precedential value of these opinions on this point because of the more recent decisions in *Markman*, *Cybor Corp.*, and *Personalized Media*. As discussed at length above, these cases have clarified that the question of indefiniteness is a question of law, not a question of fact.

A reasonable reading of *Kingsdown Medical* is that the Federal Circuit did not find determinative, in evaluating whether the challenged term is indefinite, the Defendant's use of a challenged term in discovery. Significantly, the Federal Circuit, itself, did not rule on the issue: "This court will not answer in the first instance the question of whether claim 9 is actually invalid for indefiniteness under § 112." *Kingsdown Medical*, 863 F.2d at 872 n.4, 9 USPQ2d at 1388. Although the Federal Circuit directed that, after remand, the trial court should determine whether a term ("encircled") is indefinite "in light of all the evidence, including that cited to us by Kingsdown as reflecting Hollister's lack of difficulty with the 'encircled' language during 3 years of discovery," the Federal Circuit did not state that this evidence resolved the issue. Secondly, the Federal Circuit's language in footnote 4 is dicta because it is incidental to the remand order. Other courts may have recognized that this aspect of *Kingsdown Medical* has limited precedential value because this Court has not found any other decision citing *Kingsdown Medical* for this proposition. Thus, *Kingsdown Medical* does not require this Court to hold that just because the Defendant used a challenged term during discovery, the term is definite.

Besides *Kingsdown Medical*, the Plaintiff also points to *Rosemount*, 727 F.2d at 1547, 221 USPQ2d at 7. In *Rosemount*, the Federal Circuit affirmed a decision of the trial court that found the term "close proximity" was not indefinite. In upholding the decision, the Federal Circuit reviewed the evidence and stated "Beckman is confronted also with its own ease in applying 'close proximity' to the prior art at trial and in its briefs here, the use of 'close proximity' in the claims of one of its references, its own use of 'close proximity' in describing its pH meters, its own witness' statement that he had no trouble understanding the claims of the '525 patent." *Id.*

The teaching of *Rosemount* — that the conduct of the party claiming a term is indefinite could affect the Court's analysis of that term — is greatly weakened by later developments in the law. It is abundantly clear that *Rosemount* was decided when indefiniteness depended on questions of fact.⁹ Since *Rosemount*, the Federal Circuit has

⁸ Exxon also cited other decisions. These decisions, however, are decisions by trial courts and therefore not binding on this Court.

⁹ The trial court lists under the heading of "Questions of Fact" whether the patent was indefinite. *See Rosemount, Inc. v. Beckman Instruments, Inc.*, 569 F. Supp. 934, 936, 218 USPQ

repeatedly emphasized that claim construction, including indefiniteness, is a matter of law that should be decided by looking, primarily, at the intrinsic evidence. See, e.g., *Personalized Media*, 161 F.3d at 702-03, 48 USPQ2d at 1886, *Cybor Corp.*, 138 F.3d at 1455, 46 USPQ2d at 1173. This emphasis on the intrinsic evidence, which is necessarily fixed and does not depend on the variable use of a term in litigation, cannot be squared with examining the conduct of one party in litigation.

Accordingly, the legal foundation (*Kingsdown Medical* and *Rosemount*) for Exxon's argument that this Court should examine the conduct of the United States in litigation is questionable. Further, even if the conduct of the United States were examined, the conduct does not amount to an admission that any term is definite.

Exxon relies primarily on two documents: the Defendant's First Supplemental Response to Plaintiff's First Set of Requests for Admission (Defendant's Exhibit 43) and the Defendant's Second Supplemental Responses to Plaintiff's Interrogatories Nos. 75 - 86 (Defendant's Exhibit 44). In these documents, it appears that the Plaintiff requested that the Defendant admit certain statements, some of which recited challenged terms. The Plaintiff also requested that the Defendant provide claim charts and a list of prior art that allegedly invalidated the patent. The Defendant provided this information only after this Court ordered the Defendant to do so.

At least with regard to the Supplemental Responses to Interrogatories no. 75 - 86, which is also Plaintiff's Exhibit AA, the Defendant reserved its right to supplement or amend its responses because "neither the Court nor the plaintiff has provided a claim construction for either the '982 or the '705 patent, and no expert discovery has been conducted." Plaintiff's Exhibit AA, page 2. Furthermore, for some terms, the Defendant provided "alternative" arguments and also noted that particular terms are "vague and ambiguous." The Defendant also noted that the patents failed to comply with the second paragraph of § 112. See Plaintiff's Exhibit AA, page 78, 153. In general, the Defendant's conduct during discovery does not show that it could comprehend the terms. Thus, Exxon has not convinced the Court that the Defendant admitted that the terms were definite.

Consequently, in arriving at its decision, the Court has generally not considered how the Defendant used terms during discovery for both legal and factual reasons.

2. The use of terms in other patents

Exxon asserted that the terms cannot be indefinite because the government and/or its experts have used the same terms in patents held by the government or its experts. Again, this evidence has little relevance.

For this proposition, Exxon cites *Andrew Corp. v. Gabriel Electronics*, 847 F.2d 819, 822, 6 USPQ2d 2010, 2013 (Fed. Cir. 1988) and *Rosemount*, 727 F.2d at 1547, 221

881, 883 (C.D. Cal. 1983), *aff'd*, 727 F.2d 1540, 221 USPQ2d 1 (Fed. Cir. 1984). On appeal, the Federal Circuit did not question this approach. *Rosemount, Inc. v. Beckman Instruments, Inc.*, 727 F.2d at 1542, 221 USPQ at 3 (Fed. Cir. 1984).

USPQ at 7. For the reasons explained above, *Rosemount* retains little of its vitality since the Federal Circuit has ruled that claim construction, including indefiniteness, is a matter of law, independent of underlying fact questions.

Andrew does not indicate whether the Federal Circuit viewed indefiniteness as a purely legal issue. Thus, *Andrew* continues to offer the parties a method for demonstrating that certain terms could (or could not) be more precise. Such an inference is possible only when the other patents are of record and concern “similar technology.” *Andrew Corp.*, 847 F.2d at 822, 6 USPQ2d at 2013.

Exxon submitted various patents to address some of the terms. Most of the patents do not appear to concern “similar technology,”¹⁰ and Exxon did not offer an affidavit from any of its experts that these patents are in a field similar to Fischer-Tropsch technology. Therefore, for example, whether a person with ordinary skill of the art in making defect-free fluoride glass would know what “substantially free of bubbles” means is not relevant to whether a person of ordinary skill in the art of chemical reactor design would know what “substantial absence of slug flow” means.¹¹ See U.S. Patent No. 5,078,768, Col. 6, lines 61-62 (submitted as Exxon’s Exhibit 47).

Therefore, even if the Court could consider other patents owned by a litigant — a proposition that is not certain after *Markman*, *Cybor Corp.*, and *Personalized Media* — the patents submitted by Exxon are generally not relevant. The patents concern technology that is not similar to Fischer-Tropsch technology. Accordingly, Exxon’s citation to these patents is not appropriate.

III. General Description of the Technology

Fischer-Tropsch technology is a process by which natural gas is converted into premium liquid hydrocarbons, such as petroleum. The cost of using Fischer-Tropsch technology has inhibited its wide-scale implementation. Through these patents (and more than 100 others), Exxon is attempting to make Fischer-Tropsch technology more practical.

The process of converting natural gas into premium liquid hydrocarbons begins when the natural gas is broken down into a synthesis gas and other products. The next step is subjecting the synthesis gas to a Fischer-Tropsch reaction. The synthesis gas is introduced into a slurry bubble column reactor. The slurry contains solid catalysts, specifically cobalt-supported catalysts, that are suspended in a liquid. In the presence of the catalysts, the synthesis gas reacts with other products to form liquid hydrocarbons.

¹⁰ The only exception to this general point appears to be U.S. Patent No. 5,939,350, which concerns Fischer-Tropsch reactions in a slurry bubble column. One of the inventors is James Goodwin, an expert retained by the government. See Plaintiff’s Exhibit 27.

¹¹ “Substantial absence of slug flow” is a term from the ‘982 patent that the United States challenges as indefinite. Section V. B., below, discusses it in more detail.

