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Datasheet for the decision of 11 December 2012

Case Number: T 1065/09 - 3.3.03

Application Number: 05105047.4

Publication Number: 1605007

IPC: C08G 61/12, H01L 51/30

Language of the proceedings: EN

Title of invention:
Processes to prepare oligomeric thiophene compounds

Patentee:
Xerox Corporation

Opponent:
Bayer Technology Services GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 123(2)

Keyword:
"Novelty - (no) - (main request, first, second, third auxiliary requests)"
"Amendments - added subject-matter - (yes) - (fourth, fifth, sixth auxiliary requests)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1065/09 - 3.3.03

D E C I S I O N
of the Technical Board of Appeal 3.3.03
of 11 December 2012

Appellant: (Patent Proprietor)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office, dated 18 February 2009 and posted 10 March 2009 revoking European patent No. 1605007 pursuant to Article 101(3)(b) EPC.

Composition of the Board:

Chairwoman: B. ter Laan
Members: M. C. Gordon
C. Vallet

Summary of Facts and Submissions

I. The appeal by the patent proprietor lies from the decision of the opposition division announced on 18 February 2009 and posted on 10 March 2009 revoking European patent number EP-B1-1 605 007 (granted on European patent application number 05105047.4.)

II. The patent was granted with a set of 10 claims, claim 1 reading as follows:

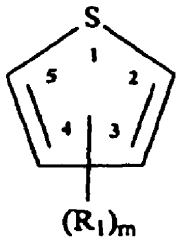
"A process comprising:

subjecting a reaction mixture comprising a reaction medium, a coupling agent, and a precursor to a coupling temperature to preferentially form a desired small molecular thiophene compound in a single-step synthesis,

wherein the precursor consists of:

(i) an optional divalent linkage, and

(ii) a plurality of thiophene units, each thiophene unit being represented by structure (A)



(A)

wherein each thiophene unit is bonded at either or both of the second ring position and the fifth ring position,

wherein m is 0, 1 or 2,

wherein each thiophene unit is the same or different from each other in terms of substituent number, substituent identity, and substituent position,

wherein each R_1 is independently selected from the group consisting of:

(a) a hydrocarbon group,

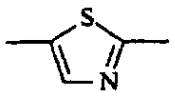
(b) a heteroatom containing group, and

(c) a halogen, and

wherein the optional divalent linkage is selected from the group consisting of

-CH=CH- (1)

-C≡C- (2)



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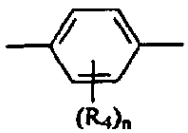


(4)

$-CH_2-$ (5)

-O- (6)

wherein n is 0, 1, 2, 3, or 4, and the substituents of R_4 are the same or different from each other within each divalent linkage and among different divalent linkages, R_4 may be a hydrocarbon group, a heteroatom containing group, and a halogen; and

wherein the small molecular compound is a compound having a specific number, not an average number of thiophene units."

Claims 2-10 were dependent process claims whereby claim 4 specified that the desired small molecular thiophene compound was preferably formed in an amount ranging from about 30% to about 90% by weight.

III. A notice of opposition against the patent was filed on 22 January 2008 in which revocation of the patent on the grounds of Art. 100(a) EPC (lack of novelty, lack of inventive step) and Art. 100(b) EPC (insufficiency of disclosure) was requested.

The following documents were, *inter alia*, cited in support of the opposition:

D2: EP-A-1 329 475

D4: Barbarella, G. *et al*, J. Org. Chem. 1996, 61, 8285-8292

D6: Bäuerle, P. *et al,* J. Chem. Soc. Perkin Trans 2 1993, 489-494.

IV. The decision of the opposition division was based on the claims of the patent as granted as the main request and six sets of claims as auxiliary requests.

The decision held that the patent met the requirements of Art. 83 EPC.

The main request, first, second, third and fourth auxiliary requests however were found not to meet the requirements of Art. 54 EPC. *Inter alia* the opposition division held that a process had to be characterised by the process steps, the process parameters and the compounds used during the process. A process could not be characterised by the end product since the end product should be the inevitable result of the technical features describing the process. Consequently features relating to the properties of the product, i.e. "to preferentially form a desired small molecular thiophene compound" and "wherein the small molecular compound is a compound having a specific number, not an

average number of thiophene units" could not serve to characterise the process. Specifically, the subject-matter of claim 1 of the main request and of the first, second and third auxiliary requests was anticipated by the disclosure of D4 and of the example of D2, Table 1. D2 disclosed a monodisperse polythiophene having a Mw of 3890 and a Mn of 3880. In view of the precursor employed, having molecular weight 641, the resulting molecular weight corresponded to a number of repeating units of 6.

