

## United States Court of Appeals for the Federal Circuit

00-1009

TEGAL CORPORATION

Plaintiff-Appellee,

v.

TOKYO ELECTRON AMERICA, INC.

Defendant-Appellant.

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00-1209

TEGAL CORPORATION,

Plaintiff-Appellee,

v.

TOKYO ELECTRON AMERICA, INC.

Defendant-Appellant.

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00-1307

TEGAL CORPORATION,

Plaintiff-Appellee,

v.

TOKYO ELECTRON AMERICA, INC.

Defendant-Appellant.

John B. Streeter, Kecker & Van Nest, L.L.P., of San Francisco, California, argued for plaintiff-appellee. With him on the briefs were James M. Emery, Eugene M. Paige, and Steven A. Hirsch. Of counsel on the briefs were Warren E. Zirkle and Robert M. Tyler, McGuire, Woods, Battle & Boothe LLP, of Richmond, Virginia. .

Edgar H. Haug, Frommer Lawrence & Haug LLP, of New York, New York, argued for defendant-appellant. With him on the briefs were Steven M. Amundson, and Robert E. Colletti.

Appealed from: United States District Court for the Eastern District of Virginia

Judge James R. Spencer

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DECIDED: July 16, 2001  
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Before LOURIE, BRYSON, and LINN, Circuit Judges.

LINN, Circuit Judge.

Three appeals are addressed in this opinion. In the first, Tokyo Electron America, Inc. ("TEA") seeks review of a final judgment of infringement from the District Court for the Eastern District of Virginia. Tegal Corp. v. Tokyo Electron Am., Inc., No. 3:98CV318 (E.D. Va. Aug. 31, 1999)

(“Opinion”). Specifically, TEA challenges the following holdings from the district court’s opinion: (1) TEA was not entitled to a jury trial; (2) claims 1 and 7 of U.S. Patent No. 4,464,223 (“’223 patent”), issued after reexamination as U.S. Patent No. B1 4,464,223, [\[1\]](#) are not invalid under 35 U.S.C. § 102(b) as being anticipated by the Itakura reference; (3) claims 1 and 7 of the ’223 Reexamination Certificate are not invalid under 35 U.S.C. § 103(a) as being obvious over the Nippon Telegraph and Telephone Corp. (“NTT”) reference; (4) the claims of the ’223 Reexamination Certificate are not unenforceable for the failure of Tegal Corp. (“Tegal”) to disclose the NTT reference; (5) TEA willfully infringed claims 1 and 7 of the ’223 Reexamination Certificate, both before and after Tegal filed suit; and (6) the case was exceptional, under 35 U.S.C. § 285, and merited attorney fees for Tegal. TEA also appeals the injunction issued against it by the district court, maintaining that it is overbroad. We affirm the district court’s decision with respect to: (1) neither party having a right to a jury trial; (2) the finding of infringement; (3) the decision that the claims of the ’223 Reexamination Certificate are enforceable; and (4) the non-obviousness decision. However, we vacate and remand: (1) the finding that Itakura did not anticipate the ’223 patent; (2) the findings of pre-filing and post-filing willfulness; (3) the finding of an exceptional case; (4) the award of attorney fees; and (5) the entry of the injunction.

In the second appeal, TEA seeks review of a final order awarding Tegal attorney fees in the amount of \$842,129.03. Tegal Corp. v. Tokyo Electron Ltd., Inc., No. 3:98CV318 (E.D. Va. Jan. 20, 2000). [\[2\]](#) In its appeal brief, TEA does not dispute the actual amount of the award. Rather, TEA argues that the award was made in error because it rested on the allegedly faulty findings that TEA had willfully infringed and that this was an exceptional case. As the parties were informed at the oral hearing, these arguments were fully briefed in the first appeal and there are no additional issues to be considered in the second appeal.

In the third appeal, TEA seeks review of a final order which clarified that the injunction extends to plasma etchers originally sold before Tegal began marking in

accordance with 35 U.S.C. § 287(a). Tegal Corp. v. Tokyo Electron Ltd., No. 3:98CV318 (E.D. Va. Mar. 17, 2000).<sup>[3]</sup> In light of our vacating the injunction in question, the issue presented in this third appeal is moot.

## BACKGROUND

### A. The '223 Patent

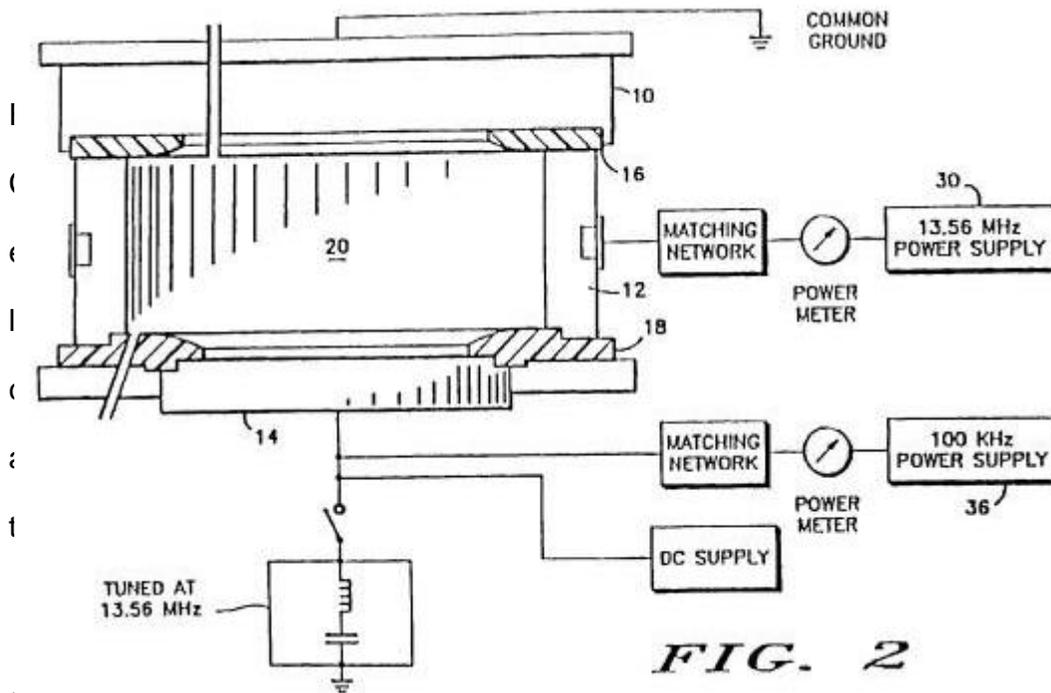
The '223 patent is directed to plasma reactors, which are used in the fabrication of semiconductor devices. In a plasma reactor, sometimes called an “etcher,” gas is injected into a low-pressure, sealed chamber where it reacts with an electric field established between electrodes to create a plasma. Although the construction of the claim terms “plasma” and “electrode” are debated issues in this appeal, some general comments can be made at this point. The plasma is created in a process called dissociation in which the electric field imparts energy to the gas within the chamber. Although a number of reactions and collisions occur between the particles in the chamber, the critical one for the purpose of plasma etching is the creation of positively charged ions.

