The opinion in support of the decision being entered today is *not* binding precedent of the Board.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte **BASF AG**

Appeal No. 2006-2247
Reexamination Nos. 90/006,554 and 90/006,894
(of United States Patent 5,578,684)

HEARD: December 11, 2006

Before DELMENDO, TIERNEY, and MOORE, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on an appeal under 35 U.S.C. §§ 134 and 306 (2006) from the examiner's final rejection of claims 1-6 in the above-identified merged reexamination proceedings. (Examiner's Answer mailed September 1, 2005; final

Office action mailed December 17, 2004; Appeal Brief filed August 5, 2005; Reply Brief filed November 1, 2005.)

Because (i) the examiner has made out a prima facie case of obviousness against claims 1-6 and (ii) the appellant (patent owner BASF AG) has failed to direct us to sufficient argument or evidence in rebuttal, we ***AFFIRM***.

I.

II. FINDINGS OF FACT

We make the following findings of fact (hereinafter "FF __").

A. Background

1. This appeal involves the merged reexamination of claims 1-6 of United States patent 5,578,684 ('684 patent) issued to Christian Schade, Dieter Boeckh, and Juergen Detering on November 26, 1996, based on application 08/507,237 filed August 24, 1995.
2. Claims 7-12, the only other claims in the '684 patent, are not involved in the reexamination. (Appeal brief filed August 5, 2005 at 5.)
3. The patent owner (appellant) is BASF AG.
4. We are told that the subject patent under reexamination is the basis for a patent infringement action captioned *BASF AG v. Reilly Industries, Inc.*, Civil Action No. IP01-1936-CY/K, currently pending in the

United States District Court for the Southern District of Indiana. (Appeal brief at 3.)

5. This merged reexamination resulted from two requests for reexamination filed by the defendant (Reilly Industries, Inc.) in the above-identified patent infringement action. (Appeal brief at 3-4.)

6. The first request was filed on February 22, 2003, asserting that a substantial new question of patentability is raised by United States patent 3,047,579 issued to Witman on July 31, 1962 either alone (when correctly understood in light of the then existing technology for commercially available hydrogen peroxide) or in combination with United States patent 3,159,611 issued to Dunn et al. (Dunn) on December 1, 1964. (Reexamination 90/006,554, request at 2.)

7. Reexamination 90/006,554 was ordered on April 11, 2003. (Paper 5 of 90/006,554.)

8. The second request was filed on December 23, 2003, alleging that "[f]urther substantial new questions of patentability are raised by U.K. 1,079,846 to Pieper et al...and/or DE 1495819 to Pieper...in view of...Witman...and/or R.A. Abramovitch, '*Pyridine and Its Derivatives, Supplement Part Two,*' John Wiley & Sons, 1974, p. 5...and/or U.S.

3,960,542 to Plant et al...as well as by Witman[] and/or Abramovitch and Plant alone." (Reexamination 90/006,894, request at 4.)

9. Reexamination 90/006,894 was ordered on February 27, 2004. (Reexamination Order mailed on February 27, 2004 in 90/006,894.)

10. The two reexamination proceedings were merged on May 14, 2004.

11. The examiner did not reopen prosecution based on the newly cited prior art identified in the second request but instead entered a final rejection on December 17, 2004 based on the same references applied in the first reexamination (90/006,554). (Paper 19.)

12. The invention relates to a process for preparing polyvinylpyridine N-oxides (PVNO) by oxidizing polyvinylpyridine (PVP) in an aqueous hydrogen peroxide solution having a water content of at least 25% in the presence of an acid and a specified catalyst. (Appeal Brief at 5.)

13. The specification of the '684 patent states: "It is an object of the present invention to provide a process for oxidizing polymers which contain vinylpyridine units which can be implemented industrially." (Column 1, lines 27-29.)

14. In its principal brief, the appellant acknowledges that "it was known to prepare PVNO by oxidizing PVP in a glacial acetic acid solution" but that "such prior art processes when operated industrially left, for

example, problematic amounts of carboxylic acids to separate at the end of process from the desired PVNO end-product." (Appeal Brief at 5-6.)

15. According to the appellant, the inventors solved the carboxylic acid problem of the prior art with the invention, which reduced the amount of acid by increasing the amount of water to at least 25% by weight, while at the same time using the specified catalysts to maintain "industrially-suitable rates of reaction." (Appeal Brief at 6.)

16. Claims 1 and 5 of the '684 patent are representative of the appealed subject matter and are reproduced as follows:

> 1. A process for preparing polyvinylpyridine N-oxides, comprising:
> oxidizing polyvinylpyridines in an aqueous hydrogen peroxide solution having a water content of at least 25% in the presence of an acid and a catalyst of an oxide, acid or salt thereof of an element of Group 5b, 6b, 7b or 8.
>
> 5. The process of claim 1, wherein the oxidation is conducted in the presence of from 0.1 to 1% by weight of sodium tungstate, phosphotungstic acid, tungstic acid, sodium molybdate, phosphomolybdic acid, molybdic acid or mixtures thereof.