The subject-matter of claim 1 of the fourth auxiliary request was anticipated by the disclosure of D4.

The first, third and fifth auxiliary requests furthermore did not meet the requirements of Art. 123(2) EPC.

With respect to the fifth auxiliary request the opposition division held that the amendment whereby the divalent linkage of the precursor was rendered mandatory whereas previously this had only been optional resulted in contravention of Art. 123(2) EPC.

The sixth auxiliary request did not meet the requirements of Art. 56 EPC. Compared to closest prior art D4 which concerned the same problem of providing a process for making oligomeric thiophene compounds having a distinct number of thiophene units, the selection of the specified (structurally different) precursor compounds was obvious. The compounds claimed were known in the art as demonstrated for example by the disclosure of D6. The underlying mechanism of the

oxidative coupling reaction employed was likewise well known in organic chemistry.

Accordingly the patent was revoked.

V. On 12 May 2009 the patent proprietor lodged an appeal against the decision, the prescribed fee being paid on the same date.

The statement of grounds of appeal was filed on 20 July 2009 and was accompanied by six sets of claims forming first to sixth auxiliary requests. The main request was for maintenance of the patent in the form as granted.

The first auxiliary request consisted of 10 claims, whereby claim 1 differed from claim 1 of the patent as granted in that the following phrase was inserted at the end of the claim:
"...; and
wherein the small molecular compound has a specific number of thiophene units of structure (A) ranging from 4 to 25".

Claims 2-10 corresponded to claims 2-10 of the patent as granted.

The second auxiliary request consisted of 8 claims. Claim 1 differed from claim 1 as granted by the insertion after the phrase "…thiophene compound in a single-step synthesis" of:
"wherein the reaction medium is tetrahydrofuran, toluene, chloroform, dichloromethane, chlorobenzene, 1,2-dichloroethane, xylene, heptane, mesitylene,

nitrobenzene, acetonitrile or cyanobenzene, or a mixture thereof,
wherein the coupling agent is $FeCl_3$, $RuCl_3$, $MoCl_5$ or a mixture thereof;
wherein the coupling temperature ranges from 23 to 150°C".

The third auxiliary request also consisted of 8 claims and differed from the second auxiliary request by specifying in claim 1 the number of thiophene units in the small molecular compound as noted for the first auxiliary request.

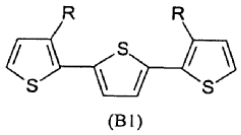
The fourth auxiliary request consisted of 8 claims. Claim 1 thereof differed from claim 1 of the main request in that according to section (i) of the claim the precursor was specified as containing an "optimal divalent linkage" rather than an "optional divalent linkage". Furthermore, the following two phrases were added at the end of claim 1:
" wherein the desired small molecular thiophene compound is preferentially formed in an amount ranging from about 30% to about 90% by weight;
wherein precipitation in the reaction mixture spontaneously occurs and the precipitate includes the desired small molecular thiophene compound."

The fifth auxiliary request consisted of 8 claims and corresponded to the second auxiliary request with the difference that in claim 1 the divalent linkage was not specified as being optional, i.e. feature (i) of claim 1 read as follows:
"(i) a divalent linkage, and"

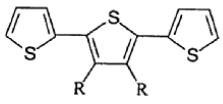
The sixth auxiliary request consisted of six claims. Claim 1 differed from claim 1 of the main request by specifying that the precursor was selected from a specific group of generically defined structures and in defining the coupling agent. Thus claim 1 of the 6th auxiliary request read as follows:

"A process comprising
subjecting a reaction mixture comprising a reaction medium, a coupling agent, and a precursor to a coupling temperature to preferentially form a desired small molecular thiophene compound in a single-step synthesis,

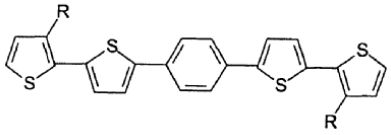
wherein the precursor is selected from the group consisting of:



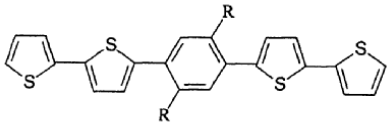
(B1)



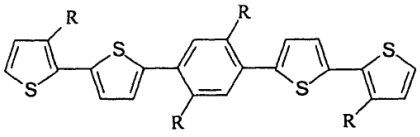
(B2)



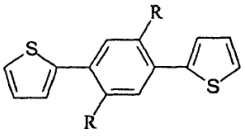
(B4)



(B5)



(B6)



(B7)

or a mixture thereof,

wherein each R is independently selected from the hydrocarbon group, the heteroatom containing group, and the halogen, and

wherein the coupling agent is $FeCl_3$, $RuCl_3$, $MoCl_5$ or a mixture thereof,

wherein the small molecular compound is a compound having a specific number, not an average number of thiophene units."

VI. The opponent - now the respondent - replied with a letter dated 4 December 2009.

VII. On 18 July 2012 the Board issued a summons to attend oral proceedings, which were rescheduled by communication of 31 July 2012. In a communication dated 6 August 2012 the Board set out its preliminary assessment of the case. The Board took the position that the desired properties of the resulting compounds could not serve as restrictions on the process but represented merely desiderata. The consequence was that claim 1 of the main request reduced to the following:
"A process.
Reaction mixture of any medium, any coupling agent and a precursor (at least dithiophene compound with linkage at 2 and/or 5 positions and optionally a substituent R) to react at any temperature".

VIII. Oral proceedings were held before the Board on 11 December 2012.

IX. The arguments of the appellant can be summarised as follows:

(a) *Main request*

The properties of the compound to be synthesized represented technical features defining the claimed process. A process was characterised not only by the starting materials employed but also by the obtained product. The product was a technical feature of the process which could be relied upon to distinguish the process from prior art processes. The position taken by the opposition division in this respect was incorrect and was also not in line with established case law of the boards of appeal.

In interpreting the terms employed in a claim and assessing the relationship of the claimed subject-matter to the prior art it was permissible to rely on the description, as was confirmed by a number of decisions of the Boards of Appeal, reference being made *inter alia* to section II.B.4.3 of the publication "Case Law of the Boards of Appeal of the European Patent Office", 4th Edition.
The preferential formation of the desired small molecular thiophene compound in a single step synthesis as specified in claim 1 was an important feature defining the process of the invention and had to be taken into account when comparing the claimed subject-matter with the prior art. Such preferential formation in a single step process furthermore represented an important improvement

over the prior art, and was neither disclosed nor derivable therefrom in an obvious manner.

Accordingly the interpretation of the claim applied by the Board in its preliminary opinion was not appropriate.

Claim 1 of the main request was novel over the disclosure of the prior art. In particular D2 related to a product having an average molecular weight. In contrast the claimed process was directed to the synthesis of a low molecular weight compound having a well defined molecular weight whereby each molecule in the obtained oligomer was identical in all respects.
The claimed process was furthermore not obvious in the light of any of the cited prior art documents.

(b) *First auxiliary request*

The specified number of thiophene units (4-25) was disclosed at page 18 line 25 of the original description. The specified range provided a further distinction over the prior art since none of the cited documents disclosed a process wherein in a single step synthesis a well defined thiophene compound having the specified number of repeating units was obtained.

(c) *Second auxiliary request*

Claim 1 was based on original claims 1, 5 and 6. The specified coupling temperature was disclosed in paragraph [0096] and the coupling agent in

paragraph [0099] of the application as filed. It was permissible to take this particular combination of features from the original disclosure as it involved no selection but constituted simply a combination of clearly defined sets of features from the description, even if the particular combination as such was not derivable from the structure of the claims as originally filed. Similarly to the main request, none of the cited documents disclosed such a process or rendered such process obvious.

(d) *Third auxiliary request*

The arguments submitted for the main and second auxiliary requests applied.

(e) *Fourth auxiliary request*

Claim 1 corresponded to a combination of claims 1, 4 and 9 as granted. The subject-matter of this request was derivable from the general disclosure of the description. Regarding novelty and inventive step the arguments submitted in respect of the earlier requests applied.

(f) *Fifth auxiliary request*

The definition of the divalent linkage as mandatory constituted a restriction to a feature already contained in original claim 1 and disclosed as a preferred feature. Such a restriction did not contravene the requirements of Art 123(2) EPC. Regarding novelty and inventive

step the arguments submitted in respect of the earlier requests applied.

