In The United States Court of Federal Claims

No. 00-705 C

(Filed: June 20, 2003)

THE BOEING COMPANY, Plaintiff, v. THE UNITED STATES, Defendant.	* Patent suit; *Markman*; Claim construction; Terms construed – "trace elements" and "consisting essentially of"; Ordinary and customary meaning; Use of dictionaries and treatises; Choice among multiple definitions; Specification; Prosecution history; Reject meaning that would require court to ascribe strained meaning to other claim language.

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Ken B. Barrett, U.S. Department of Justice, with whom was *Assistant Attorney General Robert D. McCallum* and *Vito J. DiPietro*, Director, Civil Division, for defendant.

OPINION

ALLEGRA, Judge:

The Boeing Company (Boeing) seeks compensation from the government, under 28 U.S.C. § 1498(a), for unlawful use by the National Aeronautics and Space Administration (NASA) of an aluminum-lithium alloy in the fuel tank of the Space Shuttle. It contends that the alloy and the processing of aging it are covered by claims in its U.S. Patent No. 4,840,682 (the "'682 patent"). At issue in this *Markman* proceeding is the construction of several elements of those claims.

I. BACKGROUND

Boeing is the owner of the '682 patent, which is entitled "Low Temperature Underaging Process for Lithium Bearing Alloys." According to its summary, that patent is directed to providing "a method for aging aluminum-lithium alloys of various compositions at relatively low temperatures to develop a high and improved fracture toughness without reducing the strength of

the alloy."[1] The application for the '682 patent was filed with the U.S. Patent and Trademark Office (USPTO) on November 21, 1985, and claims the earlier filing date of December 30, 1983, through a parent application that was abandoned and of which the '682 patent is a continuation-in-part. The '682 patent was issued on June 20, 1989.

The patent consists of seven claims, the latter six of which are dependent, in some fashion, upon the first. That first claim recites as follows:

> A process for improving the fracture toughness of an aluminum-lithium alloy without detracting from the strength of said alloy, ***said alloy consisting essentially of***:
>
> | Element | Amount (wt. %) |
> |---|---|
> | Li | 1.0 to 3.2 |
> | Mg | 0 to 5.5 |
> | Cu | 0 to 4.5 |
> | Zr | 0.08 to 0.15 |
> | Mn | 0 to 1.2 |
> | Fe | .03 max |
> | Si | .05 max |
> | Zn | 0.24 max |
> | Ti | 0.15 max |
> | ***Other trace elements*** | |
> | Each | 0.05 max |
> | Total | 0.25 max |
> | Al | Balance, |
>
> said alloy first being formed into an article, solution heat treated and quenched, said process comprising the step of aging said alloy article to a predetermined underaged strength level at from about 200° F to less than 300° F.

The parties disagree as to the construction of two critical aspects of this claim – those highlighted above. These phrases are also employed in claims 5 and 6 of the patent.

A *Markman* hearing was held in this matter on May 13, 2003. At the hearing, the court heard from counsel and received testimony from two experts: Dr. Warren Hunt for plaintiff, and Dr. Edgar A. Starke, Jr. for defendant.

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[1] The parties agree that "fracture toughness" is a measure of the resistance a material has to the extension of a crack. They also agree that "yield strength" refers to the strength of a material where permanent and non-recoverable, or plastic, deformation occurs, while "tensile strength" or "ultimate strength" refers to the force necessary to break a specimen when subjected to stretching.

II. DISCUSSION

Although they agree on the meaning of many terms in the patent,[2] as noted, the parties dispute the construction of two critical phrases. Specifically, plaintiff requests this court to construe "consisting essentially of" as a transition phrase modifying "said alloy," so that the alloy specified necessarily includes not only the listed alloy ingredients, but other unlisted ingredients that do not materially effect the basic and novel characteristics of the invention. Secondly, it argues that the phrase "trace elements" means impurity. Not so, defendant argues, asseverating that the phrase "consisting essentially of" should, in the context of this patent, be read in a limiting fashion, more like "consisting of." Defendant further essays that the phrase "trace elements" means chemical elements – other than those specifically and individually identified in the claimed composition – present in small quantities.