The two patents address specific obstacles in the Fischer-Tropsch reaction. The '705 patent teaches how to increase the activity, which is also known as the productivity, of the catalyst. The '982 patent teaches how to operate the slurry bubble column reactor most efficiently. These patents are described in more detail in the following sections.

IV. '705 Patent

The Court holds that terms “for a period sufficient” and “increase substantially” in claim 1 are indefinite. A person with ordinary skill in the art would not know what these terms, which appear in Claim 1, mean.

Claim 1 of the '705 patent recites the following:

A method for activating an essentially fresh, reduced cobalt containing Fischer-Tropsch catalyst which comprises treating the catalyst with hydrogen or a hydrogen containing gas in the presence of hydrocarbon liquids *for a period sufficient to increase substantially* the initial catalyst productivity.

Col. 4, line 67 - Col. 5, line 4 (emphasis added).

The United States contends that two italicized phrases are indefinite: “to increase substantially” and “for a period sufficient.” As set forth above, this Court must decide whether a person skilled in the art would understand the meaning for those terms.

The parties basically agree that a hypothetical person with ordinary skill in the art of the '705 patent would have a doctorate in chemical engineering or organic chemistry or similar field with a focus on heterogenous catalysis or a bachelor of science degree in chemistry or chemical engineering with three to five years experience. Each side submitted a declaration from a person who qualifies as an expert to opine on the knowledge of a person with ordinary skill in the art.

Exxon presented declarations from two experts. It primarily relies on M. Albert Vannice, who earned a doctorate degree in Chemical Engineering in 1970. Since 1976, he has taught at Penn State University and is currently the Merrell R. Fenske Professor of Chemical Engineering there. His research has included carbon monoxide hydrogenation, including Fischer-Tropsch synthesis, and heterogenous catalysts.

Besides Vannice, Exxon also submitted a declaration from Rocco A. Fiato, who holds a doctorate degree in Physical Organic Chemistry. He has worked for Exxon since 1980. He has written several papers related to synthesis gas conversion and Fischer-Tropsch catalysts. His declaration focuses on the background technology, not an analysis of the terms in the patent.

To provide information on its behalf, the United States submitted a declaration from James G. Goodwin, Jr. Goodwin is currently the William Kepler Whiteford Professor of Chemical Engineering at the University of Pittsburgh. He obtained a

doctorate degree in chemical engineering in 1976. His work has specialized on heterogenous catalysts, including cobalt supported catalysts in Fischer-Tropsch reactions.

Vannice and Goodwin discuss the terms at issue.

A. “To increase substantially”

The parties agree that the initial catalyst productivity must be “increased substantially.” The parties further agree that the increase must be at least 30 per cent. The parties, however, disagree as to whether a person of ordinary skill in the art would know how the patent measures the 30 per cent increase.

When the claim says “to increase substantially the catalyst productivity,” the claim means “to increase substantially the *relative* catalyst productivity.” This meaning is clear because the catalyst productivity after undergoing the super-activation procedure (which is described in the next section) is increased relative to the catalyst productivity before the super-activation procedure. But, defining “to increase substantially catalyst productivity” as “to increase substantially relative catalyst productivity” does not answer the question. How is relative catalyst productivity measured?

The specification does not provide any information so that a person with ordinary skill in the art would understand how an increase in relative catalyst productivity is measured. The specification provides the following example, under the caption “Relative Productivity.” The “before” measure is 25; the “after” measure is 100. Col. 4, lines 49-54.

As the Defendant argues, there are two ways to calculate “Relative Productivity” based on the example in the specification. The specification, however, does not explain which of the two methods should be used.

The first method is subtraction. The before measure is subtracted from the after measure. In the example, 25% is subtracted from 100%. The result is that the relative catalyst productivity increased 75%.

The second method places the difference between the after and the before in the numerator and the before value in the denominator. In the example, $75\% / 25\%$ is a 300% change.

Either method is entirely consistent with the patent specification. There is nothing in the patent that explains whether the relative catalyst productivity was increased 75% or 300%.

Which method is used can have critical importance, as the following example demonstrates. If the initial value is 75% and the final value is 100%, then the relative catalyst productivity has increased by *either* 25% *or* 33%. It has increased 25%, if the person with ordinary skill calculates the increase by the first method ($100\% - 75\%$). In contrast, it has increased 33%, if the person with ordinary skill calculates the increase by the second method ($[100\% - 75\%] / 75\%$). Since the patent requires an increase in relative catalyst productivity of at least 30%, infringement depends on which method is selected.

To meet the requirement of definiteness, the patent must be clear enough so that “those skilled in the art would understand what is claimed when the claim is read in light of the specification.” *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1576, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986). The law requires a clear boundary to avoid creating uncertainty that could interfere with further advances. See *United Carbon Co. v. Binney & Smith Co.*, 317 U.S. 228, 236 (1942).

Here, the scope of the patent’s coverage is not clear, as the example of an increase from 75% to 100% proves. Potential competitors, with ordinary skill in the art, who increased the relative productivity of the catalyst from 75% to 100% could not tell whether they are infringing. This uncertainty violates the requirement that the patent be definite. See *Morton Int’l*, 5 F.3d at 1470, 28 USPQ2d at 1195. Accordingly, the term is indefinite.

In reaching this holding, the Court has focused on the language of the claim and specifications. The Court has found no definition of the term “relative productivity.”

Although the intrinsic evidence supplies the basis of the Court’s decision, the testimony of the *Plaintiff’s* experts supports a holding of indefiniteness. Two experts, both retained by the Plaintiff, testified that each had a different understanding of the meaning “relative productivity.” The experts, at their depositions, were asked to measure the increase from 25% to 100%.

Rocco Fiato testified that the increase is 75 percent. Fiato subtracted the original level (25%) from the resulting level (100%) to arrive at 75 percent.

Q. In Example 2 of that table what percent increase in initial catalyst productivity is represented?

* * *

[A.] And the delta between those is 75 percent on this particular graph, and on this scale.

Fiato Deposition, pp. 53-54.

In contrast, Albert Vannice testified that the increase is 300 percent. Vannice divided the difference between the before and after (the difference being 75%) by the initial value (25%) and multiplied by 100.

Q. In Example 2 by what percent is the initial catalyst productivity increased?

* * *

A. Ask the question again, so I get the units. By what percent is the initial productivity?

Q. Yes

A. In that case it would be 300 percent.

Vannice Deposition, p. 166.

Exxon's attempt to harmonize the two testimonies is an after-the-fact justification without foundation in the patent. The testimony is not inconsistent, according to Exxon, because the experts are discussing two different units, which Exxon labels "relative productivity" and "productivity." This approach is flawed for two reasons. First, the experts were asked identical questions and did not distinguish between "relative productivity" and "productivity." Second, and more importantly, the patent itself fails to define "relative productivity" and the patent fails to explain how to calculate increases in "productivity." See Col. 2, lines 17-20. Because Exxon's explanation is not tied to the patent, the Court rejects it.

When looking at the patent, and interpreting the claims in light of the specification, this Court holds that a person with ordinary skill in the art could not understand what a 30% increase in relative catalyst productivity means. Accordingly, this term is indefinite.

B. "For a period sufficient"

The patent requires treatment of the catalyst with hydrogen (or hydrogen gas) "for a period sufficient" to increase the activity of the catalyst. The specification provides that "[t]he period necessary . . . may vary with temperature and treat ratio, etc., but is usually accomplished in about 0.25-24 hours, preferably about 0.5-2 hours." Col. 2, lines 58-64.

The treatment of the catalyst with hydrogen is a "super-activation procedure." It needs to be placed in the context of the sequence of steps described in the patent. First, the fresh catalyst is reduced. Col. 4, lines 30-33. It is subjected to an activity check. Col. 4, lines 43-44, 59-62. This activity check measures the "initial" activity of the fresh catalyst. Col. 4, lines 43-44. Next, the catalyst undergoes the "super-activation" procedure. Col. 4, lines 44-45. The "super-activation" procedure should be conducted before synthesis gas is introduced or shortly after the synthesis reaction has begun. Col. 2, lines 7-11. The "super-activation" procedure is sequenced in this way to avoid exposing the catalyst to carbon monoxide, which is a component of the synthesis gas. Col. 1, line 48.