B. The Applied Prior Art References

17. The examiner relies on the following prior art references (United States patents) as evidence of unpatentability:

Greenspan	2,624,655	Jan. 06, 1953
Witman	3,047,579	Jul. 31, 1962
Dunn et al. (Dunn)	3,159,611	Dec. 01, 1964
Watts	4,070,442	Jan. 24, 1978
Willard	4,362,706	Dec. 07, 1982
Hopkins et al. (Hopkins)	4,534,945	Aug. 13, 1985

C. The Rejection

18. Claims 1-6 of the '684 patent stand rejected under 35 U.S.C. § 103(a) as unpatentable over the combined teachings of Witman and Dunn, "optionally as evidenced by Watts, Greenspan, Hopkins, and Willard." (Examiner's Answer at 3-7.)

D. The Prior Art Teachings

(1) Witman

19. Witman describes a process for preparing N-oxides of tertiary amines by reacting the amines with hydrogen peroxide in the presence of

unstable inorganic per-compounds of acid-forming elements of groups VA, VIA, VIB, and VIII of the periodic table as catalyst. (Column 1, lines 66-72.)

20. Witman describes the applicability of the disclosed N-oxidation process to all tertiary amines, as follows:

> My new process efficiently effects the oxidation of the N-oxides of all of the tertiary amines which are known to oxidize to the corresponding N-oxides, and *in fact my new process is applicable generally to the oxidation of all tertiary amines to the corresponding N-oxides*. [Emphasis added; column 1, line 72 to column 2, line 5.]

21. As typical examples of such tertiary amines, Witman describes "pyridine and the various substituted pyridines." (Column 3, lines 38-40.)

22. Witman teaches that the disclosed process is advantageous, as follows:

> Since my new process employs only stable, easily handled materials, relatively inexpensive, re-usable catalysts, and gives much higher reaction rates than have heretofore been possible, it lends itself admirably as a general method for the large-scale preparation of N-oxides. The new process also effects much more efficient use of hydrogen peroxide. [Column 2, lines 5-11.]

23. According to Witman, "[a]s a general rule, an amount of the catalyst between about 1.0% and about 20%, based on the number of moles of

amine reactant charged, will effectively catalyze the reaction between the amine and the hydrogen peroxide" and in "many cases, even less of the catalyst - e.g., as little as 0.1% of the amine on a molar basis - will be sufficient..." (Column 4, lines 69-74.)

24. Witman further states that the hydrogen peroxide may be in the form of an aqueous solution containing from about 10% to about 90% by weight of hydrogen peroxide. (Column 5, lines 5-7.)

25. Witman also discloses that the reaction medium containing an aqueous solution of hydrogen peroxide may contain an additional solvent (preferably miscible with water) and that, when the amine is a heterocylic amine, the most useful solvents are lower aliphatic carboxylic acids, preferably glacial acetic acid. (Column 5, line 71 to column 6, line 5.)

26. Witman describes the recovery of the N-oxide product as follows:

> Where a solvent was used, in many cases the solvent too may be removed by distillation. It must be noted that in a great many cases the N-oxide is somewhat unstable, so that distillation of the water or water and solvent must be accomplished at such a low pressure that the N-oxide product is not decomposed. It has been found that in a great percentage of cases, the hydrohalide (e.g., hydrochloride) of the N-oxide is more stable than is the N-oxide itself. In such cases, the N-oxide is best recovered by first converting it to the hydrohalide, then removing water or water and solvent. Also, the N-oxide hydrohalides usually are crystalline, whereas the N-oxides are

not; conversion of the N-oxide to the hydrohalide thus provides a simple technique for obtaining a pure product by recrystallization techniques. [Column 7, lines 38-52.]

27. In Example V, Witman describes a process in which: (a) 31.6 parts of pyridine, 20 parts water, and 5.0 parts of molybdic anhydride were mixed together and heated to 60°C; (b) 32.8 parts of 50% by weight hydrogen peroxide was added over a ten minute period; (c) the temperature of the reaction mixture was maintained at 60-65°C for two hours until all of the peroxide was consumed; (d) 4.0 parts of calcium hydroxide were added and the temperature of the reaction mixture was allowed to cool to room temperature with continued stirring; (e) the insoluble salts were filtered; (f) 50 parts of concentrated HCl were added to the filtrate; and (g) the solution was then freed of water by distillation at 10-15 mm Hg to provide 34.3 parts of the hydrochloride salt of the pyridine N-oxide (63% yield). (Column 8, lines 60-75.)