In the etcher, the ions are induced to strike a wafer surface, or “workpiece,” situated within the chamber, with sufficient force to strip material away from the workpiece. By controlling the ion behavior, extremely precise patterns can be created, thus allowing miniaturization of semiconductor devices. Two variables that are

important in controlling the ion behavior are the ion energy and the ion density. Preferably, the ion energy and the ion density can be kept at high levels. However, prior to the '223 patent, this

was allegedly not possible. '223 patent, col. 2. The '223 patent teaches that standard prior art etchers applied an alternating-current ("AC") electric field between the etcher's electrodes that was at either a low frequency or a high frequency. See id. High frequencies increased the ion density, allowing a high etch-uniformity, but did not produce high ion energy. Id. Low frequencies, conversely, increased the ion energy, allowing a high etch-rate, but did not produce high ion density. Id. The '223 patent discloses a method and apparatus for maintaining both of these variables at a higher level by applying both a high frequency and a low frequency simultaneously to certain electrodes in the etcher. Id. at cols. 1-2. This allows both a high etch-rate and high etch-uniformity. Id.

Figure 2 of the '223 patent, reproduced below, discloses an embodiment of the claimed invention.



electrodes 10, 12, 14. Each include only two circular, that is, shaped. Id. Ring-shaped second 12 electrodes electrodes 10, 12, 14 and volume 20. Id. 30 is coupled to the electrode 14, and a

a common ground is coupled to the first electrode 10. Id. at cols. 2-3. After a workpiece is placed on the third electrode 14 and the chamber is evacuated to the desired low pressure, the power supplies 30, 36 are energized. Id. at col. 3. The two power supplies 30, 36 create a plasma within the reaction volume, id., and cause "maximum dissociation . . . as well as imparting a high ion

energy to the ions within the plasma,” id. at col. 3, ll. 41-42.

TEA was found to infringe claims 1 and 7 of the '223 Reexamination Certificate. Those claims are reproduced below.

1. A reactor apparatus including a reaction volume into which reactants are injected and from which reaction products are exhausted, and in which said reactants are acted upon by electric fields to form a plasma thereof, said apparatus comprising:
  - first, second, and third electrodes,
  - said first electrode coupled to electrical ground,
  - said second electrode selectively coupled to a high frequency source of AC power,
  - said third electrode selectively coupled to a low frequency source of AC power, and
  - wherein one of said electrodes is adapted for holding a workpiece.
  
7. A plasma reactor for treating a workpiece in a glow discharge comprising:
  - first, second, and third electrodes separated by insulators for defining a reaction volume in which said workpiece is located;
  - means for admitting reactants to said reaction volume and for removing reaction products from said reaction volume;
  - a first high frequency AC power supply coupled between said first electrode and said second electrode;
  - a second low frequency AC power supply coupled between said first electrode and said third electrode;
  - an electrical ground coupled to said first electrode;
  - said first and second power supplies producing different frequencies respectively above about 10 Mhz and below about 1 Mhz for causing a glow discharge in said volume.

'223 Reexam. Cert., col. 1, ll. 25-37 (claim 1), col. 2, ll. 19-43 (claim 7).

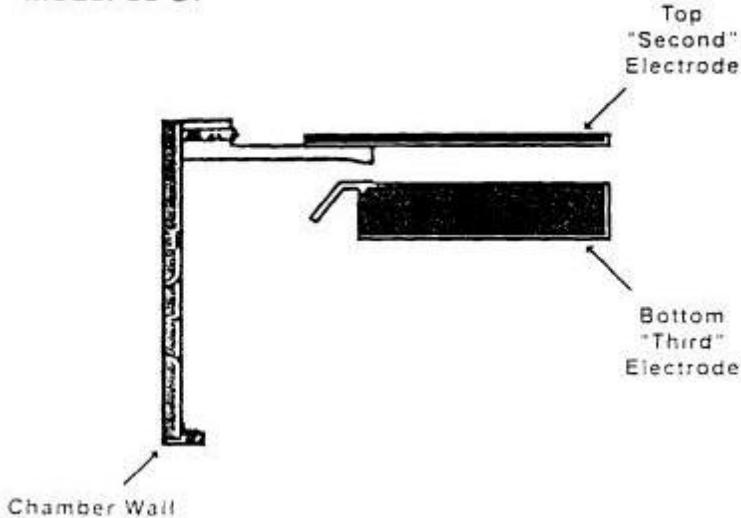
#### B. The Accused Device

TEA challenges the district court's judgment that TEA's IEM etchers, models 65DI and 85DI, infringe the '223 patent. A diagram showing the pertinent aspects of Model 85DI is reproduced below.

TEA's Chamber from Process Manual  
Model 85 DI

The diagram depicts  
dispute that the top  
supplies. In operatic  
electrodes are power

The parties' dispute  
dispute whether the  
and bottom electrode



wall. TEA does not  
ow frequency power  
d the top and bottom  
rs. First, the parties  
jme between the top  
nds to the grounded

chamber wall. Second, the parties disagree on whether the grounded chamber wall is an electrode, when that term is properly construed.

### C. Procedural History

Tegal initially requested a jury trial for its patent infringement suit against TEA. TEA asserted affirmative defenses without filing a counterclaim. Tegal sought both injunctive relief and damages. However, six days before trial, Tegal informed the district court judge that it was dropping its claim for damages. Tegal's understanding was that by withdrawing its damages claim, it would lose its right to a trial by jury. In response to Tegal's withdrawal, the district court judge issued an order that the trial would proceed without a jury. TEA, desiring a jury trial on the issues raised in the pleadings, including its affirmative defenses, filed a motion for reconsideration of that order, which the district court denied.

After a bench trial, the district court issued an opinion finding that claims 1 and 7 of the '223 Reexamination Certificate are not invalid, are enforceable, and were willfully infringed by TEA. Due to TEA's willful infringement, the district court found that the case was exceptional and awarded attorney fees to Tegal. As a further remedy, the district court entered an injunction against TEA. Paragraphs six and seven of the injunction are relevant to this appeal and provide:

6. Until October 3, 2003 (the expiration date of the '223 Patent), TEA is hereby permanently enjoined from engaging in any further infringement or infringement by equivalents of Claims 1 and 7 of the '223 Patent and is specifically barred from making, using, offering for sale, selling or importing any of the IEM model etching systems found to infringe said Claims in this case;

7. The infringing activities enjoined in paragraph 6 include acts that constitute contributory infringement or inducement to infringement, such as participating in, rendering assistance, or [in] any way facilitating infringing acts by related corporations or corporate affiliates or corporate parents, or conducting field service, testing or spare parts replacement or maintenance for customers that own infringing etching systems which were sold after October, 1997;

Tegal Corp. v. Tokyo Electron Am., Inc., No. 3:98CV318, slip op. at 2 (E.D. Va. Oct. 13, 1999) (“Injunction”). The district court later clarified that the injunction applied to etchers sold before Tegal began marking, thus barring TEA's later reselling of those etchers.