The government argues that the term "for a period sufficient" is indefinite. The government argues that the patent sets neither an upper nor a lower boundary for the claim.

Citing *In re Caldwell*, 319 F.2d 254, 138 USPQ 243 (CCPA 1963), Exxon argues that the law permits unspecific language, such as "for a period sufficient." The Plaintiff emphasizes that the inventors discovered that the productivity of the catalyst could be increased by immersing the already reduced catalyst in hydrogen gas for an additional time. According to Exxon, the amount of time for the immersion is not critical.

Exxon's expert explains that a person with ordinary skill in the art would know to take "activity checks" to measure the productivity of the catalyst. See Vannice Declaration, Paragraphs 32-33.

An “activity check” requires that the operator conduct a synthesis reaction using synthesis gas. Synthesis gas consists of hydrogen (H₂) and carbon monoxide (CO).¹²

According to how “activity checks” are presented by Exxon, it appears that the process of taking “activity checks” resembles testing whether a cake is thoroughly baked by inserting a toothpick.¹³ A recipe may say that the time for cooking is 30 to 35 minutes, but a skilled baker would know that the way to see how many minutes are really needed is to test the cake to see if it is done. Likewise, according to Exxon’s suggestion, if the productivity of the catalyst is not sufficiently increased, then the catalyst could be returned for further treatment.

The comparison, however, is inapt. The supplemental declaration of Goodwin, paragraphs 7-11, explains that a person with ordinary skill in the art could not use an “activity check” to determine when the catalyst had been exposed sufficiently. There are two reasons why an “activity check” would not be used to define “a period sufficient.” First, taking an activity check of a catalyst that has been subject to the super-activation procedure could corrupt the catalyst. The patent teaches away from exposing the catalyst to synthesis gas, including carbon monoxide, during the super-activation procedure. See Col. 1, lines 47-51. An activity check, however, necessarily exposes the catalyst to synthesis gas. An activity check *after* the super-activation procedure has begun is contrary to the teaching of the patent.

There is a second reason why a person with ordinary skill in the art would not use an “activity check” to determine when the catalyst’s exposure to hydrogen has been “for a period sufficient.” The patent directly teaches that one activity check should be taken and the check should be taken before the super-activation procedure is started. The patent does not suggest that other activity checks would be necessary. To conduct an activity check, the super-activation procedure must be stopped, then the catalyst exposed to the synthesis gas, then (assuming that more treatment is necessary) the super-activation procedure resumed, then another activity check. This procedure of starting and stopping processes and switching between the super-activation procedure and the synthesis reaction is not described at all.

Therefore, the analogy of checking a cake with a toothpick is not accurate. Unlike baking, testing the super-activated catalyst could impair the catalyst by exposing it to synthesis gas. Also unlike baking, the test procedure, itself, is somewhat complicated in that one reaction must be stopped and another started to conduct the test.

Accordingly, the Court holds that a person with ordinary skill in the art could not use “activity checks” to ascertain what length of time constitutes “a period sufficient.” Primarily because the patent teaches that an activity check could actually reduce the

¹² Exxon has not challenged this description. This explanation of what happens in an “activity check” comes from Goodwin.

¹³ Exxon did not offer this analogy. The Court, however, finds it informative.

effectiveness of the catalyst (by exposing the reduced catalyst to synthesis gas), the person with ordinary skill would not use an activity check. Thus, Exxon offers no limitation on the duration of treatment contemplated by the term “for a period sufficient.”

As a second argument, Exxon maintains that the patent is not indefinite because the phrase is as specific as it can be. *Miles Lab.*, 997 F.2d at 875, 27 USPQ2d at 1126. Exxon argues that the patent cannot be more specific because the amount of time depends on many variables, such as the temperature and treat ratio. In presenting its argument, Exxon alludes¹⁴ to the possibility of “means-plus-function claims,” which are permitted under Section 112, ¶ 6. Exxon anchors its argument by citing several cases that have upheld patents that claim an invention based on results, not based on a particular quantity of time needed to reach the result. Examples of these cases include *In re Caldwell*, 319 F.2d 254, 138 USPQ 243 (CCPA 1963); *Ex parte Clarke*, 98 USPQ 195, 196 (Pat. Office Bd. App. 1953); and *Ex parte Ebel and Drew*, 84 USPQ 202 (Pat. Office Bd. App. 1949).

Citing *In re Jolly*, 172 F.2d 566, 569-70, 80 USPQ 504, 508 (CCPA 1949), the United States argues that the failure to specify the amount of time makes the claim invalid. The United States observes that the “specification fails to provide a single example of a period of time that is sufficient to achieve any particular increase in initial catalyst productivity.” Memorandum in support of summary judgment, page 12. Therefore, according to the government, a person with ordinary skill in the art would need to experiment unnecessarily.

The Court observes that a predominate pattern in these cases, although not universal, is that the court closely considered the specification. For example, *In re Watson*, 517 F.2d 465, 477, 186 USPQ 11, 20 (CCPA 1975) rejected an argument that the patent was indefinite in part because the specification set out examples to illustrate an “effective amount of germicide suitable for use in oral hygiene.” Another example is *Ebel and Drew*, where the specifications showed the physical conditions depends upon the duration of the heating. *Ebel and Drew*, 84 USPQ at 203. This principle also guides the decision in *Jolly*, 172 F.2d at 570 (stating “the single example itself was lacking in definiteness as to reaction time.”).

Here, when the patent (both the claims and specifications) are measured against this standard, the Court must hold that the term “for a period sufficient” is indefinite. In reaching this decision, the Court notes that there are no examples of an amount of time. Without some limitation based on either the language of the claim or based on the knowledge of a person with ordinary skill in the art, the term “for a period sufficient” is limitless.

C. Summary

The Court holds that both terms from claim 1 are indefinite. Because all other claims depend on claim 1, the remaining claims are also indefinite. Accordingly, the Defendant’s Motion for Summary Judgment is granted with respect to the ‘705 patent.

¹⁴ Exxon is clear that it is not asserting a means plus function claim.

V. '982 Patent

The '982 Patent discloses a technique for operating a slurry bubble column reactor efficiently. A slurry bubble column includes elements in the gas, solid and liquid phases. The '982 patent concerns how to manipulate the mixing of the various elements to achieve the most productive result. The government asserts that ten terms in this patent are indefinite.

The parties agree that the Court must test whether a person skilled in the art would understand the claims in light of the specifications. For the '982 patent, the parties agree on the level of skill in the art a person would have: a bachelor of science degree in chemical engineering with some graduate training and with some experience in designing or operating three-phase column reactors.

Each party presented an expert. Exxon offered Alexis T. Bell, a former Dean of the College of Chemistry at the University of California at Berkeley, where he remains a professor. He is a member of the National Academy of Engineering. He has worked with and published papers on Fischer-Tropsch technology. His field of expertise, however, is in catalysis. Bell's declaration addressed whether a person with ordinary skill in the art would understand certain terms.

To support its view that a person with ordinary skill in the art would not understand these terms, the United States submitted a declaration from Y.T. Shah, the Chief Research Officer and Senior Vice Provost for Research and Graduate Studies at Clemson University. Formerly, he was the Distinguished Professor and Dean in the College of Engineering at Drexel University. He holds advanced degrees from the Massachusetts Institute of Technology. Shah worked with and published many papers on chemical reactor engineering, including slurry bubble column reactors.

Both Bell and Shah discussed the terms analyzed in the following sections.

A. "Having a diameter greater than 15 centimeters"

The government argues this term is indefinite because the patent does not define "diameter." Shah explains that a person skilled in the art would know to define diameter in four ways. Two choices include "internal diameter" and "effective diameter." Although each dimension is understood in the field, a measurement by "internal diameter" produces different results from using "effective diameter."