28. The ‘684 patent under reexamination states that the catalysts described in Witman, including acids of molybdenum, are preferred catalysts suitable for use in the claimed invention. (Column 2, line 43 to column 3, line 5.)

29. BASF admits that the molybdic anhydride catalyst described in Witman's Example V converts to molybdic acid upon contact with water. (Appeal Brief at 15.)

(2) Dunn

30. Dunn describes the preparation of fully or partially oxidized homopolymers or copolymers of vinylpyridine. (Column 1, line 60 to column 2, line 19.)

31. Dunn teaches that the N-oxidation may be facilitated in an organic solvent using any suitable organic peracid as the oxidizing agent. (Column 4, line 68 to column 5, line 7.)

(3) Watts, Greenspan, Hopkins, and Willard

32. Watts, Greenspan, Hopkins, and Willard were cited to establish that commercially available hydrogen peroxide solutions, which are described as useful in Witman at column 5, lines 7-10, have water contents greater than 25%. (Examiner's Answer at 4.)

(4) The Level of Ordinary Skill in the Art

33. We find that one of ordinary skill in the art would have a working knowledge in various areas of expertise including (but not limited to) catalysis and complex polymer science.

34. This level of skill is reflected in the teachings of the applied prior art.

35. A person having ordinary skill in the art would have the necessary knowledge and skill to determine, through nothing more than routine experimentation, the optimum ranges of reactants to successfully carry out a reaction process described in a prior art reference.

E. The Examiner's Position

36. The examiner found that Witman describes a process for making N-oxides of tertiary amines using hydrogen peroxide solutions with water contents above 25%, wherein the N-oxidation is effected by an acid catalyst, desirably under acidic conditions using an acid. (Examiner's answer at 4.)

37. The examiner also found that "[t]he oxidation of polyvinylpyridine (a polymer containing tertiary amines groups) is within the generic teaching of Witman." (Examiner's Answer at 4.)

38. With respect to separately argued claim 5, the examiner found that the recited range for the catalyst does not significantly deviate from the range disclosed in Witman. (Examiner's Answer at 7.)

39. The examiner also found that Dunn discloses a process for preparing polyvinylpyridine N-oxides by oxidizing polyvinylpyridine in the presence of an organic peracid oxidizing agent. (Examiner's Answer at 4.)

40. Based on the collective teachings of these references, examiner held that "[t]he oxidation of polyvinylpyridine (a polymer containing tertiary amine groups) is within the generic teaching of Witman" and that "it would have been obvious to one of ordinary skill in the art to use the process of Witman to oxidize [the] polyvinylpyridine shown in Dunn thus avoiding the problems and expense of handling peracids as mentioned in Witman at column 1, lines 34+." (Examiner's Answer at 4-5.)

41. The examiner further found that the Declaration of Dieter Boeckh, Ph.D, dated November 5, 2003 is insufficient to rebut the prima facie case of obviousness. (Examiner's Answer at 5.)

42. Specifically, the examiner held that the appellant's allegation of unexpected results in terms of the use of greater amounts of water

with a corresponding decrease in the amount of acid, while achieving high degrees of oxidation, is unpersuasive because Witman teaches the use of water in the amount as claimed, the degree of conversion in Witman is consistent with that reported in the patent under reexamination, and the appealed claims do not limit the acid content. (Examiner's Answer at 5.)

F. The Appellant's Position

43. The appellant's position is that the examiner has not made out a prima facie case of obviousness because the prior art teaches away from the claimed invention and that, even if a prima facie case has been established, it has been rebutted by evidence of unexpected results in the form of declaration evidence. (Appeal brief at 7.)

G. Declaration Testimony of Dieter Boeckh

44. As evidence of unexpected results, the appellant relies heavily on the declaration of Dieter Boeckh, Ph.D, dated November 5, 2003.

45. Dr. Boeckh is one of the named inventors of the '684 patent. (Boeckh Declaration, ¶1.)

46. From 1987 to the present, Dr. Boeckh has been an employee of the appellant patent owner (BASF). (Boeckh Declaration, ¶1.)

47. Dr. Boeckh acknowledges that "it was known in the chemical field to oxidize PVP using glacial acetic acid as a solvent and an aqueous solution of hydrogen peroxide as the oxidizing agent." (Boeckh Declaration, ¶5.)

