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

UNITED STATES PATENT AND TRADEMARK OFFICE

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Ex parte
MICHAEL W. LYNCH and MANIVAKKAM J.
SHANKERNARAYANAN

Appeal 2007-2136
Application 10/457,769
Technology Center 1700

Decided: July 24, 2007

Before DONALD E. ADAMS, ERIC GRIMES, and NANCY J. LINCK, *Administrative Patent Judges*.

GRIMES, *Administrative Patent Judge*.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134 involving claims to a method of forming a polyolefin resin. The Examiner has rejected the claims as anticipated or obvious. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

BACKGROUND

The Specification describes

> a method of forming a polyolefin resin . . . compris[ing] forming a reaction mixture at a sufficient temperature to allow formation of the polyolefin resin by combining molecular hydrogen, a first olefin selected from the group consisting of ethylene and C_3-C_8 α-olefin, an optional second olefin which is different than the first olefin selected from the group consisting of ethylene and C_3-C_8 α-olefin, a diluent, and a catalyst system that forms long chain branches on a polymer backbone and initiating polymerization of the reaction mixture. The resulting polyolefin resin has a density greater than about 0.92, a melt index from about 0.01 to about 20, and a long chain branching index greater than about 1.

(Specification 3.) The Specification states that this method "can be separated into two discrete parts" (*id.* at 9).

The Specification also describes a vanadium-containing catalyst system for use in this method, which includes an organoaluminum compound cocatalyst, "a promoter which improves the activity of the catalyst while also possibly modifying the molecular weight distribution," and optionally "a modifier having formula I:

$$(R^1O)_xSiR^2_{4-x} \qquad \text{I}$$

where R^1 and R^2 are each independently alkyl and x is 1 to 3" (*id.* at 8). The Specification indicates that the "modifier is useful in tailor[ing] the molecular weight distribution and long chain branching of the polyolefin[] resins" and "is added at any point during the formation of the polyolefin resin" (*id.*).

DISCUSSION

1. CLAIMS

Claims 14-25 and 27-42 are on appeal. Claims 1-13 are also pending but have been withdrawn from consideration by the Examiner.

The claims have been argued in groups (Br. 5-14). The claims within each group stand or fall together. 37 C.F.R. § 41.37(c)(1)(vii). We will focus on claims 14 and 28,[1] which are representative and read as follows:

> 14. A method of forming a polyolefin resin, the method comprising:
>
> a) forming a reaction mixture at a sufficient temperature to allow formation of the polyolefin resin by combining molecular hydrogen, a first olefin selected from the group consisting of ethylene and C_3-C_8 α-olefin, an optional second olefin selected from the group consisting of ethylene and C_3-C_8 α-olefin, a diluent, and a vanadium-containing catalyst system that includes a modifier having formula I:
>
> $$(R^1O)_xSiR^2_{4-x} \qquad \text{I}$$
>
> where R^1 and R^2 are each independently alkyl and x is 1 to 3, wherein the modifier is added at any point during the formation of the polyolefin resin; and
>
> b) initiating polymerization of the reaction mixture;
>
> wherein the first olefin is different than the second olefin and the polyolefin resin has a density greater than about 0.92, a melt index from about 0.01 to about 20, and a long chain branching index of greater than about 1.
>
> 28. A method of forming a polyolefin resin, the method comprising:

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[1] Appellants also separately argue claim 41 (Br. 9). Appellants' argument is addressed below but we find it unnecessary to reproduce that claim.

> a) forming a reaction mixture at a sufficient temperature to allow formation of the polyolefin resin by combining molecular hydrogen, a first olefin selected from the group consisting of ethylene and a C_3-C_8 α-olefin, an optional diluent, a second olefin selected from the group consisting of ethylene and a C_3-C_8 α-olefin, an optional diluent, and a catalyst system that forms long chain branches on a polymer backbone, wherein the first olefin is different than the second olefin;
>
> b) optionally removing one or more of the first olefin, the second olefin, molecular hydrogen, and the diluent; and
>
> c) introducing additional amounts of molecular hydrogen, the first olefin, and optionally, the second olefin and the diluent,
>
> wherein additional polymerization occurs in step c and the polyolefin resin has a density greater than about 0.92, a melt index from about 0.01 to about 20, and a long chain branching index of about 1 to about 6.

Thus, claim 14 is directed to a method of forming a polyolefin resin comprising combining molecular hydrogen, an olefin, a diluent, and a vanadium-containing catalyst system that includes a modifier of formula I to form a reaction mixture and initiating polymerization of the reaction mixture, the modifier being added "at any point during the formation of the polyolefin resin." Claim 14 also requires that the resulting polyolefin resin has a particular density, melt index, and long chain branching index. We interpret claim 14 to require that modifier be added after the formation of polyolefin is begun.