Internal diameter and effective diameter differ because of the construction of the column. A column for a Fischer-Tropsch reaction contains baffles or cooling tubes. These tubes may be thought of as occupying the center of the reactor. The internal diameter measures the width of the column from the inside edge of one wall to the inside edge of the opposite wall. "Internal diameter" ignores the size of the baffles. Contrastingly, "effective diameter" considers the baffles. An effective diameter must equal or be less than an internal diameter.

The government contends that the patent uses the unadorned word "diameter" without further defining it as either "effective diameter" or "internal diameter." Shah

declares that a person of ordinary skill in the art would not understand what the word “diameter” means in this context.

The Court holds that this term is definite based on solely the intrinsic evidence. In some places, the specification recites the term “effective diameter.” *See, e.g.*, Col. 8, line 29 and Col. 8, line 38. In other places, the specification uses the term “diameter.” As a matter of logic, the word “diameter” must mean something different from “effective diameter.” *See Pfund v. United States*, 40 Fed. Cl. 313, 367 (1998), *aff’d*, 178 F.3d 1313 (Fed. Cir. 1999) (table).

Furthermore, Shah testified that he understood “diameter” as meaning internal wall-to-wall diameter because the patent did not state “effective” diameter. Shah Deposition p. 169-70. Shah’s forthright explanation, which was not rebutted in his supplemental declaration, demonstrates that a person with ordinary skill in the art could make the logical inference that the meaning of “diameter” and the meaning of “effective diameter” differ.

Finally, the Court notes that Shah believes that defining diameter as internal wall-to-wall diameter could complicate the calculations of other variables such as the dispersion coefficient (D), the velocity of the gas (U_g), and the velocity of the liquid (U_L). The Court acknowledges that Shah’s concerns may have some validity. These concerns, however, do not affect whether “diameter” is indefinite. Whether the patent is invalid for reasons other than indefiniteness is a question not before the Court presently.

In concluding the term is not indefinite, the Court did not consider the prior art reference to an article by Jurgen Falbe about a reactor in Rheinpreussen, Germany. Exxon cited this document as a source where “diameter” meant “inside width” (as translated from German). The Court finds that this reference is not generally available. First, the publication is written in German. Second, the patent misidentifies the title. Third, although Bell declares that he identified the reference with the assistance of a reference librarian at the New York Public Library, Bell does not indicate where he actually found the reference. For the reasons stated, the Court determined that the Falbe article is beyond the knowledge of an ordinary artisan. *See General Electric Co. v. Brenner*, 407 F.2d 1258, 1262-63, 159 USPQ 335, 338 (D.C. Cir. 1968) (describing extent of incorporation by reference).

B. “Substantial absence of slug flow”

The government argues that an ordinary artisan could not understand what “substantial absence of slug flow” means because neither “slug” nor “substantial” is defined.

In general, a “slug” is a large bubble that interferes with the operation of the reactor. While the patent expects that there will be many small bubbles in the slurry bubble column, the patent teaches performance is better without slugs, that is, large bubbles. Col. 8, lines 29-41; *see also* Bell Declaration, ¶ 41.

Shah explains that “slug” could have three forms. The slug could extend from an internal wall to another internal wall. The slug could extend from a baffle to another

baffle. The slug could also extend from an internal wall to a baffle. Shah is not sure which of these three choices is meant by the patent.

In this regard, the Court agrees with Bell who states that a slug could be any of the three choices. Bell Declaration ¶ 40, 43. A person with ordinary skill in the art is concerned with a bubble impeding the flow up the column. It would not matter where the blockage is located.

Section 282 establishes the presumption that every patent is valid. Given that even the government's expert defines "slug," see Shah Declaration ¶ 29; the Court cannot say that the Defendant has met its burden of proving the patent is indefinite with regard to "slug."

Besides "slug," the government also contends that "substantial absence" is indefinite. In its claim construction brief, Exxon proposed to define "substantial absence" as "slug flow is not present to such a degree that reactor performance is significantly affected." Exxon's Brief on Claim Construction, filed November 10, 1999, p. 41. The government argues that Exxon's proposed definition, "significantly affected," is as indistinct as the term it is defining, "substantial absence."

Bell asserts that a person of ordinary skill in the art would understand that the column should be operated without slugs so that "there is no appreciable effect on reactor performance." Bell Declaration, ¶ 44. Exxon also referred the Court to certain pages of the prosecution history related to this term.¹⁵ All pages, however, correct a spelling error (change "plug flow" to "slug flow").

Two leading cases on the use of imprecise terms in patent claims are *Modine Manufacturing Co. v. United States International Trade Commission*, 75 F.3d 1545, 37 USPQ 2d 1609 (Fed. Cir. 1996) and *Seattle Box Co. v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 221 USPQ 568 (Fed. Cir. 1984). In these cases, the Federal Circuit discusses how definite a term must be to avoid being indefinite. One principle from *Modine* and *Seattle Box* is that "[m]athematical precision should not be imposed for its own sake; a patentee has the right to claim the invention in terms that would be understood by persons of skill in the field of invention." *Modine*, 75 F.3d at 1557, 37 USPQ2d at 1617.

Modine and *Seattle Box* permit imprecise words when they are used to describe an objective point that is explained by the claim, the specification, or the prosecution history. In *Modine*, the Federal Circuit explained that "relatively small" in the context of a tube in automobile air conditioners was not indefinite. First, the specification used the term "about 0.015-0.040" inches. Second, the diameter of the tube was necessary to distinguish the patent from the prior art. See *Modine*, 75 F.3d at 1557, 37 USPQ2d at 1617. Here, in

¹⁵During the oral argument on February 10, 2000, Exxon submitted a list of pertinent pages of the prosecution by providing an annotated copy of Exhibit J3.591. See Transcript of Oral Argument on February 10, 2000, page 53. The government did not object. Transcript of Oral Argument on February 10, 2000, page 70.

contrast, the specification has no mathematical terms. Also, Exxon did not submit any prior art that was distinguished on the ground that the prior art permitted slug flow.¹⁶

In *Seattle Box*, the Federal Circuit ruled that “substantially equal to” in the context of spacer blocks for oil pipes was not indefinite. The Federal Circuit explained that an expert would know the limitation of the claim because the “specification clearly sets forth, for example, that the divider blocks are intended to absorb the weight of the overhead loads.” *Seattle Box*, 731 F.2d at 826, 221 USPQ at 574. Further, the Federal Circuit noted that someone could be required to experiment to determine the limits of the claim. *Id.* This Court interprets *Seattle Box* as recognizing a fixed point: the point at which the divider blocks fail to absorb the weight of the overhead load.

The same analysis also shows that the other cases on which Exxon relies follow the same pattern.¹⁷ For example, *In re Mattison*, 509 F.2d 563, 565, 184 USPQ 484, 486 (CCPA 1975), held that the term “to substantially increase the efficiency of the compound as a copper extractant” is definite. The CCPA noted that the “criticized phrase . . . does not stand in a vacuum.” *Id.* A person with ordinary skill in the art would understand the phrase because “[g]eneral guidelines are disclosed for a proper choice of the substituent Ep together with a representative number of examples.” *Id.*

Lang v. Prescon Corp., 545 F. Supp. 933, 945-47, 217 USPQ 839, 850 (D. Del. 1982), held that the terms “tightly” or “tight” were definite because the specification stated that extrusion “forms a *tight* seamless plastic jacket . . . around said incased strand *substantially excluding air and gas* from between the jacket and the corrosion inhibitor.” *Id.* at 946, quoting patent specification. *Lang* further held that “substantially excluding air and gas” was definite because “the patent teaches with sufficient conciseness how the invention is to be applied and also gives a would-be infringer sufficient warning of the patent’s limits.” *Id.* at 947.

¹⁶Although the Court expects that Exxon would submit prior art, the Court is not shifting any burden on Exxon to show the patent is valid. The Court is well aware that the United States must prove the patent’s invalidity. See *North Am. Vaccine*, 7 F.3d at 1579, 28 USPQ2d at 1339.