48. Dr. Boeckh asserts:

> The problem we faced and solved with our invention in the '684 patent, therefore, was not increasing the degrees of oxidation achievable for known processes for N-oxidizing PVP, since such known processes already had achieved high degrees of oxidation in excess of 90%. Rather, we recognized that it was highly desirable to reduce the amount of acid in the reaction vessel during PVP N-oxidation, by replacing acid with water, to avoid the prior art problem of having large amounts of acid left in both the reaction vessel (at the end of the reaction) and in the final PVNO product, respectively. For safety purposes in carrying out the reaction during the oxidation reaction, we also recognized that it is highly desirable to operate in a diluted state (by adding water) to reduce any processing problems and hazardous conditions that might occur if the reaction mixture is too viscous due to a high polymer concentration. We further recognized that, even after dilution with water in place of acid, the oxidation reaction needed to proceed at desirable rates to be of any practical use, which is why we chose the specific catalysts in our invention. Therefore, our goal and the overall problem we solved with our invention, was to address each of the foregoing individual issues (reducing acid in the process by increasing water content and adding a catalyst to achieve a desirable reaction rate), while at the same time creating a process that was capable of achieving high degrees of oxidation for the PVNO product.

> Our invention balances the foregoing factors and achieves superior oxidation results by doing so. [Boeckh Declaration, ¶6.]

49. Dr. Boeckh states: "Dunn was not able to solve the above problems solved by our invention because the process of that patent oxidizes the polymer in acetic acid medium entirely (or some other organic solvent), and leaves a large amount of acid to handle at the end of the reaction." (Boeckh Declaration, ¶7.)

50. Dr. Boeckh asserts: "The examples of the '684 patent show that our process can be used to achieve degrees of oxidation of from, for example, 76% (Example 6) to 92% (Example 2) in the PVNO produced." (Boeckh Declaration, ¶8.)

51. Dr. Boeckh states that Exhibits 1 and 2, which are attached to the declaration, documents and summarizes additional experiments supporting the argument that the claimed process "provides superior oxidation results, including the ability to achieve oxidation degrees for the PVNO product above 90% in an acid medium containing at least 25% water and the specified catalyst." (Boeckh Declaration, ¶¶10-11.)

52. Dr. Boeckh states:

> Moreover, compared to the process of the Witman patent, which in any case is concerned with oxidizing monomers, not polymers (such as PVP), our process in the '684 patent provides superior oxidation results, as Witman specifies at most (Example I) 85% oxidation for its monomeric compounds (based on preparing a salt from the unisolated N-oxide). However, this 85% degree of oxidation is achieved with high excess of glacial acetic acid at low water content, which were conditions known in the prior art that could be used to prepare N-oxides at high yields, even without a catalyst (see above discussion). For example, Example V of Witman (the only example in the patent operated with a water content in excess of 25%), however, which was cited in the Official communication, the reported yield is only 63% (again for a salt prepared from the unisolated N-oxide). I also note that in Example V, Witman uses a much higher percentage of catalyst than 0.1 to 1% specified in claim 5 of our patent, yet he still was unable to produce an oxidized product at high degree of oxidation. Given Witman's apparent lack of success in operating his process in such an aqueous medium (which process was, in any event, not directed to polymers as our process is), *in my opinion it was unexpected in 1993 that we would have been able to achieve the superior oxidation results discussed above, including the ability to obtain a high degrees [sic] of oxidation in an acid medium containing a catalyst, while still advantageously reducing the amount of acid in the medium by replacing it with water (of at least 25%).* [Boeckh Declaration, ¶13; italics added.]

53. Dr. Boeckh alleges that Exhibit 3, which is attached to the Declaration, demonstrates that the inventors "were able to achieve much higher degrees of oxidation than any degree of oxidation shown in the Witman patent for its monomeric oxidation process." (Boeckh Declaration, ¶¶14-15.)

54. BASF does not identify any meaningful comparative experimental evidence establishing that the differences between the invention as broadly recited in the appealed claims and the closest prior art (Witman's Example V) leads to results that would have been considered by one of ordinary skill in the art to be truly unexpected.

II. DISCUSSION

The Claimed Subject Matter

As a preliminary matter, we note that the appellant has argued claims 1-4 and 6 as a group and claim 5 separately. (Appeal Brief at 7-20.) Accordingly, we confine our discussion to claims 1 and 5, with claims 2-4 and 6 standing or falling with claim 1. 37 CFR § 41.37(c)(vii)(2005)(effective September 13, 2004). These claims are reproduced for convenience as follows:

> 1. A process for preparing polyvinylpyridine N-oxides, comprising:
> oxidizing polyvinylpyridines in an aqueous hydrogen peroxide solution having a water content of at least 25% in the presence of an acid and a catalyst of an oxide, acid or salt thereof of an element of Group 5b, 6b, 7b or 8.
>
> 5. The process of claim 1, wherein the oxidation is conducted in the presence of from 0.1 to 1% by weight of sodium tungstate, phosphotungstic acid, tungstic acid, sodium molybdate, phosphomolybdic acid, molybdic acid or mixtures thereof.