We begin by examining the variegated tapestry of claim construction canons woven by the Federal Circuit in recent years, a tapestry which rivals that of Bayeux.[3] Determination of claim construction, including the terms of art found therein, is a matter of law. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). The Federal Circuit has instructed that, "when construing a claim, a court should look first to the intrinsic evidence, *i.e.*, the claims themselves, the written description portion of the specification, and the prosecution history." *Bell & Howell Document Mgt. Prods. Co v. Altek Sys.*, 132 F.3d 701, 705 (Fed. Cir. 1997). "Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language," the Federal Circuit has stated, because such evidence "constitute[s] the public record of the patentee's claim, a record on which the public is entitled to rely." *Vitronics Corps. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582-83 (Fed. Cir. 1996).

Within this broader fabric, the starting point for determining the meaning of a claim is, of course, its language. *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999). Generally, a claim is given its ordinary and customary meaning; that is, the meaning the claims "speak to those skilled in the art." *Electro Medical Sys. S.A. v. Cooper Life Science, Inc.*, 34 F.3d 1048, 1054 (Fed. Cir. 1994); *see also Bell Atl. Network Servs., Inc. v. Covad Comms. Group*, 262 F3d 1258, 1267 (Fed. Cir. 2001). "Dictionaries, encyclopedias and treatises, publicly available at the time the patent is issued, are objective resources that serve as reliable sources of information on the established meanings that would have been attributed to the terms of the claims by those of skill in the art." *Texas Digital Sys., Inc. v. Telegenix, Inc.*, 308 F.3d 1193, 1202-03 (Fed. Cir. 2002). Nonetheless, "the general meanings gleaned from reference sources, such as dictionaries, must always be compared against the use of the terms in context, and the intrinsic

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[2] This agreement is reflected in the "Joint Claim Construction and Prehearing Statement" filed by the parties on November 12, 2002.

[3] A well-known commentator on patent law has observed that "[j]udicial opinions in cases on patent infringement are replete with aphorisms, maxims and canons for the interpretation and application of claims." 5A Donald S. Chisum, Chisum on Patents § 18.03[2][a] (2003). As will be seen, this opinion is no exception.

record must always be consulted . . . ." *Brookhill-Wilk 1, LLC v. Intuitive Surgical Inc.*, 326 F.3d 1215, 1220 (Fed. Cir. 2003); *see also Texas Digital*, 308 F.3d at 1202; *Altiris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1369 (Fed. Cir. 2003). So too, "it is always necessary to review the specification to determine whether the inventor has used any terms in a manner inconsistent with their ordinary meaning." *Northern Telecom. Ltd. v. Samsung Electronics Co.*, 215 F.3d 1281, 1293 (Fed. Cir. 2000). Further, "[t]he prosecution history is often helpful in understanding the intended meaning as well as the scope of technical terms, and to establish whether any aspect thereof was restricted for purposes of patentability." *Vivid Technologies, Inc. v. American Science & Engineering, Inc.*, 200 F.3d 795, 804 (Fed. Cir. 1999); *see also Bell & Howell*, 132 F.3d at 705-06.

The court initially focuses on the phrase "trace elements" – plaintiff contends it refers to "impurities;" defendant argues it means "small amount." A possible contradistinction between these positions is that an element purposely added to an alloy could be a "trace element" under defendant's rendering, but likely not under plaintiff's. Perhaps, for this reason, plaintiff draws a bright line between elements purposely added to the alloy, which it refers to as "alloying elements," and those which are undesirable and thus impurities – in its lexicon, "trace elements." The available evidence suggests that, at least for purposes of the '682 patent, plaintiff is correct.

