

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 15

UNITED STATES PATENT AND TRADEMARK OFFICE

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

Ex parte PETER SCHWAB and
MICHAEL SCHULZ

Appeal No. 2001-1693
Application No. 09/168,099

ON BRIEF

Before GARRIS, WALTZ, and DELMENDO, Administrative Patent Judges.

GARRIS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on an appeal from the final rejection of claims 2, 4, 5, and 7-11 and from the refusal of the examiner to allow claims 3 and 12 as amended subsequent to the final rejection. These are all of the claims remaining in the application.

The subject matter on appeal relates to a process for preparing propene by (a) reaction of 1-butene, 2-butene and isobutene to give propene, 2-pentene and 2-methyl-2 butene, (b) separation of the propene from the product mixture formed in (a) thereby leaving a mixture of 2-pentene and 2-methyl-2-butene, (c) reaction of this last mentioned mixture with ethene to give propene, 1-butene and isobutene, (d) separation

of the propene from the mixture formed in (c), and return of the remaining 1-butene and isobutene resulting from step (d) to step (a). This appealed subject matter is adequately illustrated by independent claim 2 which reads as follows:

2. A process for preparing propene by

- a) reaction of a mixture containing 1-butene, 2-butene and isobutene to give a product mixture containing propene, 2-pentene and 2-methyl-2-butene in the presence of a metathesis catalyst comprising at least one compound of a metal of transition group VIb, VIIb or VIII of the Periodic Table of the Elements,
- b) subsequent separation of the propene from the product mixture formed in a), to give as product, either a mixture of 2-pentene and 2-methyl-2-butene or a mixture of 2-pentene, 2-methyl-2-butene and small amounts of higher boiling compounds,
- c) subsequent reaction of said mixture of 2-pentene and 2-methyl-2-butene or said mixture containing 2-pentene, 2-methyl-2-butene and small amounts of higher boiling compounds from b, with ethene to give a mixture containing propene, 1-butene and isobutene, or propene, 1-butene, isobutene and butanes, in the presence of a metathesis catalyst comprising at least one compound of a metal of transition group VIb, VIIb or VIII of the Periodic Table of the Elements,
- d) subsequent separation of the propene from the mixture formed in step c,
- e) subsequent return of the mixture of 1-butene and isobutene or mixture of 1-butene, isobutene and butanes resulting from step d) to step a).

The references set forth below are relied upon by the examiner as evidence of obviousness:

Reusser et al. (Reusser)	3,915,897	Oct. 28, 1975
Hepworth et al. (Hepworth)	4,187,362	Feb. 5, 1980
Jung et al. (Jung)	4,709,115	Nov. 24, 1987
Ambler et al. (Ambler)	5,304,615	Apr. 19, 1994
Alagy et al. (Alagy)	5,321,191	Jun. 14, 1994

Kelly (European Patent Appln.)	EP 0 691 318 A1	Oct. 1, 1996
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Turner et al. (Turner)

(Great Britain)

1,054,864

Jan. 11, 1967

Kaibel, "Distillation Columns with Vertical Partitions," Chemical Eng. Technol., Vol. 10, pp. 92-98 (1987)

Claims 2-5, 7-9, 11, and 12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Reusser combined with Turner in view of Kelly alone or alternatively further in view of Kaibel; Claims 5 and 12 are additionally correspondingly rejected over these references and further in view of Hepworth, Alagy, or Ambler; and finally claim 10 is correspondingly rejected over the references applied against independent claim 2 and further in view of Jung.¹

We refer to the Brief and Reply Brief and to the Answer for a complete exposition of the opposing viewpoints expressed by the appellants and by the examiner concerning the above noted rejections.

Opinion

For the reasons which follow, each of these rejections will be sustained.

A review of the file records for this application and its parent reveals that the examiner has relied on the Turner reference for its teaching of the catalyst features recited in dependent claims 8 and 9 and has relied on the Kaibel reference for its teaching of the dividing wall distillation column feature recited in dependent claim 3. It follows that in assessing the § 103 rejection of independent claim 2 we need consider only the Reusser and Kelly references.

¹ In light of the appellants' comments regarding the grouping of the appealed claims on pages 4 and 5 of the brief, our assessment of the respective rejections before us on this appeal will include consideration of individual claims to the extent that they have been separately argued by the appellants. See 37 CFR § 1.192(c)(7)(8)(2000).

As acknowledged by the appellants on pages 6-8 of the Brief, the Reusser process corresponds to the process defined in step (a) of the independent claim on appeal, and the Kelly process corresponds to the process defined by steps (c) and (d) of this claim. Beyond this acknowledgment, however, we find that Reusser teaches separating and isolating by suitable means the products of his reaction (e.g., see lines 7-10 in column 6). Moreover, since these products include propylene (aka, propene) (e.g., see lines 3-8 in column 3; lines 6-9 in column 4; and reactions (c) and (d) in Table I), we conclude that the Reusser patent would have suggested the separation of propene from patentee's product mixture as required by step (b) of appealed claim 2.