Claim 28 is directed to a method of forming a polyolefin resin comprising combining molecular hydrogen, two different olefins, and "a catalyst system that forms long chain branches on a polymer backbone" to form a reaction mixture "at a sufficient temperature to allow formation of

the polyolefin resin," and introducing additional amounts of molecular hydrogen and first olefin, wherein additional polymerization occurs during this introducing step, that is, step c of claim 28. Claim 28 also requires that the resulting polyolefin resin has a particular density, melt index, and long chain branching index. We interpret claim 28 to require that additional molecular hydrogen and first olefin be added after the polymerization is begun.

2. REFERENCES

The Examiner relies on the following references:

Chien	US 5,089,460	Feb. 18, 1992
Winslow	US 5,534,472	Jul. 9, 1996

3. INDEFINITENESS

Claim 24 stands rejected under 35 U.S.C. § 112, second paragraph, for being indefinite. Appellants do not traverse this rejection (Br. 4). Therefore, we summarily affirm the rejection.

4. ANTICIPATION/OBVIOUSNESS

Claims 28-39, 41, and 42 stand rejected under 35 U.S.C. § 102(b) as anticipated by, or under 35 U.S.C. § 103 as obvious over, Winslow. The Examiner relies on Winslow, specifically Winslow's Examples 3 and 4, for demonstrating "a *method* for copolymerization of ethylene and n-hexene in the presence of . . . supported vanadium containing catalysts which are identical to those of the instant claims" (Answer 3-4). The Examiner argues that, "[i]n Examples 3 and 4, hydrogen, ethylene and n-hexene are continuously fed into a 88-gallon reactor" and that this "continuous process meets the limitation of [claim 28] of introducing additional amounts of

hydrogen [and] a first olefin monomer . . . to allow additional polymerization" (*id.* at 4).

The Examiner acknowledges that "Winslow's examples do not explicitly disclose all the claimed limitations such as density, melt index and [long chain branching index]," but argues that the copolymers resulting from the disclosed methods would be expected to inherently have these properties (*id.* at 4-5). In addition, the Examiner argues that, "[e]ven if the claimed properties are not inherent in the polymers of the prior art examples, it would still have been obvious to a skilled artisan to arrive at the claimed subject matter" (*id.* at 5). In particular, relying on *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980), and *In re Fessmann*, 489 F.2d 742, 180 USPQ 324 (CCPA 1974), the Examiner argues that, "[o]nce a product appearing to be substantially identical is found and a 35 USC 102/103 rejection made, the burden of proof is shifted to the applicant to show an unobvious difference" (*id.*).

We conclude that the Examiner has set forth a prima facie case that claim 28 is either anticipated by or obvious over Winslow. Winslow describes a catalyst system for the polymerization of olefins, the catalyst system comprising a supported catalyst component containing vanadium, an organoaluminum compound cocatalyst, and a halocarbon compound promoter (Winslow, col. 4, l. 57, to col. 5, l. 9, and Abstract).

Winslow includes two examples, Examples 3 and 4, in which its catalyst systems are used to copolymerize ethylene and n-hexene (Winslow, col. 12, ll. 1-59). During operation of the isobutane-filled polymerization

reactor, ethylene, n-hexene, and hydrogen gas are continuously fed into the reactor (*id.* at col. 12, ll. 12-23).

We agree with the Examiner that the continuous addition of ethylene, n-hexene, and hydrogen gas results in the addition of molecular hydrogen and first olefin after the polymerization is begun. In addition, because Winslow describes methods that are within the method steps recited in claim 28, we agree with the Examiner that it is reasonable to conclude that the methods described in Winslow either inherently result in or render obvious a method of forming a polyolefin resin having the density, melt index, and long chain branching index recited in claim 28. *Cf. In re Marosi*, 710 F.2d 799, 803, 218 USPQ 289, 292-93 (Fed. Cir. 1983) ("Where a product-by-process claim is rejected over a prior art product that appears to be identical, . . . the burden is upon the applicants to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product.").

Appellants argue that

> claim 28 discloses a process with two distinct polymerization steps. . . . Moreover, the wording of claim 28 also makes it clear that a process with two distinct polymerization steps is disclosed. For example, claim 28 goes on to state "wherein additional polymerization occurs in step c." Clearly, such a description of step c) is only consistent with step c) being a distinct step in which more polymerization occurs and not the single polymerization step of Winslow et al. in which reactants are continuously being added.

(Br. 5-6.)