TEA appeals the district court's validity, enforceability, infringement, willfulness, and exceptional case findings, as well as the scope of the injunction and the award of attorney fees.<sup>[4]</sup> We have exclusive appellate jurisdiction. 28 U.S.C. § 1295(a)(1) (1994).

## DISCUSSION

### A. Standard of Review

“On appeal from a bench trial, we review a district court's decision for errors of law and clearly erroneous findings of fact.” Brown & Williamson Tobacco Corp. v. Philip Morris Inc., 229 F.3d 1120, 1123, 56 USPQ2d 1456, 1458 (Fed. Cir. 2000). A factual finding is clearly erroneous when, “although there is evidence to support [the factual finding], the reviewing court on the entire evidence is left with the definite and firm conviction that a mistake has been committed.” United States v. United States Gypsum Co., 333 U.S. 364, 395 (1948). Given the large number of issues, the specific standards of review for the individual issues are not set out in this section, but are included individually in the separate sections discussing each issue.

### B. Jury Trial

The threshold issue before the court in the first appeal is whether a defendant, asserting only affirmative defenses and no counterclaims, has a right to a jury trial when the only remedy sought by the plaintiff-patentee is an injunction. That issue is a matter of first impression. As explained below, we hold that such a defendant does not have a right to a jury trial.

The constitutional question of whether a party is entitled to a jury trial is a question of law that this court reviews de novo. *E.g.*, Demko v. United States, 216 F.3d 1049, 1052 (Fed. Cir. 2000) (stating that “the issue of the constitutionality of a statute is also a question of law, which this court reviews completely and independently”); Medline Indus., Inc. v. United States, 62 F.3d 1407, 1409 (Fed. Cir. 1995) (stating that “questions of law are subject to full and independent review (sometimes referred to as ‘de novo’ or ‘plenary’ review)”).

TEA challenges the district court’s decision to conduct a bench trial, arguing that: (1) TEA had an independent right to a jury trial; (2) the district court improperly focused only on the nature of the remedy—injunctive relief only—as opposed to the nature of the action; and (3) the district court violated Federal Rules of Civil Procedure 38(d) and 39(a).

TEA’s first two arguments can be addressed together by applying the Supreme Court’s test for determining if a right to a jury attaches to a particular case. The inquiry turns on whether the case “is more similar to cases that were tried in courts of law than to suits tried in courts of equity or admiralty” in 1791. Tull v. United States, 481 U.S. 412, 417 (1987); Granfinanciera, S.A. v. Nordberg, 492 U.S. 33, 41-42 (1989) (identifying 1791 as the relevant date). A right to a jury attaches only to cases more similar to those that were tried in courts of law. Tull, 481 U.S. at 417. To resolve this inquiry, the Supreme Court has repeatedly taught that courts must examine both the nature of the action involved and the remedy sought, and that the nature of the remedy is more important than that of the action. Chauffeurs, Local No. 391 v. Terry, 494 U.S. 558, 565 (1990); Tull, 481 U.S. at 417, 421. That examination requires that, “[f]irst, we compare the statutory action to 18th-century actions brought in the courts of England prior to the merger of

the courts of law and equity[, and,] [s]econd, we examine the remedy sought and determine whether it is legal or equitable in nature.” Tull, 481 U.S. at 417-18.

The action in this case is a claim of patent infringement, seeking an injunction and no damages, with invalidity issues asserted in affirmative defenses. With regard to the right to a jury trial, there is no binding precedent from this court comparing the kinds of issues involved in this action with those arising in actions in eighteenth century England. TEA cites to our opinions in Gardco Manufacturing, Inc. v. Herst Lighting Co., 820 F.2d 1209, 2 USPQ2d 2015 (Fed. Cir. 1987), and Markman v. Westview Instruments, Inc., 52 F.3d 967, 34 USPQ2d 1321 (Fed. Cir. 1995) (en banc), aff'd, 517 U.S. 370, 38 USPQ2d 1461 (1996), but neither of these is pertinent. Gardco deals with the commonality of factual issues between an unenforceability analysis and an infringement/validity analysis, and holds that there is no commonality preventing a court from trying the unenforceability issue without a jury before having a jury trial on the infringement/validity issues. Gardco, 820 F.2d at 1213, 2 USPQ2d at 2019. The reference in Markman to which TEA directs us, stating that a patent creates “federal legal rights,” does not distinguish between legal rights that arise in equity and those that arise in law. Markman, 52 F.3d at 978, 34 USPQ2d at 1329.

The Supreme Court briefly addressed the issue before us in its affirmance of our Markman opinion, stating in a conclusory manner that “there is no dispute that infringement cases today must be tried to a jury, as their predecessors were more than two centuries ago.” Markman, 517 U.S. at 377, 38 USPQ2d at 1465. The Supreme Court’s cursory disposal of the issue was entirely understandable and appropriate because damages were requested in the original trial litigation. See Markman, 52 F.3d at 973, 34 USPQ2d at 1324 (suggesting that damages were involved by noting the trial testimony concerning the number of infringing systems sold); id. at 1002, 34 USPQ2d at 1348 (Newman, J., dissenting) (stating that damages were at issue, but severed from the infringement trial). Thus, the Supreme Court’s affirmance provides no guidance on how to

analyze the case before us, in which damages are not at issue.

This court has, however, provided a relevant and detailed analysis in In re Lockwood, 50 F.3d 966, 33 USPQ2d 1406 (Fed. Cir. 1995), vacated, 515 U.S. 1182 (1995). The Supreme Court vacated Lockwood without explanation. [5] Thus, our analysis has been neither supplanted nor questioned. Although no longer binding, we find its reasoning pertinent. In Lockwood, the patentee brought an infringement action against American Airlines, seeking damages and an injunction, and demanding a jury trial. Id. at 968, 33 USPQ2d at 1407. American Airlines counterclaimed for a declaration that the asserted patents were invalid or unenforceable. Id. The district court awarded summary judgment of noninfringement and struck the patentee's demand that the issue of validity be tried to the jury. Id. at 968-69, 33 USPQ2d at 1407-08. On appeal, this court held that the patentee had a right to a jury trial in the remaining declaratory judgment action to determine validity. Id. at 980, 33 USPQ2d at 1417.

Of import to the present case is the discussion in Lockwood of the nature, in eighteenth century England, of a patent infringement action with invalidity defenses asserted by the alleged infringer. Id. at 976, 33 USPQ2d at 1414. Lockwood explained that “[i]n eighteenth-century England, allegations of patent infringement could be raised in both actions at law and suits in equity,” and that the choice was the patentee's and depended on the type of remedy sought. Id. If the patentee sought an injunction and an accounting, the patentee went to a court of equity. Id. If, however, the patentee sought only damages, a court of law was used. Id. Applying that framework to the present case, and given Tegal's interest only in an injunction, it is clear that Tegal would have needed, in eighteenth century England, to bring its case in a court of equity. We see no reason to depart from the framework provided in Lockwood, particularly given that TEA presents no analysis at all of the appropriate 1791 analog. Accordingly, the nature of Tegal's action is equitable.