¹⁷Although this decision discusses each case cited by Exxon, the decision is not based on a comparison to those cases. “The test for definiteness is whether one skilled in the art would understand the bounds of the claim when read in light of the specification.” *Miles Lab.*, 997 F.2d at 875, 27 USPQ2d 1126. This test is unique to each patent and therefore previous cases that interpret a similar term in a different patent are not binding precedents. “Certainly there may be times when the use of a word like ‘substantially’ *does* render a claim indefinite, but there is no *per se* rule either way; each case must be determined on its own facts.” *Baush & Lomb, Inc. v. Alcon Lab., Inc.*, 64 F. Supp.2d 233, 241, 52 USPQ2d 1385, 1391 (W.D.N.Y. 1999)(emphasis in original). Because each case must be decided on its own facts, *Andrew Corp. v. Gabriel Electronics, Inc.*, 847 F.2d 819, 821-22, 6 USPQ2d 2010, 2013 (Fed. Cir. 1988), does not control the result here.

CPC International, Inc. v. Archer Daniels Midland Co., 831 F. Supp. 1091, 1110, 30 USPQ2d 1427, 1442 (D. Del. 1993), *aff'd*, 31 F.3d 1176 (Fed. Cir. 1994) (table) also discusses words of degree, such as “good mixing” and “about 600 cm/sec.” The discussion in *CPC Int’l* is relatively sparse perhaps because the court had already determined that the patent was invalid for failing to disclose the best mode. *Id.* at 1108-09. Accordingly, the discussion of indefiniteness is dicta.

For the case at bar, the Court holds that the term “substantial absence” is indefinite. Neither the patent nor the specification nor the prosecution provides *any* guidance on what “substantial absence” means. Even the definition proposed by Exxon, “no appreciable effect” is vague. No objective and fixed point distinguishes a reaction with slugs that do not inhibit reactor performance from a reaction with slugs that do adversely affect reactor performance. In the ‘982 patent, there is no fixed point when the slugs are substantially present (as opposed to substantially absent) that they have an appreciable effect on reactor performance.

Confronted with the term “substantial absence,” a potential competitor could not determine whether there is infringement. The uncertain boundary leads to a holding of indefiniteness. *See Morton Int’l*, 5 F.3d at 1470, 28 USPQ2d at 1195.

C. “Fluidizing solid particles to the height, $H > 3m$ ”

Another teaching of this patent concerns the degree to which the solid catalyst particles are fluidized. The specification states “optimal operation of a slurry bubble column reactor requires that the solid phase be fluidized in the liquid phase over the entire height of the column.” Col. 5, lines 47-49. Claim 1(b) requires “fluidizing the solid . . . particles . . . to the height, $H > 3m$, of the expanded liquid in the column.” Col. 13, lines 62-64. The specification explains that the fluidization height is $D / (U_S - U_L)$. Col. 7, lines 33-34.

The United States argues that this term is indefinite because the patent is internally inconsistent. One part of the patent requires fluidization along the entire column while another part permits fluidization along only one-half the column.

Col. 14, line 3, sets forth the following equation: $0.5 (U_S - U_L) \frac{D}{H}$, where $H > 3m$. Using basic algebra this formula can be rewritten as $\frac{1}{2} H = D / (U_S - U_L)$. In this formula, the fluidization height, which is defined as $D / (U_S - U_L)$, can equal one-half H .

Exxon’s response is difficult to comprehend. At one point, Exxon argued that claim 1(b) does not concern “fluidization height.” Instead, claim 1(b) concerns the element H . *See* Transcript of Oral Argument on Feb. 10, 2000, p. 18.¹⁸

Exxon asserts that the concentration of solid particles at the top of the slurry must be at least 13.5% of the concentration of solid particles at the bottom. *See* Bell

¹⁸When this statement was pointed out to Exxon’s counsel, Exxon clarified that claim 1(b) “does relate to fluidizing catalyst particles.” Transcript of Oral Argument on February 10, 2000, p. 39.

Declaration 50-51, explaining Col. 10, lines 51-66. This assertion is consistent with the statement in Col. 13, lines 62-64.

Exxon, however, never addresses the equation set forth in Col. 14, line 3. Mindful of the Court's obligation to construe a claim to preserve the patent's validity, *Wang Laboratories, Inc. v. America Online, Inc.*, 197 F.3d 1377, 1383, 53 USPQ2d 1161, 1165 (Fed. Cir. 1999), the Court has examined most closely Exxon's argument. The Court has looked for an explanation from Exxon as to how a term that is defined inconsistently within the same claim could be definite. The Court has found no explanation.

Shah reinforces this analysis: "Dr. Bell never addresses the fact that claim 1 provides two distinct, incompatible restrictions on the height to which catalyst particles must be suspended in the liquid." Shah Supp. Declaration, ¶ 8.

The Court holds that the term "fluidizing solid particles to the height, $H > 3m$ " is indefinite. The claim, when read in light of the specification, tells a person with ordinary skill in the art *both* that the solid particles must be fluidized to the top of the expanded liquid *and* that the particles may be fluidized to only one-half the height of the expanded liquid. This inherent inconsistency makes the term indefinite. *In re Merat*, 519 F.2d 1390, 1394, 186 USPQ 471, 476 (CCPA 1975). Further, if a person with ordinary skill in the art fluidized the solid particles to a height equaling three-quarters of the height, the person could not determine whether there is infringement. This uncertainty leads to a holding of indefiniteness. *See Morton Internat'l*, 5 F.3d at 1470, 28 USPQ2d at 1195.

D. "Maintaining plug flow"

The invention relates to the mixing characteristics of the solid and gas phases within the reactor. The two extremes for mixing characteristics are "plug flow" and "fully mixed," which is also known as "well-stirred." In a "plug flow" reactor, the catalyst is stationary relative to the flow of reactants and products. In this invention, which concerns a three-phase reactor, the gas bubbles traverse the length of the reactor in a "plug" towards the top. The "Peclet number" (Pe) defines the place on the spectrum between "plug flow" (Pe = infinity) and "fully mixed" (Pe = zero). Defendant's Memorandum in Support of Summary Judgment, pp. 7-8. The Plaintiff did not dispute this characterization.

The government argues that the patent is not consistent about what Peclet number is required. The government cites to various places in the patent in which Pe number is greater than 1, much greater than (" $>>$ ") 1, greater than or equal to 2, and greater than 10. Another place says the Pe number must be equal to or greater than 0.2. But, in other places, the patent says a Pe number of less than 1 is part of a fully-mixed system.

Exxon argues that the patent is not internally inconsistent. Claim 1(c) requires the Peclet number to equal or be greater than .2 while maintaining plug flow. Col. 14, lines 10-14. This requirement, according to Exxon, is consistent with other parts of the specification where plug flow behavior is exhibited at Peclet numbers greater than 1, 2, or 10.

The argument from the United States has some appeal. Nevertheless, in light of the presumption of validity under Section 282, this argument is rejected.

Plug flow and back mixed are terms to describe opposite conditions in a reactor. A reactor will typically display some amount of plug flow and some amount of back mixing. Only in an ideal setting would a reactor have absolutely all plug flow to the exclusion of all back mixing. *See* Bell Declaration ¶ 61. The prior art associates “plug flow” with Peclet numbers greater than ten. *See* Col. 2, lines 46-48.

According to Exxon, the inventors discovered that the beneficial properties of a plug flow reaction occur with Peclet numbers as low as 0.2. Transcript of Oral Argument on February 10, 2000, pp. 61, 82. The claim clearly discloses what is required: a Peclet number of greater than or equal to 0.2. For this reason, the claim is definite.

The patentee’s choice of words to describe a reaction with a Peclet of 0.2 is not important because the patent’s disclosure is clear. Although the language may differ from how ordinary artisans would use the language (because some ordinary artisans would describe a reactor with a Peclet number of 0.2 as “back mixed”), patentees are free to describe the invention in their own terms. *See W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1558, 220 USPQ 303, 316 (Fed. Cir. 1983) (“It is well settled that a patent applicant may be his own lexicographer.”); *National Tractor Pullers Ass’n, Inc. v. Watkins*, 205 USPQ 892, 913 (N.D. Ill. 1980) (“The patentee is his own lexicographer and 35 U.S.C. § 112 is satisfied where the patentee reasonably disclosed the subject matter of the invention in terms which are reasonably clear and consistent.”). The clarity of the patent is confirmed by Shah’s deposition: “Claim 1(c) implies maintaining plug flow means Peclet number of gas phase greater or equal to .2.” Shah Deposition, p. 247.¹⁹

E. “Particles of average diameter”

The United States argues that this term is indefinite in two respects. First, the claim does not set an upper limit on the size of the particles. Second, the patent does not explain how to determine the “average.”