Turning first, as we must, to the claim language, the court is faced not with a battle of experts, but rather one of opposing dictionaries and treatises. These lexicographic sources stitch no less than three definitional lines. Consistent with defendant's construction, several of them define the phrase "trace element" essentially as a "chemical that occurs in minute quantities in a substance."[4] Others, however, introduce the notion that a trace element is not only minute, but so minute, indeed, as to defy quantitative determination.[5] While these references support defendant to the extent they indicate that a "trace element" is minuscule, they favor plaintiff in suggesting that such elements do not include desirable materials purposely added to the alloy, which presumably would be quantitatively determinable. The last line of definition, which appears to reinforce plaintiff's position, arises primarily in metallurgical treatises, including one specifically dealing with aluminum, and refers to "trace elements" as not including alloying elements, but instead as involving only impurities, that is, undesired elements.[6]

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[4] The American Heritage Dictionary 1283 (2d College ed. 1982); 18 The Oxford English Dictionary 333 (2d ed. 1989); *see also* McGraw Hill Dictionary of Scientific and Technical Terms 1647 (1978) (trace: "[a]n extremely small, but detectable quantity of a substance).

[5] *See* The American Society for Metals, Metals Handbook 15 (1948) (an "[e]xtremely small quantity of an element, usually too small to determine quantitatively"); *see also* Webster's New Collegiate American Dictionary 1227 (1981) (trace: "an amount of chemical constituent not quantitatively determined because of minuteness").

[6] *See* The Aluminum Association, Aluminum Standards and Data 7 (9th ed. 1988) (drawing a distinction between "alloying elements" and "impurities"); American Society for Metals, 2 Metals Handbook 711 (1st ed. 1979) (describing characterizations of metal purity and indicating

So which of these competing definitions applies (as the old saying goes, "a man with one watch knows what time it is; one with two is not sure")? Obviously, more is required here than a counting room convention. And while the Federal Circuit has cautioned against the use of general dictionaries for defining technical words, *see AFG Indus., Inc. v. Cardinal IG Co., Inc.*, 239 F.3d 1239, 1247-48 (Fed. Cir. 2001)*; Toro Co. v. White Consol. Indus., Inc.*, 199 F.3d 1295, 1299 (Fed. Cir. 1999), that rule is unavailing here as both parties have presented technical definitions in support of their constructions. Fortunately, a number of recent Federal Circuit decisions hold that where there are multiple dictionary- or treatise- derived meanings for a term, the court should "consult the intrinsic record 'to identify which of the different possible dictionary meanings of the claim terms in issue is the most consistent with the use of the words by the inventor.'" *Tehrani v. Hamilton Medical Inc.*, 2003 WL 21360705 at *5 (Fed. Cir. June 13, 2003) (*quoting Texas Digital*, 308 F.3d at 1203); *see also, e.g., Rexnord Corp. v. Laitram Corp*. 274 F.3d 1336, 1343 (Fed. Cir. 2001); *Dow Chem. Co. v. Sumitomo Chem. Co.*, 257 F.3d 1364, 1372-73 (Fed. Cir. 2001); *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249-50 (Fed. Cir. 1998). Indeed, the intrinsic record here is revealing for several reasons.

First, plaintiff's view of the claim language is consistent with other language in the patent's specification. On this count, the Federal Circuit has explained that "where there are several common meanings for a claim term, the patent disclosure serves to point away from the improper meanings and toward the proper meaning." *Renishaw*, 158 F.3d at 1250; *see also Inverness Medical Switzerland GmBH v. Princeton Biomeditech Corp.*, 309 F.3d 1365, 1370 (Fed. Cir. 2002); *Texas Digital*, 308 F.3d at 1203.

Here, the specification points away from defendant's construction and toward plaintiff's, consistently distinguishing between "alloying agents" or "alloying elements," on the one hand, and, on the other, "trace elements." For example, the "Detailed Description of the Invention" begins by explaining the types of aluminum-lithium alloys that are suitable to the low-temperature underaging process, identifying the "alloying agents" that are beneficial or essential to an alloy to

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that "[t]hese impurity elements, referred to as trace elements now can be detected by a variety of analytical methods"); *see also* McGraw-Hill Dictionary of Scientific and Technical Terms 1547 (1978) (defining a trace element as "[a] nonessential element found in small quantities (usually less than 1.0%) in a mineral"). Interestingly, The Condensed Chemical Dictionary 466 (8th ed. 1971) defines an "impurity" as "[t]he presence of one substance in another in such low concentration that it cannot be measured quantitatively by ordinary analytical methods." This definition tracks the way that several sources cited above define a "trace element," further suggesting an equivalency between these two terms.