**The second prong of the Supreme Court's test, the more important prong, inquires into**

**the nature of the remedy sought. Little analysis is required; Tegal sought only an injunction, a purely equitable remedy. Considering the two prongs, both of which point to equity, there is no doubt that neither party had a right to a jury in this case. In summary, this court holds that a defendant, asserting only affirmative defenses and no counterclaims, does not have a right to a jury trial in a patent infringement suit if the only remedy sought by the plaintiff-patentee is an injunction.**

TEA's assertions that the district court violated Federal Rules of Civil Procedure 38(d) and 39(a) are procedural challenges to the district court's decision that there were no issues entitled to be tried before a jury. These challenges are reviewed under the precedent of the pertinent regional circuit, the Fourth Circuit in this case. Wexell v. Komar Indus., Inc., 18 F.3d 916, 919, 29 USPQ2d 2017, 2019 (Fed. Cir. 1994) ("This court applies the law of the pertinent regional circuit when the precise issue to be addressed involves an interpretation of the Federal Rules of Civil Procedure."). Under Fourth Circuit law, TEA's assertions are wholly without merit. Rule 39(a) specifically directs the court not to use a jury, even when a jury has been requested, if "the court . . . finds that a right of trial by jury . . . does not exist." Fed. R. Civ. P. 39(a). This is exactly what the district court did. Francis v. Dietrick, 682 F.2d 485, 486-87 (4th Cir. 1982) (holding that Rule 39a was not violated by a district court's decision to allow the plaintiff to amend his complaint to withdraw his request for damages, and its ruling that there were no remaining issues entitled to be tried before a jury). Rule 38(d) applies to the withdrawal by a party of its demand for a jury, and is thus inapplicable. Fed. R. Civ. P. 38(d) ("A demand for trial by jury made as herein provided may not be withdrawn without the consent of the parties."); Francis, 682 F.2d at 486-87 (finding no violation of Rule 38, as well as Rule 39). Accordingly, the district court's decision to conduct a bench trial did not violate either Rule 38(d) or Rule 39(a).

### C. Construction of "Electrode"

Claim construction is a matter of law and is reviewed de novo on appeal. Cybor Corp. v. FAS

Techs., Inc. , 138 F.3d 1448, 1456, 46 USPQ2d 1169, 1174 (Fed. Cir. 1998) (en banc).

1.

During the district court proceedings, the parties vigorously disputed the proper construction of the claim term “electrode.” The district court construed this term in its Markman hearing approximately four months before trial, as “any conductive surface, including a metal chamber wall or other surface, coupled to the plasma.” Opinion, slip op. at 6 (quoting the Markman order). The district court then defined “coupled” to mean “[e]lectrically connected or connected by a conductive path, capacitively, inductively, or by any other means of transferring energy.” Id. at 6 (quoting the Markman order).

TEA argues that an “electrode” must participate in generating the electrical field that forms the plasma, and not merely be coupled to the plasma. TEA also asserts that Tegal made, and relied upon, such a distinction in the prosecution history to secure allowance of the '223 patent. TEA further argues that the district court improperly relied on extrinsic evidence in construing “electrode.”

Tegal defends the district court’s construction. Tegal also asserts that “coupling to the plasma” and “generating the electric field” have the same general result that the electrodes “act together to create AC electric fields that charge the gas.” Tegal argues, however, that characterizing an electrode as being coupled to the plasma is “more faithful to the specification and the claim language.”

2.

We need not address each of the parties’ claim construction arguments directly. Rather, we construe the term “electrode” according to the normal rules of claim construction.

First, we look to the claim language. Then we look to the rest of the intrinsic evidence, beginning with the specification and concluding with the prosecution

history, if in evidence.

If the claim language is clear on its face, then our consideration of the rest of the intrinsic evidence is restricted to determining if a deviation from the clear language of the claims is specified. . . .

. . . .

. . . Relying on extrinsic evidence to construe a claim is proper only when the claim language remains genuinely ambiguous after consideration of the intrinsic evidence. . . .

. . . But extrinsic evidence may never be used for the purpose of varying or contradicting the terms in the claims.

Throughout the construction process, it is important to bear in mind that the viewing glass through which the claims are construed is that of a person skilled in the art.

Interactive Gift Express, Inc. v. Compuserve Inc., 231 F.3d 859, 865-66, 56 USPQ2d 1647, 1652-53 (Fed. Cir. 2000) (citations and internal quotations omitted).

Looking first to the claims, we observe that the term “electrode” is used throughout the claims, particularly claims 1 and 7, and is used in a broad sense. It is also clear that “electrode” is a term of art susceptible to various meanings, and so we go to the specification, as indeed the parties direct us, to determine the scope of this term.

The specification also supports a broad construction, focusing primarily on the fact that electrodes are coupled to an electric potential or source. The specification introduces the term “electrode” in the summary section by merely describing the electric potential or the electrical, or electromagnetic, source to which a given electrode is “coupled.” [\[6\]](#) '223 patent, col. 1, ll. 50-55 (“One of the electrodes is held at ground while the second is selectively coupled to a high frequency AC source and the third is selectively coupled to a low frequency AC source.”). The specification then states that electric fields are established between the electrodes. Id. at col. 1, ll. 55-57.

A subsequent section of the specification, entitled Detailed Description of Preferred Embodiments, continues this focus on electric potential or source by noting that the electrodes must have “electrical isolation” between them. Id. at col. 2, l. 39. That section goes on to describe the electrodes of the preferred embodiment in terms of the electric potential or source to which they

are coupled. Id. at col. 2, ll. 58-66 (stating that “a high frequency power supply 30 and a low frequency power supply 36 are coupled to the second and third electrodes” and “the top electrode 10 is coupled to ground”). The specification, therefore, broadly describes an “electrode,” and imposes no limitations beyond its having an electric potential or source coupled to it, and the implicit requirement that it be a conductive surface so that electric fields can be established between electrodes.

Examining the prosecution history, we note that Tegal distinguished over the prior art by asserting that the '223 invention produced a single discharge among three electrodes. Tegal asserted, for example, that “[t]here is nothing in [the cited prior art references] which would lead one of ordinary skill in the art to connect the AC sources to produce a single discharge[, that is, plasma,] from three electrodes.” (Emphasis omitted). Accordingly, the word “electrode” must be read to reflect this position. However, the parties disagree as to how best to characterize this position. In essence, they debate whether “produc[ing]” the plasma “from three electrodes” requires that the three electrodes actually generate the plasma.