The patent teaches that the particles to be fluidized will have an average diameter of greater than 5 μ m. The specification states that “Particles with greater than 100 μ m diameters cannot be effectively fluidized without a backmixing debit on the kinetic driving force.” Col. 13, lines 42-45.

Citing *In re Corkill*, 771 F.2d 1496, 1500-51, 226 USPQ 1005, 1009 (Fed. Cir. 1985), the Defendant argues that the term is indefinite because the claim fails to set an upper boundary. The Defendant believes that this omission in the patent claim is especially egregious because the specification indicates a boundary. In his initial

¹⁹The Defendant tries to minimize the effect of this statement by placing it in context. Immediately prior to this passage in his deposition, Shah testified: “plug flow definition in this patent is very confusing and varies from which part of the specifications you look at. What I intend to point out is one of the flaws in this patent is the inconsistency in the definition of plug flow in various parts of this patent.” Shah Deposition, page 246.

The Court concludes that, as a whole, Shah’s deposition shows he understood the meaning of the term.

declaration, Shah does not state that an ordinary artisan would not understand this term for this reason, although Shah states that the claim does not limit particle size. *See* Shah Declaration, ¶ 51-53.

Exxon implicitly agrees that claim 1 does not limit the size of the particles in so many words.²⁰ Exxon, however, argues that the claim as a whole places “a functional or operative upper limit.” Exxon’s Memorandum in Opposition to Summary Judgment, page 43. In making this argument, Exxon consequently is conceding that the term must have an upper boundary. Exxon points out that the claim must be interpreted as a whole, a proposition that the government does not dispute. As a whole, claim 1(b) requires the solid particles to be fluidized to a height along the column.

The question then is, does claim 1(b) set forth an upper limit such that a person with ordinary skill in the art would understand the boundary of the patent? *See Brunswick Corp. v. United States*, 34 Fed. Cl. 532, 566-67 (1995) (stating the term “at radio frequencies exceeding 2,000 MHz” is not indefinite because “one of ordinary skill in the art would know to test the materials at the frequencies where radar threats were located.”), *aff’d*, 152 F.3d 946, 46 USPQ2d 1448 (Fed. Cir. 1998).

Exxon contends that the functional upper limit to the size of the particles are the particles that can be fluidized. Large particles, like those the size of bowling balls, cannot be fluidized. Therefore, the functional limit is the particles themselves. Further, Bell opines that “the size of particles covered by the claim is readily discernible according to whether they would be operative in step (b) of claim 1.” Bell Declaration, ¶ 66.

The United States agrees with part and disagrees with part of Exxon’s contention. The United States recognizes and implicitly agrees that only those particles that can be fluidized are within the claim. If a particle is too large to be fluidized, then it is outside the claim.

The United States disagrees with Exxon as to whether a person with ordinary skill in the art would know what size particles can be fluidized. Shah directly contradicts Bell’s opinion: “one of ordinary skill in the art, however, could not discern which particle diameters would work in a column of any given height.” Shah Supplemental Declaration, ¶ 24 (emphasis in original). Shah explains that the upper limit on particle size is not ascertainable because other variables such as the height-to-effective diameter ratio and the settling velocity makes the analysis too complex for a person with ordinary skill in the art to predict.

Would a person with ordinary skill in the art understand how to calculate the upper limit on the size of particles that could be fluidized? For the answer to this question, the Court must rely on the information submitted by Bell and Shah. This information conflicts.

The Court holds that a person with ordinary skill in the art would not know how to calculate an upper limit for two reasons. First, Shah explains why the calculation is too

²⁰A limitation from a specification cannot be read into a claim. *Sjolund v. Musland*, 847 F.2d 1573, 1581, 6 USPQ2d 2020, 2027 (Fed. Cir. 1988).

complex. Bell, in contrast, offers the conclusory statement that the size of particles that could be fluidized is “readily discernible.” This statement is made without explanation. Because it is too general, it does not rebut Shah’s more tightly presented argument.

As a second reason for holding that a person with ordinary skill in the art would not know how to calculate an upper limit, the Court compared the relative experiences of Bell and Shah. Bell is a less experienced expert in the field of designing reactors for Fischer-Tropsch reactions.²¹ As someone with less expertise, Bell is more likely to have been mistaken in estimating the ability of a person with ordinary skill in the art.

For a claim to be definite, the law does not require mathematical certainty in the claim. Instead, the claim must be “as precise as the subject matter permits.” *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1385, 231 USPQ 81, 94 (Fed. Cir. 1986); *see also Modine*, 75 F.3d at 1557, 37 USPQ2d at 1617. The subject matter of this term — the maximum size of the particles to be fluidized — permits a greater amount of precision. First, the patent could explain how a person with ordinary skill in the art could discern or calculate the maximum size. Second, the specification states “Particles with greater than 100 m diameters cannot be effectively fluidized.” Col. 13, lines 43-45. The specification, therefore, provides ample support for the proposition that the claim could be expressed with definiteness.

Accordingly, the Court concludes that a person of ordinary skill in the art could not predict the size of the particles to be fluidized. Thus, there is no functional upper limit to the size. Without an upper limit, the term is indefinite.

As an alternative argument, the Defendant claims that the term “average diameter” is indefinite because the patent fails to define how to calculate the average diameter. Shah testifies that there are at least four ways to define “average diameter.” Each method causes a different numerical value. Further, a person with ordinary skill in the art could not tell what meaning should be used.

Among the four alternatives, Exxon contends that “average” means the particles must have a “mass weighted diameter” greater than 5 microns. Bell contends that a person with ordinary skill in the art would know that “mass weighted diameter” normally equals the “volume averaged” diameter. This equity is caused by the similar technique used to calculate either number. Exxon, thus, challenges Shah’s opinion that each method produces substantially different results.

The remaining two alternatives of the four proposed by Shah are a strict numerical average and a surface area average. A strict numerical average of the diameters of the largest and smallest particles could produce an impractical result because particles at either extreme could deviate so greatly from the mean that either could skew the result. Therefore, it is extremely unlikely that the person with ordinary skill in the art would

²¹ Bell’s main field of expertise is the field of catalysis, designing catalysts to work in chemical reactions. Catalysis, however, differs from reactor design.

consider using such an unreliable method. *See* Bell Declaration, ¶ 71. This possible method would not confuse a person with ordinary skill in the art.

The fourth alternative proposed by Shah is “surface area average.” Bell avers that “surface area average” is “appropriate only for situations in which mass transfer was a primary concern.” This statement *implies* that mass transfer is not a primary concern in a Fischer-Tropsch reaction. This direct inference is not contested by Shah. Thus, the Court holds that a person with ordinary skill in the art would not measure average particle diameter by using the surface area method because surface area is less relevant.

The Court holds that the Defendant has failed to meet its burden to show that a person of ordinary skill in the art would not understand how to calculate the average diameter. Accordingly, the term is not indefinite for this reason.

F. U_g

For the next two terms, U_g and U_L , a further explanation of the technology is necessary. To understand the technology and the viewpoint of the ordinary artisan, the Court is relying predominantly on the explanation provided by Bell, although Shah agrees with his statements.

The amount of space for gas flow affects the speed (velocity) at which the gas can travel through the reactor. The gas velocity increases as the cross-sectional area through which the gas flows decreases. (Picture the same quantity of gas moving through a narrow straw or a wide tube. The gas moves move slowly if it has to expand through a larger area.)

There are two methods for calculating the effect of available space on gas velocity: superficial and interstitial. The superficial method uses the amount of free cross-sectional space (the column width minus any internal structures). The superficial method ignores any liquid in the column.