Although Reusser fails to disclose steps (c) and (d) of the claim under review, his non-propene reaction products (e.g., again see reactions (c) and (d) of Table I) include the 2-pentene and 2-methyl-2-butene products claimed by the appellants and utilized as starting materials for reaction with ethylene in the corresponding metathesis process of Kelly to thereby produce desirable products including propylene (aka, propene), isobutene and 1-butene (e.g., see claims 1, 2, and 5, the paragraph bridging the third and fourth pages as well as lines 3-4 on the fourth page of Kelly). These circumstances lead us to conclude that an artisan with ordinary skill would have combined the processes of Reusser and Kelly so as to thereby use the non-propene reaction products of Reusser in the Kelly process in order to produce propene, isobutene, and 1-butene. Further, after recovery of propene from these last mentioned products (e.g., again see lines 3-4 on the fourth page of Kelly), it would have been obvious for the artisan to recycle the isobutene and 1-butene products to the beginning of Reusser's process since Reusser teaches using isobutene and 1-butene as starting materials in

his process (e.g., see lines 55-58 in column 6) and since Reusser teaches recycling to his reaction zone unconverted feed materials or products (e.g., see lines 11-13 in column 6). The modified process resulting from this combination of Reusser and Kelly would fully correspond to the process defined by appealed independent claim 2.

In support of their nonobviousness position, the appellants present the following argument on pages 11 and 12 of the Brief:

There are principally two reaction systems present in the claimed process. On the one hand 1-butene and isobutene is [sic] reacted to get propene and 2-methyl-2-butene, which is further reacted with ethene to result in propene and the initial isobutene, which is recycled.

In the other reaction system 1-butene is reacted with 2-butene to give propene and 2-pentene, which is further reacted with ethene to result in propene and 1-butene, which is recycled into the first reaction. The advantage of the present invention is that the combination of the two metathesis reactions produces an increased amount of propene without the need of employing an excess of ethene, see page 3, lines 8-12. Most importantly, and apparently overlooked by the examiner, is the fact that the two systems are not simple sequential processes, but they are interwoven and both occur in both reaction steps, steps a) and c).

The reaction of 2-pentene and 2-methyl-2-butene with ethene formally requires only equimolar amounts of ethene in order to obtain the product in high yield. Thus, the amount of ethene used can be kept small. The prior art does not disclose or suggest such process.

This argument is unconvincing primarily because it is predicated on features not required by the independent claim on appeal. For example, step (a) of this claim does not require the above argued features that "1-butene and isobutene is [sic] reacted to get propene and 2-methyl-2-butene" and that "1-butene is reacted with 2-butene to give propene and 2-butene." Instead, this claim step requires only the generic "reaction of a mixture containing 1-butene, 2-butene and isobutene to give a product mixture containing propene, 2-pentene and 2-methyl-2-butene." This requirement is satisfied

by reactions (c) and (d) in Table I of Reusser.² Analogously, contrary to the belief reflected by the appellants' argument, appealed independent claim 2 does not exclude "employing an excess of ethene" and does not require "only equimolar amounts of ethene." Id., at page 12.

Additionally, the appellants present the following argument on page 13 of the Brief:

Although it could be said that optimizing the yield of propylene in a metathesis reaction was generally motivated in the prior art by economic considerations, there is nothing in the references of record to provide a suggestion, or to motivate one of ordinary skill in the relevant art, to select the various aspects of the references relied on to result in an integrated process as here claimed to give exactly that desired result.

This argument also is unpersuasive. Again, it is appropriate to clarify that the independent claim under review does not contain any limitation regarding propylene yield as the appellants implicitly suggest in the argument under review. We simply disagree with the appellants' contention regarding suggestion and motivation. For the reasons previously mentioned, an artisan with ordinary skill would have been motivated to combine Reusser and Kelly in such a manner as to yield a process fully corresponding to the here claimed process.

Concerning the separate prior art rejections of claims 5, 10, and 12, these rejections have not been contested by the appellants with any reasonable specificity (e.g., see page 15 of the Brief). That is, the appellants do not argue that the particular

² More specifically, reaction (c) combines 2-butene with 1-butene to yield 2-pentene and propene (which corresponds to the appellants' second argued reaction system), and reaction (d) combines isobutene with 2-butene (which is distinguishable from the 1-butene of the appellants' first argued but not claimed reaction system) to yield 2-methyl-2-butene and propene.

features recited in these claims distinguish patentably over the applied prior art. On the contrary, the appellants, at least implicitly, concede that these features were known in the prior art. In essence, therefore, the only arguments presented by the appellants with respect to these claims are those arguments regarding independent claim 2 which were discussed above and found to be unconvincing.

Finally, it is appropriate to clarify the appellants' apparent impression (e.g., see the paragraph bridging pages 15 and 16 of the Brief) that the Jung reference was applied against dependent claim 3. It was not. Instead, the Kaibel reference was applied against claim 3 (e.g., see pages 6 and 7 of the Answer), and we agree with the examiner's conclusion that this reference would have suggested using the dividing wall distillation column disclosed therein for effecting Reusser's desiderata of separating and isolating his products by fractionation (e.g., see lines 8-10 in column 6 of Reusser).

In light of the foregoing, we will sustain each of the § 103 rejections before us on this appeal.

The decision of the examiner 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

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Bradley R. Garris)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
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Appeal No. 2001-1693
Application No. 09/168,099

Page 9

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