We conclude that the prosecution history is more accurately described as requiring the electrodes to be “coupled to the plasma,” and not, as argued by TEA, as requiring the electrodes to generate the plasma. The inaccuracy of TEA’s characterization is revealed by the specification, which instructs us that a plasma is “generated by the high and/or low frequency electric fields established between the electrodes.” '223 patent, col. 1, ll. 55-57. Thus, the electric fields, and not the electrodes, generate the plasma. However, it is undisputed that the electrodes will be coupled to the plasma due to the presence of ions, and a current, in the plasma.

In the prosecution history, Tegal also distinguished over the Cotton reference by stating that “the electrodes claimed in the present invention are not the same as those disclosed in Cotton,” which Tegal described as being spiked electrodes. Accordingly, the term “electrode” must be construed so as not to cover a spiked electrode.

In sum, we construe an electrode as any conductive surface, including a metal chamber wall or other surface except a spike, coupled to the plasma, and having an electric potential or source coupled to it. Further, because claim 1 recites it, at least one of the electrodes must be “adapted for holding a workpiece.” ’223 Reexam. Cert., col. 1, ll. 36-37. Because the phrase “having an electric potential or source coupled to it” is duplicative of other limitations in the asserted claims, our construction diverges from the district court’s only in explicitly excluding a spiked electrode.

#### D. Construction of “Plasma”

##### 1.

The district court did not explicitly construe the now-disputed claim limitation of “plasma.” However, the district court’s opinion did provide the following working definition of the term “plasma” in its discussion of the technology of the ’223 patent:

Plasma is a charged collection of particles. It has no shape or form. Although the density of the plasma can vary in different locations, the plasma reaction occurs throughout the chamber. During the ionization process, charged particles are created that strike all of the surfaces on the interior of the chamber.

Opinion, slip op. at 2-3 (citations to the record omitted).

TEA asserts that the district court improperly relied on extrinsic evidence in “construing” the term plasma and that the intrinsic evidence, particularly the prosecution history, “unambiguously defines ‘plasma’ to mean a ‘glow discharge.’” TEA maintains that a glow discharge is a particular type of plasma characterized by having a current within a specific range, and argues that Tegal relied on this distinction in the prosecution history of the ’223 patent to obtain allowance.

Tegal responds that the district court never construed the term “plasma” because TEA failed to identify it as a disputed term, and that TEA has therefore waived any argument concerning the meaning of this term. Tegal states that TEA failed to identify “plasma” as a disputed term in its

Markman brief, its Rule 26 Expert's report, its expert's deposition, any pre-trial filing or trial brief, or its opening statement at trial. Tegal alleges that TEA first raised the issue during trial and then again in post-trial briefing. Tegal also responds that the intrinsic evidence supports a broad construction of "plasma" and that TEA improperly resorts to extrinsic evidence for its narrower definition of glow discharge.

2.

Although it is unclear why the parties did not identify the term "plasma" as a disputed claim limitation before trial, it is not disputed that they did so at trial. If Tegal thinks that TEA waited too late, Tegal should have prevailed upon the district court to exclude TEA's evidence of what "plasma" meant. The term having been brought into dispute at trial, and the district court having addressed the term in its opinion, albeit informally, we do not consider the issue to have been waived. Cf. Sage Prods., Inc. v. Devon Indus., Inc., 126 F.3d 1420, 1426, 44 USPQ2d 1103, 1108 (Fed. Cir. 1997) ("With a few notable exceptions, . . . appellate courts do not consider a party's new theories, lodged first on appeal. If a litigant seeks to show error in a trial court's overlooking an argument, it must first present that argument to the trial court.").

As with "electrode" above, we need not address each of the parties' claim construction arguments directly, but proceed to construe the term "plasma" according to the normal rules of claim construction. Looking to the claims, we note that the term "plasma" occurs only in claim preambles. '223 Reexam. Cert., col. 1, l. 28 (claim 1), col. 1, l. 43 (claim 2), col. 2, l. 8 (claim 6), col. 2, l. 19 (claim 7). Preambles are not necessarily limiting. Kropa v. Robie, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951) (stating that a preamble is limiting when it is "necessary to give life, meaning and vitality to the claims or counts"). However, the parties do not dispute that "plasma" is a limiting term in the claims at issue and, at least for the reason that we have construed "electrode" in terms of "plasma," we agree. The term "plasma" is not limited to any narrow definition by its use in the claims. It is also clear that "plasma" is a term of art susceptible

to various meanings, so we go to the specification, as indeed the parties direct us, to determine the scope of this term.

The specification also supports a broad construction of “plasma,” in which the “plasma” need only contain ions and be generated by electric fields. As explained earlier, the specification states that the plasma is “generated by the high and/or low frequency electric fields established between the electrodes.” ’223 patent, col. 1, ll. 55-57. The specification also emphasizes the need to control both the density and the energy of the ions in the plasma, thus focusing on the fact that the plasma must contain ions. Id. at col. 1, l. 39, col. 2, ll. 15-24, col. 3, ll. 37-42. Beyond the obvious requirement that there be ions in the plasma, to perform the ion bombardment, the specification does not impose further requirements and uses the term “plasma” in a broad sense. The various examples illustrate that the plasma can be created from a variety of gases and used at a variety of operational settings (power, duration of exposure, frequencies, pressures). Id. at cols. 4-5. Further, there is no indication in the specification that the claimed invention is to be restricted even to these illustrated ranges.

The prosecution history primarily reinforces the specification’s broad use of the term “plasma.” TEA first argues that Tegal equated “plasma” with a “glow discharge.” We agree. Tegal used the terms “discharge” and “plasma” interchangeably, or even together as in “plasma discharge,” in referring to the prior art references and the claimed invention. For example, Tegal refers to: (1) the claimed invention’s plasma as a discharge; (2) the Cotton reference as disclosing either a discharge or a plasma; and (3) the Chapman reference as disclosing either a discharge or a plasma. Tegal also equated the claimed “plasma” with a “glow discharge,” stating that a “plasma in accordance with the present invention is a glow discharge,” and that the claimed “invention relates to apparatus for processing semiconductor wafers in a plasma glow discharge.”

TEA’s second argument, however, is that Tegal’s use of the term “glow discharge” is limiting and is defined by its current. We disagree. TEA relies on a figure from a physics book, published

approximately ten years after the '223 patent issued. The figure shows that a “glow discharge” is differentiated from other discharges by the amount of current flowing through the discharge. In order of ascending current flow, ranging from approximately  $10^{-10}$  amps to 10 amps, the figure depicts a Townsend discharge, a glow discharge, an “abnormal glow discharge,” and an arc discharge. TEA’s reliance on this figure is misplaced. Neither the claims, the specification, nor the prosecution history even suggest that the claimed plasma is limited to the particular range of current TEA proposes, and TEA’s use of extrinsic evidence to establish such a contrary proposition is improper. Interactive Gift Express, 231 F.3d at 866, 56 USPQ2d at 1652-53.