In the PTO where patentability issues are decided, claims are given their broadest reasonable interpretation consistent with the specification. *In re Bigio*, 381 F.3d 1320, 1324, 72 USPQ2d 1209, 1211 (Fed. Cir. 2004)("[T]he PTO gives a disputed claim term its broadest reasonable interpretation during patent prosecution."). This mode of claim interpretation applies even for a patent under reexamination. *In re Yamamoto*, 740 F.2d 1569, 1571, 222 USPQ 934, 936 (Fed. Cir. 1984)("We affirm the board's decision to give claims their broadest reasonable interpretation, consistent with the specification, in reexamination proceedings.").

Here, appealed claim 1 does not specifically limit the "oxidizing" step to any particular degree of oxidation, although the specification states that "[t]he polyvinylpyridines used in the process...are up to 100, preferably 50-98,% oxidized." (Column 3, lines 50-52.) Because the term "up to 100...%" in the present context includes any positive value from 0 to 100, we must interpret appealed claim 1 to read on *any* degree of oxidation. Additionally, the appealed claims do not recite any amount for the acid component nor distinguish the acid component from the acid catalyst. Accordingly, we interpret the appealed claims to read on the use of any amount of acid that is sufficient to oxidize polyvinylpyridine to any degree as well as a process in which the acid component and acid catalyst are one and the same. Furthermore, appealed claim 1 recites the

transitional term "comprising" in defining the step(s) of the claimed process. In claim drafting, the term "comprising" not only alerts potential infringers that the recited steps are essential, but that other unrecited steps may be performed and still form a construct within the scope of the claim. *See, e.g.*, *In re Baxter*, 656 F.2d 679, 686, 210 USPQ 795, 802 (CCPA 1981). Thus, we construe the claimed process to read on processes that include a further step, such as adding hydrochloric acid to facilitate recovery of the N-oxide product.

With this claim construction in mind, we turn to the examiner's rejection.

Under 35 U.S.C. § 103(a), a claimed invention is unpatentable if the differences between it and the prior art are "such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains." The Supreme Court of the United States has held that the factual inquiry into whether claimed subject matter would have been obvious includes a determination of: (1) the scope and content of the prior art; (2) the differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) secondary consideration (e.g., the problem solved) that may be indicia of (non)obviousness. *Graham v. John Deere Co., Inc.*, 383 U.S. 1, 17-18 (1966).

The Scope and Content of the Prior Art

Witman describes a process for preparing N-oxides of tertiary amines by reacting the amines with hydrogen peroxide in the presence of unstable inorganic per-compounds of acid-forming elements of groups VA, VIA, VIB, and VIII of the periodic table as catalyst. (Column 1, lines 66-72.) Witman describes the applicability of the disclosed N-oxidation process to all tertiary amines, as follows:

> My new process efficiently effects the oxidation of the N-oxides of all of the tertiary amines which are known to oxidize to the corresponding N-oxides, and *in fact my new process is applicable generally to the oxidation of all tertiary amines to the corresponding N-oxides*. [Emphasis added; column 1, line 72 to column 2, line 5.]

As typical examples of such tertiary amines, Witman describes "pyridine and the various substituted pyridines." (Column 3, lines 38-40.) Witman teaches that the disclosed process is advantageous, as follows:

> Since my new process employs only stable, easily handled materials, relatively inexpensive, re-usable catalysts, and gives much higher reaction rates than have heretofore been possible, it lends itself admirably as a general method for the large-scale preparation of N-oxides. The new process also effects much more efficient use of hydrogen peroxide. [Column 2, lines 5-11.]

According to Witman, "[a]s a general rule, an amount of the catalyst between about 1.0% and about 20%, based on the number of moles of amine reactant charged, will effectively catalyze the reaction between the amine and the hydrogen peroxide" and in "many cases, even less of the catalyst - e.g., as little as

0.1% of the amine on a molar basis - will be sufficient..." (Column 4, lines 69-74.) Witman further states that the hydrogen peroxide may be in the form of an aqueous solution containing from about 10% to about 90% by weight of hydrogen peroxide. (Column 5, lines 5-7.) Witman also discloses that the reaction medium containing an aqueous solution of hydrogen peroxide may contain an additional solvent (preferably miscible with water) and that, when the amine is a heterocylic amine, the most useful solvents are lower aliphatic carboxylic acids, preferably glacial acetic acid. (Column 5, line 71 to column 6, line 5.) Witman describes the recovery of the N-oxide product as follows:

> Where a solvent was used, in many cases the solvent too may be removed by distillation. It must be noted that in a great many cases the N-oxide is somewhat unstable, so that distillation of the water or water and solvent must be accomplished at such a low pressure that the N-oxide product is not decomposed. It has been found that in a great percentage of cases, the hydrohalide (e.g., hydrochloride) of the N-oxide is more stable than is the N-oxide itself. In such cases, the N-oxide is best recovered by first converting it to the hydrohalide , then removing water or water and solvent. Also, the N-oxide hydrohalides usually are crystalline, whereas the N-oxides are not; conversion of the N-oxide to the hydrohalide thus provides a simple technique for obtaining a pure product by recrystallization techniques. [Column 7, lines 38-52.]

