Paper No. 24

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte CHARLES A. DRAKE
and AN-HSIANG WU

Appeal No. 2003-0366
Application 09/349,759

ON BRIEF

Before KIMLIN, GARRIS and WARREN, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

Decision on Appeal

This is an appeal under 35 U.S.C. § 134 from the decision of the examiner finally rejecting claims 15 through 20, 36 through 42, 79, 81, 83, 84 and 86, which are all of the claims in the application. Claims 15 and 36, as they stand of record, [1] are illustrative of the claims on appeal:

15. A method of converting non-aromatic hydrocarbons to aromatic hydrocarbons, ethylene, and propylene comprising contacting a feed comprising at least one non-aromatic hydrocarbon containing 2-16 carbon atoms per molecule selected from a group consisting of alkanes, alkenes, and cycloparaffins, with a silylated, acid leached zeolite composition, under contacting conditions effective in obtaining a reaction product comprising ethylene, propylene,

[1] Appealed claim 15 was erroneously copied in the appendix to the brief. See the amendment of October 10, 2000 (Paper No. 7).

and aromatic hydrocarbons and further wherein said silylated, acid leached zeolite composition is a zeolite which is acid leached then silylated.

36. A method of converting non-aromatic hydrocarbons to aromatic hydrocarbons, ethylene, and propylene comprising contacting a feed comprising at least one non-aromatic hydrocarbon containing 2-16 carbon atoms per molecule selected from a group consisting of alkanes, alkenes, and cycloparaffins, with a steam treated, silylated zeolite composition, under contacting conditions effective in obtaining a reaction product comprising ethylene, propylene, and aromatic hydrocarbons and further wherein said steam treated, silylated zeolite composition is a zeolite which is silylated then steam treated.

The appealed claims, as represented by claims 15 and 36, are drawn to methods of converting non-aromatic hydrocarbons to aromatic hydrocarbons, ethylene and propylene comprising contacting a feed comprising at least one non-aromatic hydrocarbon containing 2-16 carbon atoms per molecule selected from the group consisting of alkanes, alkenes, and cycloparaffins with a silylated, acid leached zeolite composition wherein the zeolite is acid leached then silylated, and a steam treated, silylated zeolite composition wherein the zeolite is silylated then steam treated, respectively. The zeolite catalyst can be a ZSM-5 zeolite (appealed claims 79 and 84). According to appellants, each of the zeolite compositions increases the ratio of olefin to aromatics and reduces the rate of coke formation in the conversion reaction (specification, e.g., pages 3-4).

The references relied on by the examiner are:

Cattanach (Cattanach ‘942)	3,756,942	Sep. 4, 1973
Cattanach (Cattanach ‘024)	3,760,024	Sep. 18, 1973
Beck et al. (Beck)	5,567,666	Oct. 22, 1996

The examiner has rejected appealed claims 15 through 20, 36 through 42, 79, 81, 83, 84 and 86 under 35 U.S.C. § 103(a) as being unpatentable over Beck incorporated with either Cattanach ‘942 or Cattanach ‘024.

Appellants state in their brief (page 3) that the appealed claims “stand or fall together as a group with claims 15 and 36.” Thus, we decide this appeal based on appealed claims 15 and 36. 37 CFR § 1.192(c)(7) (2002).

We affirm.

Rather than reiterate the respective positions advanced by the examiner and appellants, we refer to the examiner’s answer and to appellants’ brief for a complete exposition thereof.

Opinion

As an initial matter, we find that, when considered in light of the written description in the specification as interpreted by one of ordinary skill in this art, *see, e.g., In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997), the plain language of appealed claims 15 and 36 require that the method of converting non-aromatic hydrocarbons to aromatic hydrocarbons is conducted with a silylated, acid leached zeolite composition wherein the zeolite is acid leached then silylated, and a steam treated, silylated zeolite composition wherein the zeolite is silylated then steam treated, respectively. The product-by-process format thus used to characterize the zeolite catalyst compositions must be given weight in applying prior art. S*ee generally, In re Thorpe*, 777 F.2d 695, 697, 227 USPQ 964, 966 (Fed. Cir. 1985).

We determine that the examiner has done so in pointing out that Beck discloses zeolite catalysts for the same method, as evinced by the Cattanach references, which are silylated and then acid leached or steam treated and then silylated, that is, prepared in the reverse order of steps set forth in appealed claims 15 and 36, and there is no quarrel between the parties in this respect (answer, page 3; brief, pages 4-5).

Therefore, the issues are whether the examiner has established a *prima facie* case of obviousness based on such facts, and if so, whether the evidence in the specification as relied on by appellants in the brief constitutes sufficient evidence of nonobviousness to out weight the evidence of obviousness.