While most of the definitions cited herein were presented by the parties in preparation for the *Markman* hearing, several were subsequently discovered by the court. The Federal Circuit has held that a court may conduct such independent research. *See Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1346 (Fed. Cir. 2003).

be treated by the process. Using the terms "impurities" and "trace elements" somewhat interchangeably, it then warns:

> The impurity elements iron and silicon can be present in amounts up to 0.3 and 0.5 percent, respectively. It is preferred, however, that these elements be present only in trace amounts of less than 0.10 percent. Certain trace elements such as zinc and titanium may be present in amounts up to but not to exceed 0.25 percent and 0.15 percent respectively. Certain other trace elements such as cadmium and chromium must each be held to levels of 0.05 percent or less. If these maximums are exceeded, the desired properties of the aluminum-lithium alloy will tend to deteriorate. The trace elements sodium and hydrogen are also thought to be harmful the properties of aluminum-lithium alloys and should be held to the lowest levels practically attainable . . . .

This paragraph is followed by a table which, according to the specification, represents the proportions in which the "alloying and trace elements may be present." These references in the specification thus distinguish between alloying and trace elements, and do so in a fashion that suggests that the latter elements are undesirable constituents in the alloy – in a word, "impurities." *See Renishaw*, 158 F.3d at 1250 ("The construction that stays true to the claim language and most naturally aligns with the patents description of the invention will be, in the end, the correct construction.").

This conclusion takes on sturdier proportions when viewed in light of the prosecution history. Before turning to this point in detail, a few more exegetic panels of the canonical tapestry must be examined. Thus, the Supreme Court, in *Graham v. John Deere Co.*, 383 U.S. 1, 33 (1966), indicated that "an invention is construed not only in light of the claims, but also with reference to the file wrapper or prosecution history in the Patent Office."[7] Burnishing these comments, the Federal Circuit more recently stressed, in *Southwall Techs., Inc. v. Cardinal IG Co.*, 54 F.3d 1570, 1579 (Fed. Cir. 1995), that "arguments made during prosecution regarding the meaning of a claim term are relevant to the interpretation of that term in every claim of the patent absent a clear indication to the contrary." *See also Digital Biometrics, Inc. v. Identix, Inc.*, 149 F.3d 1335, 1344 (Fed. Cir. 1998); *Spectrum Int'l, Inc. v. Sterilite Corp.,* 164 F.3d 1372, 1378-79 (Fed. Cir. 1998); *Pall Corp. v. Hemasure, Inc.*, 181 F.3d 1305, 1308 (Fed. Cir. 1999). The prosecution history is especially important where, as here, "the claimed invention is in a crowded art." *Amhil Enterprises, Ltd. v. Wawa, Inc.*, 81 F.3d 1554, 1560 (Fed. Cir. 1996).

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[7] This rule of construction has oft been reiterated by the Federal Circuit. *See Ballard Medical Products v. Allegiance Healthcare Corp.*, 268 F.3d 1352, 1358 (Fed. Cir. 2001); *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000); *Biodex Corp. v. Loredan Biomedical, Inc.*, 946 F.2d 850, 863 (Fed. Cir.1991) ("a particular interpretation of a claim term may have been disclaimed by the inventor during prosecution"); *McGill Inc. v. John Zink Co.*, 736 F.2d 666, 673 (Fed. Cir. 1984) ("Prosecution history may be used not only in an estoppel context but also as a claim construction tool.").

The file wrapper for the '682 patent indicates that, on September 11, 1984, the patent examiner initially rejected a number of claims in the parent application as being anticipated by U.S. Patent 2,915,391 (Criner), which also involved a process of aging aluminum alloys at relatively low temperatures for a relatively long time. On March 15, 1985, the inventors responded by adding a new claim to their patent application and asserting in respect thereof –

> Criner discloses aluminum alloys containing cadmium as an essential alloying element; . . . The cadmium may be replaced in whole or in part by one or more of the elements mercury, tin, indium, and thallium, at least one of which must be employed in the Criner alloy. . . . In contrast, the alloy of the present invention consisting essentially of the constituents set forth in new Claim 21 does not contain cadmium, mercury, tin, indium, or thallium as an alloying element.