In Example V, Witman describes a process in which: (a) 31.6 parts of pyridine, 20 parts water, and 5.0 parts of molybdic anhydride were mixed together and heated to 60°C; (b) 32.8 parts of 50% by weight hydrogen peroxide was added over a ten minute period; (c) the temperature of the reaction mixture was

maintained at 60-65°C for two hours until all of the peroxide was consumed; (d) 4.0 parts of calcium hydroxide were added and the temperature of the reaction mixture was allowed to cool to room temperature with continued stirring; (e) the insoluble salts were filtered; (f) 50 parts of concentrated HCl were added to the filtrate; and (g) the solution was then freed of water by distillation at 10-15 mm Hg to provide 34.3 parts of the hydrochloride salt of the pyridine N-oxide (63% yield). (Column 8, lines 60-75.) At this point, it is important to point out that the '684 patent under reexamination states that the catalysts described in Witman, including acids of molybdenum, are preferred catalysts suitable for use in the claimed invention. (Column 2, line 43 to column 3, line 5.) In this regard, BASF admits that the molybdic anhydride catalyst described in Witman's Example V converts to molybdic acid upon contact with water. (Appeal Brief at 15.) Additionally, Dr. Boeckh also acknowledged that the reaction medium described in Witman's Example V has a water content greater than 25%.

Dunn describes the preparation of fully or partially oxidized homopolymers or copolymers of vinylpyridine. (Column 1, line 60 to column 2, line 19.) According to Dunn, the N-oxidation may be facilitated in an organic solvent using any suitable organic peracid as the oxidizing agent. (Column 4, line 68 to column 5, line 7.)

Differences between the Claimed Invention and the Prior Art

As noted earlier, the appealed claims read on a process wherein the acid component and the catalyst may be one and the same material. At oral argument, the appellant's counsel agreed with this interpretation.

Like the claimed process, Witman's process as described in Example V carries out N-oxidation of a pyridinic molecule in an aqueous hydrogen peroxide solution in which the water content is greater than 25% in the presence of a catalyst of an acid of 6b of the periodic table (molybdic acid). Thus, we find that Witman's process as described in Example V is the closest prior art. This prior art process differs from the invention recited in appealed claim 1 *only* in that the N-oxidation is applied to pyridine instead of polyvinylpyridine.

Level of Ordinary Skill in the Art

We find that one of ordinary skill in the art would have at least a working knowledge in various areas of expertise including (but not limited to) catalysis and complex polymer science. This level is reflected in the teachings of the applied prior art. *Litton Industrial Products, Inc. v. Solid State Systems Corp.*, 755 F.2d 158, 163, 225 USPQ 34, 38 (Fed. Cir. 1985).

On Whether One of Ordinary Skill in the Art Would Have Been Led to Combine the References

Based on our findings as to the scope and content of the prior art as well as the level of ordinary skill in the art as reflected in the applied prior art references, we are in complete agreement with the examiner that a person having ordinary skill in the art would have found the subject matter of appealed claim 1 prima facie obvious. Specifically, a person having ordinary skill in the art would have found it prima facie obvious to replace the pyridine of Witman's exemplified process with polyvinylpyridine as shown in Dunn in order to realize all of the advantages disclosed in Witman column 2, lines 5-11, which states:

> Since my new process employs only stable, easily handled materials, relatively inexpensive, re-usable catalysts, and gives much higher reaction rates than have heretofore been possible, it lends itself admirably as a general method for the large-scale preparation of N-oxides. The new process also effects much more efficient use of hydrogen peroxide.

Additionally, a person having ordinary skill in the art would have been led to make this combination because Witman describes the applicability of the disclosed N-oxidation process to all tertiary amines known to oxidize to N-oxides, as follows:

> My new process efficiently effects the oxidation of the N-oxides of all of the tertiary amines which are known to oxidize to the corresponding N-oxides, and *in fact my new process is applicable generally to the oxidation of all tertiary amines to the corresponding N-oxides*. [Emphasis added; column 1, line 72 to column 2, line 5.]

Furthermore, Witman teaches that the tertiary amine includes substituted pyridines. Polyvinylpyridine, which was known to be oxidizable to an N-oxide as shown in Dunn and as admitted by Dr. Boeckh, is a substituted pyridine. *In re Mayne*, 104 F.3d 1339, 1343, 41 USPQ2d 1451, 1454 (Fed. Cir. 1997)("Structural relationships often provide the requisite motivation to modify known compounds to obtain new compounds.").