We are not persuaded by this argument. We agree with Appellants that claim 28 requires two steps. In particular, claim 28 requires some

polymerization of the reaction mixture recited in step a and additional polymerization upon the introduction of additional amounts of molecular hydrogen and first olefin in step c. However, we agree with the Examiner that the continuous method described in Winslow has both of these two steps. In particular, in the continuous method, once some of each of the reactants are fed into the reactor, there would be some polymerization of the reaction mixture, as required in step a. Then, as additional ethylene, n-hexene, and hydrogen gas are fed into the reactor, there would be additional polymerization, as required in step c. We do not agree that claim 28 requires that the introduction of reactants be stopped and then restarted in step c, such that the end of step a and the start of step c can be clearly identified.

Appellants also argue that the "formation of polymer resins with [the] combination of properties [recited in claim 28] is **not a necessary** outcome of the processes taught by Winslow" and that therefore Winslow does not anticipate claim 28 (Br. 7). In addition, Appellants argue that Winslow "does not suggest or provide any motivation for adjusting parameters to obtain polymer resin simultaneously having a density greater than about 0.92, and a long chain branching index of about 1 to about 6" (*id.* at 8). Furthermore, Appellants argue that, because "the claims at issue are **method** claims . . . , the statements regarding substantially identical products and reliance on *In re Fessman[n]* and *In re Fitzgerald* is inappropriate" (*id.* at 9).

We are not persuaded by these arguments. First, we do not agree that the Examiner's reliance on *Fessmann* and *Fitzgerald* is inappropriate. As pointed out by Appellants, claim 28 is a method claim, whereas *Fessmann*

and *Fitzgerald* concern product claims. However, the limitations at issue are product limitations that Appellants argue are "in essence a limitation in part on the relative concentrations of the polymerizations reagents" (Br. 8). As stated in *Fessmann*, "the Patent Office is not equipped to manufacture products by the myriad of processes put before it and then obtain prior art products and make physical comparisons therewith." 489 F.2d at 744, 180 USPQ at 325 (quoting *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972)).

In the present case, the Patent Office is not equipped to manufacture the products made by the methods described in Winslow to determine whether these products have the properties recited in claim 28. Thus, we agree with the Examiner that it is appropriate to shift the burden to Appellants to demonstrate that Winslow does not teach the method of claim 28. "Whether the rejection is based on 'inherency' under 35 USC 102, on 'prima facie obviousness' under 35 USC 103, jointly or alternatively, the burden of proof is the same." *In re Best*, 562 F.2d 1252, 1255, 195 USPQ 430, 433-434 (CCPA 1977).

We also agree with the Examiner that Appellants have not met this burden. As discussed above, Appellants argue that that the "formation of polymer resins with [the] combination of properties [recited in claim 28] is **not a necessary** outcome of the processes taught by Winslow" (Br. 7). In particular, Appellants state that the "processes of Winslow et al. may produce a polymer resin with a density lower than 0.92, because as pointed out by the Examiner 'density of the ethylene polymer is based on the ethylene/hexene ratio'" (*id.*). However, Winslow's Examples 3 and 4

describe an ethylene/hexene ratio range. Specifically, Winslow's Examples 3 and 4 state that the "ethylene was continuously fed into the isobutane filled reactor such that it was present in a concentration of between 10 and 15 mole %, based on the number of moles of isobutane present in the reactor" and that the "n-Hexene was continuously fed into the . . . reactor such that its concentration in the isobutane was between 0.5 and 1.5 mole %" (Winslow, col. 12, ll. 14-20). Appellants have not even attempted to demonstrate that a density greater than 0.92, or any of the other properties recited in claim 28, would not necessarily be inherent in the processes recited in Winslow's Examples 3 and 4.

With regard to claim 41, Appellants additionally argue that Winslow "does not disclose the use of a modifier having formula $(R^1O)_xSiR^2_{4-x}$" and that claim 41 "requires that the modifier be added during step c) which is well after the commencement of polymerization in step a)" (Br. 9).

We are not persuaded by these arguments. Claim 41 states that the modifier is added during step c. However, claim 41 depends from claim 34, not claim 40 as indicated in the Appeal Brief (Br. 9). Claim 34 states that the modifier is optional. Thus, when claim 41 is given its broadest reasonable interpretation, we agree with the Examiner that "the modifier is optional in claim 41" (Answer 8). Thus, Winslow need not describe the modifier or when it is added in order to teach or suggest claim 41.

We conclude that the Examiner has set forth a prima facie case that claims 28 and 41 are anticipated by or obvious over Winslow, which Appellants have not rebutted. We therefore affirm the rejection of claims 28

and 41 under 35 U.S.C. § 102 or § 103. Claims 29-39 and 42 fall with claim 28.