As the examination process continued, the inventors reiterated this explanation, again and again, each time attempting to traverse objections raised by the examiner based on Criner.[8] While it is unclear whether the examiner ultimately accepted this explanation, that is not important. What is important is that in arguing that cadmium was not an alloying element, but rather a trace element, the inventors made the same essential distinction that plaintiff now reasserts. Conversely, under defendant's proffered interpretation of the phrase "trace element," cadmium could be an alloying element, albeit one in a minute quantity. That view obviously was not shared by the inventors. This critical aspect of the prosecution history thus provides yet additional support for plaintiff's construction of the claim language. *See Engel Indus. Inc. v. Lockformer Co.*, 96 F.3d 1398, 1405 (Fed. Cir. 1996) (noting importance in claim construction of argument made by inventors "to distinguish their claimed invention over the prior art").

As a final matter, adopting defendant's definition would require this court to jettison the conventional meaning of "consisting essentially of." That phrase is one of several commonly-encountered transitional clauses used to delimit the scope of a claim. These phrases can be arrayed over a spectrum, depending upon the degree to which they allow the possibility of additional elements not specified. *See AFG Indus.,* 239 F.3d at 1244-45; *see also* Stephen A. Becker, 1

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[8] On November 21, 1985, a continuation-in-part application was filed with the USPTO. As that application progressed, the examiner continued to raise Criner and the inventors continued to distinguish that patent on the basis that cadmium, though potentially a "trace element," was not an alloying element. For example, in a May 5, 1986, transmittal to the USPTO, the inventors again argued that "Criner discloses aluminum alloys containing cadmium an essential alloying element," whereas, "[i]n contrast, the subject alloy defined by Claim 1 limits cadmium content to 0.05% or less as a trace element." The examiner was apparently not convinced and, on March 27, 1987, she rejected various claims "as being unpatentable over Criner for the reasons set forth in the previous" rejection. On September 28, 1987, the inventors again responded by making the same distinction between "alloying" and "trace" elements. That some of the referenced arguments were made in the parent application is of no moment. *See Wang Labs., Inc. v. America Online, Inc.*, 197 F.3d 1377, 1384 (Fed. Cir. 1999); *Jonsson v. Stanley Works*, 903 F.2d 812, 818 (Fed. Cir. 1990).

Patent Applications Handbook § 2.4 (2002). If one side of that spectrum is reserved for "open-ended" transitional phrases that do not exclude the possibility of additional structures or steps in a claim, then that position is undoubtedly occupied by phrases like "comprising" or "including." At the polar opposite is the "close-ended" phrase "consisting of," which, in the patent world, signifies restriction and exclusion. *See Vehicular Techs. Corp. v. Titan Wheel Int'l., Inc.*, 212 F.3d 1377, 1383 (Fed. Cir. 2000) ("In simple terms, a drafter uses the phrase 'consisting of' to mean 'I claim what follows and nothing else.'"). Toward the middle of this spectrum, we encounter the phrase employed here, "consisting essentially of," which is often used in claims involving chemical compositions. That phrase is "open to 'unlisted ingredients that do not materially affect the basic and novel properties of the invention.'" *AFG*, 239 F.3d at 1245 (quoting *PPG Indus. v. Guardian Industry Corp.*, 156 F.3d 1351, 1354 (Fed. Cir. 1998)); *see also Water Technologies Corp. v. Calco, Ltd.*, 850 F.2d 660, 666 (Fed. Cir. 1988); *Reese v. Hurst*, 661 F.2d 1222, 1229 (C.C.P.A. 1981); *In re Garnero*, 412 F. 2d 276, 279 (C.C.P.A. 1969).