As to the "acid" component recited in appealed claim 1, Witman discloses that the reaction medium containing an aqueous solution of hydrogen peroxide may contain an additional solvent (preferably miscible with water) and that, when the amine is a heterocylic amine, the most useful solvents are lower aliphatic carboxylic acids, preferably glacial acetic acid. (Column 5, line 71 to column 6, line 5.) Accordingly, a person having ordinary skill in the art would have found it prima facie obvious to include a suitable amount of glacial acetic acid in the reaction medium of Witman's Example V as expressly described in the reference.

With respect to separately argued claim 5, Witman teaches that "[a]s a general rule, an amount of the catalyst between about 1.0% and about 20%, based on the number of moles of amine reactant charged, will effectively catalyze the reaction between the amine and the hydrogen peroxide" and in "many cases, even less of the catalyst - e.g., as little as 0.1% of the amine on a molar basis - will be sufficient..." (Column 4, lines 69-74.) The subject matter of appealed claim 5,

which recites an amount for the catalyst of "from 0.1 to 10% by weight of...molybdic acid" would have been obvious to a person having ordinary skill in the art because the prior art range and the claimed range overlap. *In re Peterson*, 315 F.3d 1325, 1329-30, 65 USPQ2d 1379, 1382-83 (Fed. Cir. 2003). This is because "[t]he normal desire of scientists or artisans to improve upon what is generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages." *In re Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382.

The teachings of Watts, Greenspan, Hopkins, and Willard, which were cited to establish that commercially available hydrogen peroxide solutions have water contents greater than 25%, are unnecessary to establish the obviousness of appealed claims 1 and 5. (Examiner's Answer at 4.) Indeed, the patent owner states that the examiner's finding with respect to these references "is irrelevant to the BASF arguments against the claim rejections..." (Appeal Brief at 8-9, n. 2.) Therefore, we do not have to discuss them.

The patent owner argues that a person having ordinary skill in the art would not have combined the references because Witman teaches away from the claimed invention. (Appeal Brief at 8-9.) Specifically, the patent owner urges that, with respect to the aqueous type of process, Witman teaches that the N-oxide is "somewhat unstable" and therefore requires addition of large quantities of

hydrochloric acid at the end of the reaction to prepare the hydrochloride salt of the N-oxide. (Appeal Brief at 9.)

This argument is unavailing. Our reviewing court in *In re Gurley*, 27 F.3d 551, 553, 31 USPQ2d 1130, 1132 (Fed. Cir. 1994) provided guidance on "teaching away" as follows:

> Gurley's position appears to be that a reference that teaches away "cannot" serve to create a *prima facie* case of obviousness. We agree that this is a useful general rule. However, such a rule can not be adopted in the abstract, for it may not be applicable in all factual circumstances. Although a reference that teaches away is a significant factor to be considered in determining unobviousness, the nature of the teaching is highly relevant, and must be weighed in substance. A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.
>
> The facts in Gurley's record are that this use of epoxy was known, the structure of these circuit boards was known, and epoxy had been used for Gurley's purpose. We share Gurley's view that a person seeking to improve the art of flexible circuit boards, on learning from Yamaguchi that epoxy was inferior to polyester-imide resins, might well be led to search beyond epoxy for improved products. However, Yamaguchi also teaches that epoxy is usable and has been used for Gurley's purpose. The Board recognized Yamaguchi's teaching of the deficiencies of epoxy-impregnated material, but observed that Gurley did not distinguish his epoxy product from the product described by Yamaguchi. On the facts of this case, Gurley's teaching away argument was insufficient to establish patentability. Gurley did not offer specific epoxies, or improved properties, and we are not presented with the question of whether any such products might meet the requirements of patent ability. Even reading Yamaguchi's description as discouraging use of epoxy for this purpose, Gurley asserted no discovery beyond what was known to the art.

Here, Witman does not say that an aqueous medium leads to an inoperable process. Quite the contrary, Witman teaches that the N-oxide product is "somewhat unstable" and therefore the distillation of the water or water and solvent during product recovery must be performed at "low pressure that the N-oxide product is not decomposed." (Column 7, lines 39-52.) Alternatively, Witman teaches that "the N-oxide is best recovered by first converting it to the hydrohalide [which is more stable than the N-oxide], then removing water or water and solvent." (Column 7, lines 43-48.) Thus, Witman expressly discloses solutions to the instability problem, which is to perform low pressure distillation or first convert the N-oxide to hydrohalide. As we discussed above, the appealed claims do not preclude the recovery of N-oxide by first converting the product to the hydrochloride. The disclosure in Witman is hardly the type of teaching that can reasonably be considered to "teach away."

To the extent that the prior art suggests that an aqueous reaction medium is inferior to a non-aqueous reaction medium, the patent owner has not satisfactorily established any discovery beyond what was known to the art. Contrary to what the patent owner would have us believe, our reviewing court has explained that the "case law does not require that a particular combination must be the preferred, or the most desirable, combination described in the prior art in order to provide the

motivation for the current invention." *In re Fulton*, 391 F.3d 1195, 1200, 73 USPQ2d 1141, 1145 (Fed. Cir. 2004). Rather, the court has instructed:

> "[T]he question is whether there is something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination," not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available.