In contrast, the interstitial method considers the liquid through which the gas cannot flow. If gas occupies 40% of the free cross-sectional area and liquid occupies 60%, then the interstitial gas velocity is equal to the superficial gas velocity divided by 0.4. Because the interstitial velocity takes into account the presence of the liquid, it is the “true” or “actual” velocity.

Although with regard to the definiteness of U_g the Defendant raises several issues, one can be disposed of summarily. The Court holds that U_g in claim 1(c), Col. 14, line 11, means “average gas velocity.” Although claim 1(c) omits the word “average,” U_g is defined earlier in claim 1(a) as “average gas velocity.” The specification also states “ U_g is the average velocity of the gas along the reactor.” Col. 9, lines 37-38. This consistent definition means that a person skilled in the art would know that when claim 1(c) refers to U_g , it means average gas velocity.

Beside this meaning of U_g in claim 1(c), the Defendant raises two other challenges to whether a person with ordinary skill in the art would understand the term U_g . First, the

definition of velocity is ambiguous. Second, the way for calculating average is not explained.

The velocity of the gas can be measured either as an interstitial velocity or a superficial velocity. The government argues that the patent does not inform a person with ordinary skill in the art which of the two methods to use. Exxon in contrast argues that a person with ordinary skill in the art would recognize that an equation contained in the specification (Col. 10, line 30) inherently discloses that the velocity is the superficial velocity.

The Court holds that a person with ordinary skill in the art would know that the velocity is the superficial velocity. Bell reviews the equation in his declaration at paragraphs 80-82. See Transcript of Oral Argument, February 10, 2000, pp. 155, 157. Without setting forth all the details of Bell's recitation, the Court notes that interstitial velocity is superficial velocity divided by gas holdup. In the equation, the term U_g is divided by τ_g , a term that represents the gas holdup. If U_g were interstitial velocity, a term that derives from the gas holdup, then dividing for a second time by the gas holdup would make no sense. Accordingly, U_g cannot be interstitial. Thus, U_g is superficial.

Although it appears that the government conceded this point at oral argument, the government also argues that ordinary artisans typically specify whether the gas velocity is superficial or interstitial. The Court recognizes that the term could be more clear – an express statement would have eliminated all uncertainty. Nevertheless, the law does not require absolute clarity and the law presumes that patents are valid. *Miles Lab.*, 997 F.2d at 875, 27 USPQ2d at 1126. Given this background, the Defendant did not meet its burden of proving by clear and convincing evidence that the term was indefinite for failing to explain which type of measurement was used.

In addition to this reason, the Defendant argues that U_g is indefinite because the patent does not specify how to calculate “average.” Shah contends that there are several ways to calculate average and a person with ordinary skill in the art would not know which method to select.

Exxon argues that the term is definite because an ordinary artisan would know that the average is obtained by “simply calculating the arithmetic average of the inlet and outlet gas flow rates divided by the average reactor free cross-sectional area.” Exxon's Memorandum in Opposition to Motion for Summary Judgment, p. 58. This method, according to Exxon, is consistent with the specification that states the calculation is “relatively straightforward.” Col. 9, lines 63-66. In addition, typical operators of commercial reactors use this method.

The Court looks first to the patent's claims and specifications. Nothing in the patent informs a person how to calculate “the arithmetic average of the inlet and outlet gas flow rates divided by the average reactor free cross-sectional area.” This method is just one alternative. The government also proposes “a simple arithmetic average of the inlet and outlet superficial gas velocities.” This calculation is more straightforward than the one proposed by Exxon because the government's choice omits one step (dividing by the average reactor free cross-sectional area.) The government proposes a second method — the total volumetric gas flow rate integrated along the length of the column, divided by the

length, divided by the free cross-sectional area, divided by the gas holdup. This approach is less straightforward because it has more steps (such as divided by the gas holdup). The patent does not explain which of the three methods to use. The claim is silent; the specification is too vague to be informative.

Although the intrinsic evidence does not explain the term, the Court's inquiry does not end there. The next step is to explore the extrinsic evidence, which includes the commercial practice. *Tillotson, Ltd v. Walbro Corp.*, 831 F.2d 1033, 1039, 4 USPQ2d 1450, 1454 (Fed. Cir. 1987); *Charvat v. Comm'r of Patents*, 503 F.2d 138, 151, 182 USPQ 577, 587 (D.C. Cir. 1974) (reversing a rejection for indefiniteness because of, in part, "commercial practice of inventions"); *Minnesota Mining and Mfg. Co. v. Johnson & Johnson Orthopaedic, Inc.*, 22 USPQ2d 1401, 1410 (D. Minn. 1991) (rejecting an indefiniteness challenge because of the "commercial situation"), *aff'd*, 976 F.2d 1559, 24 USPQ2d 1321 (Fed. Cir. 1992). The commercial practice, for which the evidence is not rebutted, is that the average velocity is calculated as set forth by Exxon.

Section 282 establishes a presumption of validity. The government has not overcome the burden. The government has failed to show that a person with ordinary skill in the art would deviate from the standard commercial practice. Accordingly, the term is not indefinite.

G. U_L

U_L represents the "liquid velocity along the column." Col. 14, line 23. As described in the preceding section, the velocity can be measured as either interstitial or superficial. The government argues that because the patent does not define U_L as either interstitial or superficial, the term is indefinite.

Exxon argues that the patent inherently reveals that U_L is interstitial based on a formula, $C_p = A \exp \left[-x \frac{U_s - U_l}{D} \right]$, set out at Col. 10, line 58. Unlike the formula that inherently discloses the meaning of U_g , this formula does not inherently disclose whether U_L is interstitial or superficial. For example, this formula does not divide by a term for the liquid holdup, when dividing the liquid velocity by the liquid holdup implies that U_L must be the superficial velocity. (See discussion in Section V. F., above.)

The lack of a clear implication by the formula, itself, seems implicitly conceded by Exxon. Instead of focusing on the formula, Exxon resorts to extrinsic evidence, a book by Liang-Shih Fan *Gas-Liquid-Solid Fluidization Engineering* (1989)(hereinafter "Fan"). Appropriate extrinsic evidence may be consulted in determining whether a term is indefinite. *Personalized Media*, 161 F.3d at 706, 48 USPQ2d at 1889. The Court has looked at some extrinsic evidence. Fan, however, is not an appropriate reference.

Exxon fails to link Fan to this part of the patent. Bell states "The mass-balance differential equations from which the equation in Col. 10, line 58, is derived are described in Fan." Bell Declaration, ¶ 86. Exxon does not support this assertion at all. The patent's only reference to Fan is at Col. 8, line 37. This reference is in the context of describing column diameters, not the velocity. In the context of Example 4, where the formula appears, Fan is not cited. Exxon does not assert that a person with ordinary skill in the art,

upon confronting the equation set forth at Col. 10, line 58, would seek more information from Fan.

Even if a person skilled in the art were to search for whether U_L is interstitial or superficial in Fan, Fan is unclear. The formula from Fan on which Exxon relies appears on page 286. This formula includes the term $\frac{U_{sl}^*}{(1 - \epsilon_g)}$. U_{sl}^* is the volume-averaged superficial slurry velocity. ϵ_g is the gas holdup. Exxon contends that the quantity $(1 - \epsilon_g)$ is equal to the liquid holdup in the slurry. Therefore, the quantity $U_{sl} / (1 - \epsilon_g)$ is the average liquid interstitial velocity. “Hence the quantity $U_{sl}^* / (1 - \epsilon_g)$ corresponds to U_L in the patent.” Bell Declaration, ¶ 87.

Within Exxon’s arguments are many leaps, none of which are asserted to be known to a person with ordinary skill in the art. First, U_{sl}^* is the velocity of the *slurry*. Shah points out that the slurry and the liquid are separate in a three phase reactor. How Exxon moves from a term U_{sl}^* , which is the slurry, to using that same term in a quantity $(U_{sl}^* / (1 - \epsilon_g))$ to mean the liquid velocity is not explained. Exxon has not offered any evidence that a person with ordinary skill in the art would understand this shift in meaning.