Although Tegal did not restrict the claimed “plasma” to the current range proffered by TEA, Tegal did distinguish the claimed “plasma” from the discharge of the Cotton reference. Tegal’s statement, quoted above, that “[a] plasma in accordance with the present invention is a glow discharge,” was followed by the statement that “Cotton, on the other hand, is concerned primarily with an arc discharge.” Tegal also characterized the Cotton discharge as a spike discharge, emanating from a spiked electrode at frequencies up to 300 GHz. Accordingly, “plasma” must be construed so as not to cover a spike or arc discharge emanating from a spiked electrode.

In sum, we construe “plasma” as a charged collection of particles, generated by the high and/or low frequency electric fields established between the electrodes, excluding arc or spike discharges such as would emanate from a spiked electrode.

The parties also dispute the proper construction of the claim term “glow discharge.” This term is recited only in claim 7, in a context similar to that in claim 1. '223 Reexam. Cert., col. 2, ll. 20, 42. It does not appear in the specification. However, as explained above, the prosecution history indicates that “glow discharge” is intended as a substitute for “plasma.” Because one of skill in the art would understand from the prosecution history that the term “glow discharge” is intended to be coextensive with the term “plasma,” we construe it accordingly.

## E. Anticipation

What a prior art reference discloses in an anticipation analysis is a factual determination that we review under the clearly erroneous standard. In re Graves, 69 F.3d 1147, 1151, 36 USPQ2d 1697, 1700 (Fed. Cir. 1995).

The district court found that the Itakura reference did not anticipate claims 1 and 7, under 35 U.S.C. § 102(b), because “Itakura does not contain each and every element in the contested claims of the ’223 [Reexamination Certificate].” Opinion, slip op. at 15. The district court’s analysis consists of three substantive sentences, repeated below:

[Itakura] does not disclose three electrodes; rather, Dr. Sawin testified that a third electrode is “implicit” in Itakura, but he pointed to no teaching in the patent to support his claim. Itakura actually discloses two plasmas separated by a metal grid with very small holes. In addition, there is no single “plasma” or single “reaction volume,” and there is nothing to indicate that it has a “workpiece located within the reaction volume” that claim 7 specifically requires.

Id. at 15.

In this analysis, the district court thus found that Itakura did not disclose a third electrode, a single plasma, a single reaction volume, or a workpiece being located in each reaction volume. Tegal argues a slight variation, asserting that Itakura discloses a single plasma but that it does not fill the entire chamber. Tegal further argues that Itakura does not disclose three electrodes at different potentials with one of the potentials being ground. As we explain below, we hold that each of the district court’s findings with regard to Itakura are clearly erroneous, but we cannot reverse the finding of no anticipation because the district court made no findings with regard to the two frequency limitations of claims 1 and 7. Accordingly, we must remand for that determination.

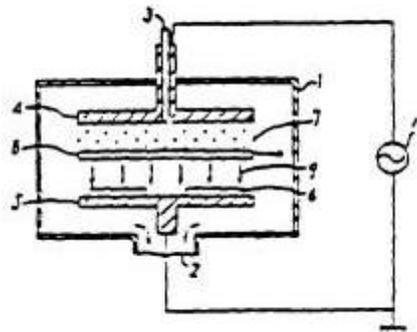
In the remainder of this section we address the following points, considering Tegal’s arguments where appropriate: (1) the district court’s findings regarding Itakura’s disclosure of electrodes; (2)

the district court’s remaining findings; and (3) the remaining limitations of claims 1 and 7.

1.

The district court found that Itakura did not disclose three electrodes, as required by both claims 1 and 7. *Id.* at 15. However, Itakura states that reference numerals 4, 5, and 8, of Figure 2 (reproduced below), are each electrodes; it discusses them as electrodes; and it claims them as electrodes.

Figure 2

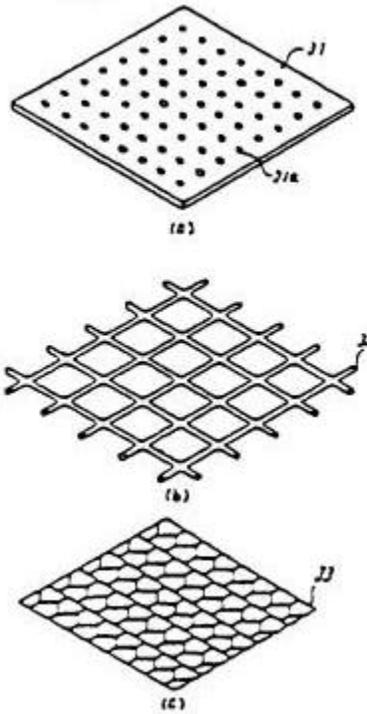


The district court relied on testimony from Itakura. *Id.* We have searched the record pointing us to it; and TEA expert testified to the contrary, saying that

the third electrode is only implicit in the testimony; Tegal carefully avoids repeating this testimony but that Dr. Sawin testified that

More importantly, Itakura’s “third electrode” is only implicit in the testimony; Tegal carefully avoids repeating this testimony but that Dr. Sawin testified that the third electrode is only implicit in the testimony. More importantly, Itakura’s “third electrode” is only implicit in the testimony. The district court refers to Itakura’s third electrode, reference numeral 8, as a “metal grid,” not regarding it as an “electrode.” Itakura, however, refers to the structure identified by reference numeral 8 as “a third electrode (8) having many small holes,” and provides a variety of shapes as indicated in Figure 3, reproduced below.

Figure 3

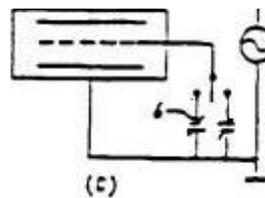


Itakura provides the following explanation shown in Figure 3, is composed of electroconductive material lattice (Figure 3(c)) . . . .” Clear

Itakura also discloses that the third electrode, stating that “a positive or negative voltage is applied to the third electrode” One of these embodiments is illustrated in Figure 3(c)

shape of the third electrode, as arial plate (31) (Figure 3(a)), an electroconductive material net (33) “the” has a conductive surface. I to an electric potential or source, low-frequency alternating-current second electrode.” One of these d below.

The “third electrode” of Itakura is thus a conductive surface that is not a spike, and that has an electric potential. Further, Figure 2 shows that at least the electrode of reference number 2 is holding a workpiece.” There is no dispute that the “third electrode” will also be coupled to the plasma. Accordingly, Itakura’s “third electrode” meets the limitations of the claimed electrode in the ’223 patent. The district court’s finding to the contrary is clearly erroneous.



2.

The district court implicitly construed claim 7 to require a single plasma and a single reaction volume, and found that Itakura did not disclose these. The district court appears to have concluded that Itakura discloses two separate plasmas and two separate reaction volumes. Tegal agrees that there are two reaction volumes, but argues that Itakura only discloses a single plasma that fills only one of the volumes.