Id. (quoting *In re Beattie*, 974 F.2d 1309, 1311, 24 USPQ2d 1040, 1042 (Fed. Cir. 1992)).

With respect to separately argued claim 5, the appellant urges that Witman never links the amount of catalyst within the range of claim 5 to the water-based process of Witman in which the water content is greater than 25%. (Appeal Brief at 12.) We disagree. Witman's range of catalyst amounts at column 4, line 69 to column 5, line 3 is generic to all processes described as Witman's invention.

Secondary Considerations

It is well settled that once a prima facie case of obviousness is established, the burden then shifts to the applicant to rebut. *In re Mayne*, 104 F.3d at 1342, 41 USPQ2d at 1454.

The patent owner argues that a problem was solved by "reducing the acid content by utilizing at least 25% water and a catalyst to ensure that superior oxidation results are achieved and high oxidation yields are still achievable..."

(Appeal Brief at 10.) In support of this position, the appellant relies on the declaration of Dr. Boeckh, who happens to be one of the named inventors and an employee of the patent owner BASF. (Appeal Brief at 10; Boeckh Declaration, ¶¶6-8.)

We, like the examiner, find the relied upon evidence insufficient to rebut the prima facie case of obviousness. As pointed out by the examiner, the appealed claims read on any amount of acid. As to the advantage of using water in an amount greater than 25%, Witman's Example V describes a process in which the water content is greater than 25%, as admitted by Dr. Boeckh. Thus, the recited water content is of no help to the appellant. Also, the appellant argues that the oxidation was much higher for Dr. Boeckh's experiments in comparison to Witman's Example V. (Appeal Brief at 16.) We note, however, the N-oxide yield of Witman's Example V and the yields for the experiments discussed in the Boeckh declaration are irrelevant, because these experiments are not back-to-back runs that are properly comparable to Witman's Example V. Here, the appellant has failed to proffer any evidence that demonstrates (by way of meaningful comparative experiments) that the *differences* between the claimed subject matter and the closest prior art (the absence of acid and the use of pyridine as opposed to PVP in Witman's Example V) give rise to unobvious results. *In re Baxter Travenol Labs*, 952 F.2d 388, 392, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991)

("[R]esults must be shown to be unexpected compared with the closest prior art."); *In re Dunn*, 349 F.2d 433, 439, 146 USPQ 479, 483 (CCPA 1965) ("While we do not intend to slight the alleged improvements, we do not feel it an unreasonable burden on appellants to require comparative examples relied on for non-obviousness to be truly comparative. The cause and effect sought to be proven is lost here in the welter of unfixed variables.").

Without such comparative experimental evidence, the opinion testimony of an interested party is of little or no probative value. *Cf. Ferring B.V. v. Barr Laboratories, Inc.*, 437 F.3d 1181, 1188, 78 USPQ2d 1161, 1167 (Fed. Cir. 2006)("A witness's interest is always pertinent to his credibility and to the weight to be given to his testimony...").

Even when the lack of a truly comparative showing is ignored for a moment, we find the experiments of record relied upon by Dr. Boeckh to be insufficient in terms of scope. (Boeckh Declaration, ¶¶8-14.) For example, the working examples reported in the patent under reexamination are all limited to molybdenum or tungsten acid catalysts. By contrast, the appealed claims are significantly broader ("catalyst of an oxide, acid or salt thereof of an element of Group 5b, 6b, 7b or 8"). With regard to the experiments identified in Exhibits 1-3 (largely in German) attached to the declaration, it is not at all clear what specific catalyst(s) were used. Under these circumstances, it can hardly be said that the showing is

even close to being commensurate in scope with the degree of patent protection desired. *In re Peterson*, 315 F.3d at 1330-31, 65 USPQ2d at 1383.

For the foregoing reasons, we determine that the evidence of obviousness far outweighs the proffered evidence in support of nonobviousness. Accordingly, we uphold the examiner's rejection.

ORDER

In sum, it is:

ORDERED that claims 1-6 of United States patent 5,578,684 are unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Witman and Dunn, "optionally as evidenced by Watts, Greenspan, Hopkins, and Willard."

The decision of the examiner to finally reject claims 1-6 is **AFFIRMED**.

TIME FOR TAKING ACTION

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

/Romulo H. Delmendo/ ROMULO H. DELMENDO Administrative Patent Judge	)
/Michael P. Tierney/ MICHAEL P. TIERNEY Administrative Patent Judge	) BOARD OF PATENT) APPEALS AND
/James T. Moore/ JAMES T. MOORE Administrative Patent Judge	) INTERFERENCES

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