The weakness of Exxon’s logic is also shown in Exxon’s selection of the quantity $U_{sl}^* / (1 - \epsilon_g)$ “to correspond[] to U_L in the patent.” It seems just as plausible that U_{sl}^* (without being divided by the gas holdup) could correspond to U_L in the patent. If so, then U_L would be superficial because it is later divided by the gas holdup. Again, Exxon offers no evidence that a person with ordinary skill in the art would think that $U_{sl}^* / (1 - \epsilon_g)$ – and not U_{sl}^* – corresponds to U_L .

Also, any reference to U_{sl}^* in Fan is inherently misleading for the meaning of U_L in the patent. Fan, itself, uses U_L and explicitly defines U_L as the “superficial liquid velocity.” This definition is simple. Why a person with ordinary skill in the art who is searching for the definition of U_L and has located Fan as a reference would not assume that U_L is measured consistently in Fan and the patent is not explained.

Several times the Court notes that Exxon has failed to offer evidence or explanation. The Court has not shifted any burden to Exxon. The United States presented a “clear and convincing” argument to meet its burden that the term U_L is indefinite because it could mean interstitial or superficial. The Court has examined Exxon’s response carefully and found it lacking.

As explained above, Exxon’s response depends on extrinsic evidence. Exxon must depend on extrinsic evidence because the patent does not refer to the liquid velocity as interstitial or superficial. *See* Transcript of Oral Argument, February 10, 2000, p. 168 (statement by Exxon’s attorney that patent “never uses” interstitial or superficial for liquid velocity). In citing extrinsic evidence to respond to the government’s arguments, Exxon must show why the extrinsic evidence rebuts the argument. Exxon has not done this.

Bell, in a slightly different argument, contends that U_L must be interstitial because claim 1(b) concerns the fluidization of the catalyst. *See* Bell Declaration, ¶ 86. Exxon, however, does not present this particular point in its brief. Bell argues that because the fluidization of the catalyst is involved, the relevant liquid velocity is the “true” velocity.

This statement is completely conclusory. The fluidization of the catalyst could also be compared to the superficial velocity. Why the interstitial is preferred over the superficial velocity is not explained. A related point, brought out in Shah's Supplemental Declaration, ¶ 18, is that a person with ordinary skill in the art — an engineer — is unlikely to define U_L as interstitial but U_g as superficial. U_L and U_g are related concepts: the velocity of different phases of the slurry column reaction. A person with ordinary skill in the art would expect these variables to be defined consistently.

The preceding analysis, by itself, is sufficient to support the Court's holding that U_L is indefinite. The Defendant also raised a secondary point that supplements the Court's analysis. Exxon's proposed definition of U_L introduces a new variable — the liquid holdup. U_L is the superficial liquid velocity divided by the liquid holdup. Since calculating U_L is possible only by knowing the liquid holdup, a person with ordinary skill in the art would expect liquid holdup to be explained in some respect. The patent, however, is silent on this term. This omission adds additional ambiguity and confusion to the meaning of the term U_L .

Finally, as a last argument, Exxon argues that the United States has admitted U_L is definite and clearly defined when the Defendant incorporated U_L into its proposed definition of "D," the symbol for the dispersion coefficient. In its initial claim construction brief, filed on November 1, 1999, the Defendant states that D means "an intermediate dispersion coefficient that satisfies the conditions $5 U_g D/H > 0.5(U_s - U_L)$." See Claim Construction Brief, filed November 1, 1999, pp. 41-43; see also Brief in opposition to the Plaintiff's claim construction, filed November 15, pages 40-42.

Ultimately, this argument is unsustainable, but this argument differs from Exxon's more general arguments (previously discussed in Section II. D., above) that the United States admitted that various terms were definite by using those terms in discovery. A statement in the same brief in which the Defendant asserts that certain terms were indefinite has a different character from statements in answering discovery. As explained in Section, II. D., above, the Defendant took care to qualify its answers to discovery. The Defendant, however, did not qualify its proposed definition of D. Since the Defendant's definition of D depends on the term U_L , as a matter of logic, the Defendant is clearly communicating that it understands U_L . If the Defendant did not understand U_L , then the Defendant should not have used the term when defining D.

Although logical, the Plaintiff's argument must be rejected. The interpretation of a patent is a question of law — it does not and cannot depend on the acts or omissions of the parties litigating the particular case before the court. If this Court were to hold that although the language of the patent entirely fails to define the term U_L , U_L is definite *solely* because the Defendant admitted its definiteness, then interpretation would cease to be an issue of law.

A hypothetical example may help clarify this point. Suppose another person was accused of infringing this patent in some case arising in the future. This hypothetical defendant could raise the exact same arguments that U_L is definite. Further, the hypothetical defendant would avoid defining D in terms of U_L and thereby not admit that

U_L is indefinite. Would a hypothetical court conclude that U_L is indefinite? This inconsistency in interpretation of a patent cannot be permitted. Quoting the Supreme Court's decision in *Markman*, the en banc decision in *Cybor Corp* has emphasized that “treating interpretative issues as *purely legal* will promote (though not guarantee) intrajurisdictional certainty through the application of *stare decisis* on those questions not yet subject to interjurisdictional uniformity under the authority of the single appeals court.” *Cybor Corp.*, 138 F.3d at 1455, 46 USPQ2d at 1173 (quoting *Markman*, 517 U.S. 370, 391, 116 S. Ct. 1384, 1396, 134 L. Ed.2d 577 (1996) (emphasis in original).

Consistent with the instructions from *Cybor Corp.* to treat claim interpretation as a purely legal matter, the Defendant's “admission” (if this is the correct term) that U_L is definite cannot interfere with this Court's legal analysis. The above examination of the intrinsic evidence and permitted extrinsic evidence shows that a person with ordinary skill in the art would not know whether U_L is a measurement based on interstitial or superficial velocity. Accordingly, the term is indefinite.

H. “ ρ_s ”

is defined as the “effective density of the particles.” Col. 14, line 17. The Defendant argues that the patent does not explain what “effective” means. Dr. Shah explains that a skilled practitioner would know that solid catalyst particles are porous. An “effective” particle density means the weight of the particle plus the weight of the liquid trapped in the pore volume of the particle, divided by the volume of the particle.

Although Shah asserts that there are many ways to calculate the pore volume diameter, Shah does not list them in either his original declaration, see ¶ 60-61, or his supplemental declaration, see ¶ 23. Shah also adds the conclusory statement “depending upon which technique is chosen, the numerical value of pore volume *may vary.*” Shah Decl. ¶ 60 (emphasis added).

The Court holds that the United States has failed to meet its burden of “clear and convincing” proof. Shah's statements lack any explanation. Without such a detailed showing, the Court cannot hold that the Defendant has overcome the presumption of validity.

I. “Terms in dependent claim 7”

All previous terms are found in claim 1, on which all other claims depend. The government has also raised, very briefly, arguments about two other terms in claim 7: “indigenous product” and “the CO hydrogenation reaction.”

The government has not submitted a declaration that a person with ordinary skill in the art would fail to understand them. Accordingly, the government has failed to meet its burden. These terms are not indefinite.²²

²² “Indigenous product” means FT wax. Bell Declaration, ¶ 91. “CO hydrogenation reaction” means the FT reaction. Bell Declaration, ¶ 93.

J. Summary

The Court holds that four terms present in claim 1 are indefinite. Since all other claims depend on claim 1, they are also indefinite. Thus, the Defendant's Motion for Summary Judgment with respect to the '982 patent is granted.

VI. Conclusion

For the '705 patent, the Court holds that two terms are indefinite: "for a period sufficient" and "to increase substantially." Accordingly, the Defendant's Motion for Summary Judgment is GRANTED.

For the '982 patent, the Court holds that four terms are indefinite. These are "substantial absence" in the context of "substantial absence of slug flow;" "fluidizing solid particles . . . to the height, $H > 3m$, of the expanded liquid in the column;" " $d_p > 5 m$ " in the context of "particles of average diameter, $d_p > 5 m$;" and " U_L ". Accordingly, the Defendant's Motion for Summary Judgment is GRANTED.

The Clerk's Office is directed to enter judgment in favor of the Defendant.

EDWARD J. DAMICH
Judge, U.S. Court of Federal Claims