The examiner takes the position that one of ordinary skill in the art would have expected that zeolite catalysts "prepared in any sequence of acid-leaching, steaming, and silylating [as shown in Beck] would [have] similar properties" to those described by Beck for the zeolite catalysts prepared by the sequence of steps shown in the reference, including the conversion of non-aromatic hydrocarbons to aromatic hydrocarbons for which Beck incorporates the teachings of the Cattanach references (answer, pages 3-4). .

We find that Beck acknowledges that it was known in the art to modify zeolite catalysts with respect to aluminum and silicon (cols. 1-3). Beck would have disclosed to one of ordinary skill in this art a process wherein an organosilicone compound is first used to deposit siliceous

material on the zeolite catalyst and then an aqueous solution of a dealuminizing agent, such as an acid, is applied to the silylated zeolite catalyst (cols. 3-4). Beck theorizes that such treatments, *inter alia*, render "acid sites on the external surfaces of the zeolite substantially inaccessible to reactants" (col. 10, lines 37-54). Beck would have further disclosed that "[t]he 'alpha value' of a catalyst is an approximate indication of its catalytic cracking activity," which value "may be increased by mild steaming" (col. 10, line 55, to col. 11, line 5). Beck exemplifies the use of, *inter alia*, ZSM-5 zeolites and teaches that the zeolite catalysts can be used, *inter alia*, "in the conversion of light paraffins and olefins to aromatic compounds" as exemplified by the Cattanach references (e.g., cols. 5-7 and 12-16, col. 14, lines 37-41, and the Examples). The Cattanach references also would have disclosed the use of ZSM-5 zeolites as catalysts for the same conversion methods.

Based on this substantial evidence in the references, we agree with the examiner's position because we find on this record that, *prima facie*, Beck would have provided the motivation to one of ordinary skill in this art to prepare similar zeolite catalysts to those disclosed in the reference using the same steps taught in the reference, albeit in different order, in the reasonable expectation of obtaining similar zeolite catalysts having similar properties that are useful in the same methods, thus enabling the preparation of such zeolites and their use. Indeed, on this record, we determine that, *prima facie*, one of ordinary skill in this art, armed with the knowledge in the art that zeolite catalysts can be beneficially modified with respect to aluminum and silicon, would have reasonably expected that the silylation step, the acid dealumination step and the steam treatment step taught by Beck would each function in similar manner to provide a zeolite catalyst, such as a ZSM-5, with a similar structure with respect to the availability of acid sites on the external surfaces thereof and an increased "alpha value," thus providing similar properties for use in the same methods, regardless of the order in which the steps are employed. Consequently, we are of the opinion that one of ordinary skill in this art routinely working within the teachings of Beck would have reversed the treatment steps shown in the reference and would have used the resulting zeolite catalyst in the methods of the Cattanach references incorporated by Beck, thus reasonably arriving at the claimed methods encompassed by appealed claims 15 and 36 without recourse to appellants' specification. *Compare In re Dillon*, 919 F.2d 688, 692-

93, 16 USPQ2d 1897, 1900-01 (Fed. Cir. 1990)(*in banc*); *In re Payne*, 606 F.2d 303, 315-17, 203 USPQ 245, 254-56 (CCPA 1979).

Accordingly, since a *prima facie* case of obviousness has been established over the combined teachings of Beck and the Cattanach references by the examiner, we have again evaluated all of the evidence of obviousness and nonobviousness based on the record as a whole, giving due consideration to the weight of appellants' arguments and the evidence in the specification Examples as relied on in the brief. *See generally, In re Johnson*, 747 F.2d 1456, 1460, 223 USPQ 1260, 1263 (Fed. Cir. 1984); *In re Piasecki*, 745 F.2d 1468, 1472, 223 USPQ 785, 788 (Fed. Cir. 1984); *In re Rinehart*, 531 F.2d 1048, 1052, 189 USPQ 143, 147 (CCPA 1976).

We have carefully considered all of appellants' arguments and the evidence presented in the specification as relied on by appellants in the brief. In view of the substantial evidence we find in Beck and the Cattanach references incorporated by Beck, we cannot agree with appellants' contention that the examiner has failed to provide a factual foundation for finding a *prima facie* case of obviousness. Because appellants have not submitted argument with respect to the evidence in the applied references, we now consider the objective evidence of nonobviousness in the specification on which appellants rely in the brief. *See Dillon*, 919 F.2d at 692-93, 16 USPQ2d at 1901; *Payne*, 606 F.2d at 315, 203 USPQ at 256.