The arguments of both the district court and Tegal assume that the plasma and its ions cannot

pass through Itakura's "third electrode" and, thus, two volumes are formed with at least one of them having a confined plasma. An examination of Itakura, however, shows that this assumption is clearly erroneous. Itakura's Figure 3, reproduced above, particularly the lattice of Figure 3(b), shows that the "third electrode" can be an extremely porous barrier. Itakura also states, in describing Figure 3, "that the passage of the reaction component [through the third electrode] is smooth." This statement clarifies that the "third electrode" does not prevent the plasma from passing through it. Additionally, it follows logically that the plasma ions must pass through the "third electrode" in order to etch the workpiece at all.

The claims require a reaction volume containing a plasma, and our construction requires that all three electrodes couple to that plasma. Itakura discloses these requirements and the district court's findings to the contrary are clearly erroneous. We also note that Itakura's reaction volume contains, as required by the asserted claims, a workpiece.

### 3.

TEA maintains that Itakura anticipates claims 1 and 7 of the '223 Reexamination Certificate. Accordingly, we address the remaining contested limitations of claims 1 and 7.

Tegal's argument that Itakura does not disclose three electrodes at different potentials, with one electrode being coupled to ground, is meritless. Itakura's Figure 4(c), reproduced above, clearly sets forth such a configuration, with the top electrode being coupled to an AC source, the middle electrode being coupled to either a positive or negative direct-current source, and the bottom electrode being coupled to ground. More importantly, Itakura suggests modifying Figure 4(c) by "applying low-frequency alternating-current voltage to the second [electrode] or third [electrode]." Thus, Itakura not only discloses three different potentials, but these potentials include a high-frequency AC source, a low-frequency AC source, and ground, as required by the asserted claims.

Although we have reversed each of the district court's findings and have rejected all of Tegal's arguments, we cannot reverse the finding of no anticipation because the district court made no findings regarding the frequency limitations. Claim 1 recites a "low frequency" and a "high frequency," and claim 7 recites "1 MHz" and "10 MHz." '223 Reexam. Cert., col. 1, ll. 32-35 (claim 1), col. 2, ll. 41-42 (claim 7). These limitations were in issue and the district court expressly construed the claim 1 limitations. The district court construed "low frequency" as any frequency less than about 1 MHz and construed "high frequency" as any frequency greater than about 10 MHz. The parties do not dispute these constructions and we accept them. However, the district court never made any findings regarding whether Itakura disclosed the claimed high and low frequencies. We must remand, therefore, for further findings. On remand, the district court may address whether Itakura, or another reference, discloses the claimed frequencies and whether claims 1 and 7 are rendered invalid by Itakura, either alone or in combination with another reference.

#### F. Obviousness

"The ultimate determination of whether an invention would have been obvious is a legal conclusion based on the totality of the evidence, including underlying factual inquiries . . . . Accordingly, this ultimate determination of obviousness is reviewed without deference, while any factual findings are reviewed for clear error." Brown & Williamson, 229 F.3d at 1124, 56 USPQ2d at 1459 (citations omitted).

The district court determined that the '223 patent was not invalid under 35 U.S.C. § 103(a) as being obvious over the NTT reference. The district court based this legal conclusion, in part, on the finding that the "NTT reference does not disclose a chamber wall." Opinion, slip op. at 16. Implicit in this finding is a finding that the NTT reference does not disclose a metal wall. The district court's determination was also based on its finding that "it would not have been obvious to one of ordinary skill in the art in 1983 to convert the NTT etcher into a triode configuration with a

metal wall serving as a third electrode.” Id. The district court also found that the secondary indicators of non-obviousness favored Tegal, thus supporting the conclusion of non-obviousness. Id. at 17. TEA appeals, arguing in part that those skilled in the art would recognize, first, that the apparatus disclosed in the NTT reference had a chamber wall and that it could be glass or metal and, second, that metal chamber walls were usually grounded.

We note that the NTT reference states that “[t]he apparatus inside is exhausted by a vacuum pump.” Creating a vacuum requires a closed structure, so NTT implicitly discloses a chamber wall. However, the NTT reference never discusses the chamber wall and contains no suggestion that the wall should or could be conductive. Accordingly, the district court’s implicit finding, that the NTT reference does not disclose a metal wall, is not clearly erroneous.

This finding does not preclude a conclusion that the asserted claims would have been obvious. Arguing for such a conclusion, TEA identifies testimony from the trial asserting that there were two “obvious” choices for the chamber wall, either glass or metal, and that the “trend” was to use metal, which would usually be grounded for safety purposes. We deal here with a presumption of validity, which can only be overcome by clear and convincing evidence. The testimony identified by TEA is insufficient to convince us that the district court erred in holding that it would not have been obvious to one of ordinary skill to use a grounded metal chamber with the NTT etcher.

#### G. Inequitable Conduct

“The ultimate question whether there was inequitable conduct is committed to the discretion of the trial court and we review the court’s determination . . . for abuse of discretion. We will not disturb that determination absent a showing that it was based upon erroneous finding of fact, a misapplication or misinterpretation of applicable law, or evidences a clear error of judgment.” Gen. Electro Music Corp. v. Samick Music Corp., 19 F.3d 1405, 1408, 30 USPQ2d 1149, 1151 (Fed. Cir. 1994).

The district court determined that Tegal had not engaged in inequitable conduct by failing to disclose the NTT reference to the United States Patent and Trademark Office (“PTO”) during the ’223 reexamination, even though that reference was cited against a Japanese counterpart to the ’223 patent. *Id.* at 13. The court found that TEA had failed to meet its burden, which was clear and convincing evidence, on both the intent prong and the materiality prong of the inequitable conduct test. *Id.* at 10-14; *Kingsdown Med. Consultants, Ltd. v. Hollister, Inc.*, 863 F.2d 867, 872, 9 USPQ2d 1384, 1389 (Fed. Cir. 1988) (en banc) (“Inequitable conduct resides in failure to disclose material information . . . with an intent to deceive . . .”). With regard to the materiality prong, the court’s opinion reveals that TEA failed to meet its burden because it failed to overcome the evidence that the NTT etcher was a diode etcher and, therefore, cumulative art.

TEA asserts error in the district court’s materiality finding and presents two arguments in support thereof. TEA’s first argument alleges that a Japanese counterpart to the ’223 patent was issued only after amending the claims to avoid the NTT reference, allegedly surrendering in the process most of the subject matter covered by the U.S. claims. We do not find this argument persuasive. We note that the Japanese office action, to which TEA directs us, concerns two pieces of prior art. TEA fails to explain why the amendments were not necessitated by the second piece of prior art, and also fails to address the differences between U.S. and Japanese patent law which may have required an amendment for patentability in Japan but not in the United States.

TEA’s second argument alleges that “Tegal distinguished prior art by telling the PTO that no reference applied two separate frequencies to two different electrodes,” but TEA asserts that Figure 3 of the NTT reference shows this feature. Having reviewed the prosecution history that TEA cites, we note that TEA overstates the case because Tegal distinguished only a single reference with this argument. Regardless, TEA’s argument assumes that which it seeks to prove—that the NTT reference is not cumulative. In its reply brief, TEA addresses this weakness directly, asserting that the NTT reference is the only reference disclosing this feature. We

acknowledge that whether the NTT reference is cumulative is a debatable factual question. However, after reviewing the evidence of record, we discern no reversible error in the district court's finding that NTT had not satisfied its burden of proving materiality.