5. OBVIOUSNESS

Claims 14-25 and 27-42 stand rejected under 35 U.S.C. § 103 as obvious over Winslow in view of Chien. The Examiner relies on Winslow for teaching "all of the limitations of the instant claims except the silane modifier" (Answer 6). The Examiner relies on Chien for describing "[u]se of a modifier such as alkoxysilane in [a] vanadium catalyst composition to increase stereoregularity in olefin polymerization" (*id.*). The Examiner concludes that "it would have been obvious to a skilled artisan at the time the invention was made to employ Chien's silane modifier to Winslow's catalyst's composition to provide an olefin polymer with improved stereoregularity" (*id.*).

We conclude that the Examiner has set forth a prima facie case of obviousness. Winslow is discussed above. Chien describes "a catalyst system for the polymerization of alpha-olefins," comprising a solid precursor comprising the reaction product of a halogenated vanadium compound with other components, a hydrocarbyl aluminum cocatalyst, and an outside electron donor (Chien, col. 1, l. 51, to col. 2, l. 1). "The electron donor can be . . . a silicon compound including silanes and alkoxysilanes" (*id.* at col. 4, ll. 60-64). "Examples of useful silicon compounds are diphenyldimethoxy silane, n-propyltrimethoxy silane, di-tert-butyldimethoxy silane, diphenyldiisobutoxy silane, diisobutyldimethoxy silane, and dimethyldiethoxy silane" (*id.* at col. 5, ll. 47-51). The amount of outside electron donor "is adjusted to provide stereoregularity in the

homopolymer or copolymer being produced" (*id.* at col. 5, ll. 52-56). We conclude that it would have been obvious to include a silicon compound described in Chien in the catalyst system described in Winslow to provide stereoregularity.

With regard to claim 28, Appellants argue that this claim "is allowable over Winslow et al. and Chien since neither reference . . . disclose[s] a polymerization process with two distinct polymerization steps" (Br. 13). For the reasons discussed above, we agree with the Examiner that the method described in Winslow includes the two process steps recited in claim 28. Thus, we are not persuaded by this argument.

With regard to claim 14, Appellants argue that this claim requires "that the modifier be added during the polymerization" and that "Chien does not disclose a process in which a modifier is added in this manner" (Br. 11). In particular, Appellants argue that, in Chien's Example 2, the modifier "is charged to the reactor before polymerization is initiated while in claim 14, the modifier is added . . . 'at any point during the formation of the polyolefin resin'" (*id.* at 12-13).

We are not persuaded by this argument. Chien's Example 2 states that the "polymerization is carried out as in example 1" (Chien, col. 8, ll. 40-41). Chien's Example 1 states that a reactor is charged with n-heptane, propylene is introduced into the reactor, and the components of the catalyst system are charged into the reactor (Chien, col. 8, ll. 3-10). This example does not indicate that the components of the catalyst system are added in any particular order. Thus, we agree with the Examiner that it would have been obvious to add the outside electron donor after other catalyst components.

Because the outside electron donor is not needed to begin polymerization, adding any amount of the silicon electron donor after components that are required for polymerization meets the claim limitation requiring adding the modifier "during the formation of the polyolefin resin."

Appellants also argue that the

> class of modifiers used in the present invention are more restrictive than the compounds of Chien. The silicon compounds of Chien may (or may not) have a hydrogen, ch[l]orine, bromine, or iodine directly bonded to the silicon atom. . . . The modifiers used in the present invention **cannot** contain hydrogen, chlorine, bromine and iodine. Accordingly, the present invention has identified a sub-class of silicon modifiers that are particularly useful for achieving polymer resins with simultaneously high density and high long chain branching.

(Br. 13.)

We are not persuaded by this argument. We agree with Appellants that Chien discloses a broad class of silicon compounds that can be used as its electron donor. However, as pointed out by the Examiner, Chien, at column 5, lines 47-51, describes examples of useful silicon compounds that are "within the scope of silane modifiers of [claim 14]" (Answer 9). The Examiner has set forth a prima facie case that it would have been obvious to select any one of these exemplified silicon compounds as the electron donor.

We conclude that the Examiner has set forth a prima facie case that claims 14 and 28 would have been obvious over Winslow in view of Chien, which Appellants have not rebutted. We therefore affirm the rejection of claims 14 and 28 under 35 U.S.C. § 103. Claims 15-25, 27, and 29-42 fall with claims 14 and 28.

OTHER ISSUES

In claim 34, step (iii) refers to "step (b)." It is not clear what "step (b)" is intended to refer to. Claim 34 also ends with the term "and." If prosecution of this application is continued, these potential indefiniteness issues should be resolved.

SUMMARY

The Examiner's position is supported by the preponderance of the evidence of record. We therefore affirm the rejection of claim 24 under 35 U.S.C. § 112, second paragraph; the rejection of claims 28-39, 41, and 42 under 35 U.S.C. § 102 or § 103: and the rejection of claims 14-25 and 27-42 under 35 U.S.C. § 103.

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

AFFIRMED

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