Appellants rely on the comparisons provided in specification Examples I and II and the results thereof reported in specification Table I. The comparisons involve an untreated ZSM-5 catalyst, designated "A," the silylated modification of that catalyst, designated "B," and the steam treated modification of the silylated catalyst representing claim 36, designated "C." Appellants state that the claimed zeolite catalyst "C" exhibited "higher yields of aromatics . . . along with a lower rate of coking" than the other zeolite catalysts (brief, page 5). Appellants state in the specification that silylated catalysts B and C "exhibited less coking than control Catalyst A which had not been treated," and that silylated catalysts B and C had higher yields of aromatics than untreated catalyst A, with catalyst C which was steam treated achieving "[a] additional increase" in aromatics compared to catalyst B (pages 11-15). We note that there appears to be little different between the silylated catalysts B and C with respect to the "Composition of Liquid

products" and catalyst B exhibits a slightly lower rate of coking than catalyst C. No statement is made with respect to the relative performance of the three catalysts regarding the "Composition of Gas Products," of which ethylene and propylene are specified in the appealed claims. While appellants do note that some results reported in Table I are "higher" and others "lower" with respect to steamed, silylated zeolite catalyst C representing appealed claim 36, there is no statement in either the brief or the specification of the practical significance of such results and there is no explanation or evidence bearing on whether such results would have been unexpected.

Appellants further rely on the comparisons provided in specification Examples III and IV and the results thereof reported in specification Table II. The comparisons involve an untreated ZSM-5 catalyst, designated "T-4480 Zeolite," the acid-leached modification of that catalyst, designated "Acid Leached Zeolite," and the silylated modification of the acid leached catalyst representing claim 15, designated "Silylated, Acid Leached Zeolite." Appellants state that the claimed silylated, acid leached ZSM-5 zeolite catalyst exhibited "significantly improved" weight ratio of lower olefin to aromatic and "significantly lower" reduced coking than the other zeolite catalysts in the brief (page 5) and in the specification (page 17). We accept appellants' statements. However, while appellants do note that the results are "significant" with respect to silylated, acid leached ZSM-5 zeolite catalyst representing appealed claim 15, there is no statement in either the brief or the specification of the practical significance of such results and there is no explanation or evidence bearing on whether such results would have been unexpected.

The examiner submits that the comparisons are "not persuasive since a catalyst as disclosed by the closest art (Beck et al.) is not used to compared with the claimed catalyst" in each of the Tables, as "only an untreated zeolite and one-treatment-step zeolite are used to compare with the presently claimed" catalysts (answer, page 4).

Upon carefully considering the objective evidence relied on, we agree with the examiner's position because in the absence of such a showing as deemed necessary by the examiner, the evidence does not address the thrust of the examiner's ground of rejection. *See e.g., Baxter Travenol Labs.*, 952 F.2d 388, 392, 21 USPQ2d 1281, 1285 (Fed. Cir. 1991) ("[W]hen unexpected results are used as evidence of nonobviousness, the results must be shown to be unexpected compared with the closest prior art. [Citation omitted.]"); *In re Burckel*, 592

F.2d 1175, 1179-80, 201 USPQ 67, 71 (CCPA 1979) (the claimed subject matter must be compared with the closest prior art in a manner which addresses the thrust of the rejection); *In re Dunn*, 349 F.2d 433, 439, 146 USPQ 479, 483 (CCPA 1965) ("[W]e 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."). Indeed, appellants have not submitted any explanation or evidence with respect to the practical significance of such results vis-à-vis the teachings of Beck and why the results would have been considered unexpected. *See generally, In re Geisler*, 116 F.3d 1465, 1470, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997); *In re Merck*, 800 F.2d 1091, 1099, 231 USPQ 375, 381 (Fed. Cir. 1986); *In re Longi*, 759 F.2d 887, 897, 225 USPQ 645, 651-52 (Fed. Cir. 1985); *In re Lindner*, 457 F.2d 506, 508, 173 USPQ 356, 358 (CCPA 1972); *In re Klosak*, 455 F.2d 1077, 1080, 173 USPQ 14, 16 (CCPA 1972); *In re D'Ancicco*, 439 F.2d 1244, 1248, 169 USPQ 303, 306 (1971).

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of Beck, Cattanach '942 and Cattanach '024 with appellants' countervailing evidence of and argument for nonobviousness and conclude that the claimed invention encompassed by appealed claims 15 through 20, 36 through 42, 79, 81, 83, 84 and 86 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

The examiner's decision is affirmed.

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

AFFIRMED

EDWARD C. KIMLIN Administrative Patent Judge	)	
BRADLEY R. GARRIS Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
CHARLES F. WARREN Administrative Patent Judge	)	

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