Having failed to prove materiality, TEA cannot prevail on its appeal of the inequitable conduct issue.

#### H. Infringement

Literal infringement is a question of fact that we review under the clearly erroneous standard. Biovail Corp. Int'l v. Andrx Pharms., Inc., 239 F.3d 1297, 1300, 57 USPQ2d 1813, 1815 (Fed. Cir. 2001).

The district court found that TEA's IEM etchers, models 65DI and 85DI, infringed [\[7\]](#) claims 1 and 7 of the '223 Reexamination Certificate. Opinion, slip op. at 6. Central to this conclusion was the finding that the grounded chamber walls of the accused devices "are electrically coupled to the plasma." Id. at 7. The court explained that "[a]lthough the density of the plasma may vary inside the chamber, it is able to expand throughout and is thus not confined solely to the area between the upper and lower electrodes." Id. The court explicitly found that the current in the plasma extends to the wall. Id. TEA challenges this finding on appeal, asserting that the accused devices "confine" the plasma between the top and bottom electrodes and, thus, do not infringe. TEA is essentially arguing that the plasma does not extend to, and therefore is not coupled to, the grounded chamber wall. Tegal responds by pointing to the evidence of etching and sputtering on the grounded chamber wall of the accused devices, which indicates that the wall is coupled to the plasma.

We have construed "plasma" to require "a charged collection of particles," and "electrode" to require a "conductive surface . . . coupled to the plasma, and having an electric potential or source coupled to it." The dispute over infringement revolves, then, around whether charged

particles are coupled to the grounded chamber wall. Given the evidence that the grounded chamber wall was being etched, we cannot say that the district court's finding of infringement was clearly erroneous.

#### I. Willfulness, Exceptional Case, Attorney Fees

"A court's determination that infringement was willful is a finding of fact, reviewable under the clearly erroneous standard." Graco, Inc. v. Binks Mfg. Co., 60 F.3d 785, 792, 35 USPQ2d 1255, 1260 (Fed. Cir. 1995). At trial, willfulness must be proven by clear and convincing evidence. Embrex, Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1350, 55 USPQ2d 1161, 1164 (Fed. Cir. 2000). "The determination of whether a case is exceptional and, thus, eligible for an award of attorney fees under § 285 is . . . a factual determination reviewed for clear error." Cybor, 138 F.3d at 1460, 46 USPQ2d at 1178 (citation omitted). The subsequent determination of whether attorney fees are appropriate is reviewed for an abuse of discretion. Id.

The district court found that TEA's infringement was willful both before and after Tegal's filing of the infringement suit. Opinion, slip op. at 9-10. Based exclusively on the willfulness findings, the district court determined that this case was exceptional and then awarded attorney fees to Tegal under 35 U.S.C. § 285. Because there were no damages, the district court's willfulness findings were only relevant to the court's § 285 determination. Section 285 provides that attorney fees can only be awarded to the prevailing party. Because we have vacated the determination that the '223 patent was not anticipated, there is no prevailing party as of yet. As a result, any analysis of exceptional case status or attorney fees under § 285 is premature. DH Tech., Inc. v. Synergystex Int'l, Inc., 154 F.3d 1333, 1334, 47 USPQ2d 1865, 1866 (Fed. Cir. 1998) ("We also vacate the district court's denial of exceptional case status and attorney's fees because the prevailing party . . . has yet to be determined."). Accordingly, we vacate the finding that this was an exceptional case and the award of attorney fees, as well as the subsidiary findings of willfulness, and remand for further proceedings consistent with this opinion. The district court can address these issues

anew after it revisits the validity determination.

## J. Injunction

“[D]istrict courts are . . . given broad discretion under 35 U.S.C. § 283 . . . to determine whether the facts of a case warrant the grant of an injunction and to determine the scope of the injunction. Accordingly, we review a district court’s decision to grant an injunction and the scope of that injunction for abuse of discretion.” Joy Techs., Inc. v. Flakt, Inc., 6 F.3d 770, 772, 28 USPQ2d 1378, 1380 (Fed. Cir. 1993) (citations and footnotes omitted); see Ortho Pharm. Corp. v. Smith, 959 F.2d 936, 945, 22 USPQ2d 1119, 1127 (Fed. Cir. 1992) (annunciating same standard).

After determining that the ’223 patent was valid and infringed, the district court awarded Tegal an injunction. TEA challenges the breadth of the injunction, asserting that it fails to satisfy the requirements for particularity in Rule 65(d) of the Federal Rules of Civil Procedure and that it runs afoul of the marking statute.

We do not reach these issues. Injunctions may be granted to “prevent the violation of any right secured by patent.” 35 U.S.C. § 283. In light of our decision to vacate and remand the determination that the ’223 patent is not invalid, the right secured by the ’223 patent remains under challenge and uncertain. Therefore, we vacate the injunction.

## CONCLUSION

We affirm the district court’s decision that neither party had a right to a jury trial, and that claims 1 and 7 of the reexamined ’223 patent are enforceable, not obvious over the NTT reference, and were infringed. We vacate, however, the finding that Itakura does not anticipate claims 1 and 7. We also vacate the findings of pre-filing and post-filing willfulness, the finding of an exceptional case, the award of attorney fees, and the injunction. We remand for proceedings consistent with this opinion.

AFFIRMED-IN-PART, REVERSED-IN-PART, VACATED-IN-PART AND REMANDED

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[1] The final result of the reexamination was a Reexamination Certificate that includes the first page of the original patent and the new claims but does not include the remainder of the written description. Accordingly, citations to the written description will be from the original patent (“’223 patent”) and citations to the claims will be from the Reexamination Certificate (“’223 Reexam. Cert.”).

[2] The caption on the district court’s order incorrectly names Tokyo Electron Limited, Inc., the appellant’s parent corporation, instead of the appellant.

[3] The caption on the district court’s order incorrectly names Tokyo Electron Ltd., the appellant’s parent corporation, instead of the appellant.

[4] The district court also found that the ’223 patent was not infringed by another TEA product and that a second patent, U.S. Patent No. 4,585,920, was not infringed by TEA. Tegal does not appeal these findings.

[5] After the Supreme Court granted certiorari, Lockwood withdrew his request for a jury trial, thus mooting the issue before the Supreme Court. See 515 U.S. 1121 (1995) (granting certiorari); 1995 WL 848568 (Lockwood’s motion asking the Supreme Court to dismiss his case as moot); 1995 WL 848570 (Lockwood’s reply to the response from American Airlines).

[6] Regarding the term “coupled,” we note that the parties do not dispute the district court’s construction, and we accept it.

[7] Although neither the district court nor the parties specify whether the infringement was literal or by equivalents, it is clear from the arguments of the district court that it was literal.