Relying on its definition of "trace element," defendant contends that the list of chemical ingredients in claim 1 is essentially closed, with unlisted ingredients being limited to the maximum amounts listed for "[o]ther trace elements" in the patent, that is, 0.05% max each and 0.25% total. But, the cited percentage limitations actually cut the opposite way. For one thing, they suggest that defendant's interpretation of "trace" would render that word either superfluous or redundant.[9] While, in some circumstances, a modicum of redundancy is understandable, the court perceives no reason, either logical or in the intrinsic evidence, why an inventor would refer to an element constituting less than 0.05 percent by weight of an alloy as being a "trace" element, if trace merely meant "small."[10] Indeed, on this point, defendant would have this court exercise a bit of patent *joie de revision*, as it readily admits that, to adopt its construction, the usually open-ended "consisting essentially of" must be given the close-ended meaning ordinarily ascribed to "consisting of." Only then can defendant argue the scope of the claim is limited to the listed ingredients. Such linguistic legerdemain, however, is neither favored nor required by plaintiff's construction of the phrase "trace element," which can peacefully coexist with the normal understanding of the transitional phrase "consisting essentially of." Case law suggests that the latter construction – one which gives all the words in the claims their ordinary and accustomed meaning – is preferred. *See Brookhill*, 326 F.3d at 1220 (emphasizing the importance of the surrounding words in determining the ordinary and custom meaning of a construed term); *see generally, Comm'r v. Kelley*, 293 F.2d 904,

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[9] *See Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp.*, 93 F.3d 1572, 1578 (Fed. Cir. 1996) (court should avoid construction that renders claim language mere surplusage); *Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 988 F.2d 1165, 1171 (Fed. Cir. 1993) (same).

[10] Contrary to defendant's further argument, the court does not believe that plaintiff's construction of the phrase "trace elements" is belied by the reference in claim 1 to "other" trace elements. As verified by the specification, some of the elements listed in the table above this reference are trace elements (*e.g.*, Fe). Thus, the "other" reference does not suggest that ***all*** of the elements listed above that reference are potentially trace element, but only recognizes that ***some*** of those elements are of the trace variety. The same is true of like references made in claims 5 and 6 of the patent.

907 (5th Cir. 1961) (stating, in construing a statute, that "required to choose between two possible constructions, we feel compelled to give effect to the one that more naturally conveys the ordinary meaning of the words as they are written").[11]

III. CONCLUSION

This court will not paint the lily. The meaning of the elements in question is derivable from the intrinsic record, standing alone.[12] Parsing the plain meaning of the terms in question, consistent with the specification and in the context of the prosecution history, leads to a single, albeit two-pronged conclusion: that, as used in claim 1 and other claims of the '682 patent, the phrase "trace element" means undesired impurities and the phrase "consisting essentially of" is open to unlisted ingredients that do not materially affect the basic and novel properties of the invention.

IT IS SO ORDERED.

s/ Edward J. Damich
Edward J. Damich, Chief Judge
for Judge Francis M. Allegra

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[11] Defendant argues that, wholly apart from the definition of "trace element," the phrase "consisting essentially of" should be construed in such a way that there are no unlisted elements in the alloy. For this proposition, it relies heavily on *Talbert Fuel Sys. Patents Co. v. Unocal Corp.*, 275 F.3d 1371, 1375 (Fed. Cir. 2002). To be sure, in *Talbert* , the Federal Circuit held that the phrase "consisting essentially of" could not negate the limiting effect of other claim language that indicated that the subject reformulated gasoline had a claimed boiling point range of 121-345F. 275 F.3d at 1375. However, in the claim considered by the court, the signal "consisting essentially of" did not modify the boiling point range, but rather an accompanying hydrocarbon composition. And, during the prosecution of that patent, the inventor had repeatedly stressed that 345F was the upper boiling point for the gasoline. *Id.* Both facts were relied upon by the Federal Circuit in construing the phrase "consisting essentially of." Neither finds a corollary in this case. Accordingly, *Talbert* is inapposite.

[12] Because the meaning of the phrases ""trace element" and "consisting essentially of" are established by the intrinsic evidence, this court need not and does not consider the expert testimony presented by the parties, which, on these issues, was largely at odds. *See Brookhill*, 326 F.3d at 1225.