(g) *Sixth auxiliary request*

Claim 1 was based on original claim 8 and the list in paragraphs [0055] and [0057] of the original application. The only difference was the deletion of structure B3. The resulting combination of features was an allowable restriction of the subject-matter of the application as filed as it constituted simply a combination of preferred features but did not result in any new subject-matter. Otherwise the arguments submitted for the earlier requests applied.

X. The arguments of the respondent can be summarised as follows.

(a) *Main request*

A process could not be defined by the properties of the resulting product. The appellant had failed to cite any case law in support of its position in this respect. The subject-matter of claim 1 was anticipated by the disclosures of D2, D4 and D6, particular reference being made to Table 1 of D2. D2 and D4 both disclosed single step reactions leading to single products.

(b) *First auxiliary request*

The subject-matter of the first auxiliary request was not new for the same reason as the main request.

(c) *Second auxiliary request.*

The specified combination of features of the second auxiliary request was not disclosed in the application as filed. The amendments made did not constitute a reduction of scope but represented a non-disclosed combination meaning that the requirements of Art 123(2) EPC were not satisfied.

(d) *Third auxiliary request*

The arguments for the first auxiliary request applied.

(e) *Fourth auxiliary request*

The fourth auxiliary request related to an undisclosed combination of features. It was not permissible to combine claims 1, 4 and 9. Claims 4 and 9 were each independently dependent on claim 1. The combination of their subject-matter constituted matter extending beyond the content of the application as filed.

(f) *Fifth and sixth auxiliary requests*

The subject-matter of the fifth and sixth auxiliary requests constituted non-disclosed selections.

XI. The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims as granted or alternatively that the patent be maintained on the basis of one of the first to sixth auxiliary requests filed with the statement of grounds of appeal.

XII. The respondent (opponent) requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. Novelty

2.1 Claim 1 of the main request is directed to a process involving a reaction mixture of a reaction medium, a coupling agent and a precursor, which are subjected to a coupling temperature "to preferentially form" a "desired small molecular thiophene compound in a single-step synthesis". According to the final phrase of the claim the "small molecular compound" has a "specific number, not an average number of thiophene units".

2.1.1 The features

- "desired small molecular thiophene compound" and
- "specific number, not an average number of thiophene units"

to the extent that they provide any unambiguous technical meaning, set out the intended outcome of the process but do not constitute technical features of the process itself.

2.1.2 The precursor is defined as having, *inter alia*, an "optional divalent linkage". The restriction which this term imposes on the claimed subject-matter is ambiguous, since it is not known what an "optional" linkage - regardless of the valency thereof - is. The description does not provide any explanation of this term either.

2.1.3 Further the wording "to preferentially form" does not provide any clear definition of the subject-matter claimed since it is not apparent which technical feature(s) are meant thereby.

2.1.4 There is no basis in the EPC or the case law of the Boards for definition or characterisation of a process by its products, as petitioned by the appellant. On the contrary, by analogy and corollary with the well established case law on so-called "product-by-process" claims, it is the features of the process, i.e. starting materials, process steps and conditions that define the process, the resulting product being the inevitable outcome of the specified steps.

2.1.5 The appellant did not cite any decision in support of its contention that the case law supported its position that a process could be defined by its products.

Therefore it is not clear how the properties or features of the product can constitute a meaningful definition of the claimed process.

2.2 D2 relates according to claim 1 to an electronic device containing a polythiophene of defined (generic) formula. The first example of Table 1 D2 discloses the preparation of such a polythiophene by reaction of 5,5'-bis(3-dodecyl-2-thienyl)-2,2'-dithiophene in chloroform with $FeCl_3$, followed by heating at 25°C for 24 hours and then precipitation from methanol. The resulting product has a Mw of 3890 and a Mn of 3880.

The starting material falls within the definition of the precursor specified in operative claim 1. The process of D2 also involves a reaction medium, i.e. chloroform, and a coupling agent ($FeCl_3$). The process is carried out at a temperature at which coupling occurs, i.e. a coupling temperature. Therefore the process reported in example of D2, Table 1 first entry exhibits all the features of the process of claim 1 of the main request. If the product of D2 is different from that resulting from the process of operative claim 1, the differences in the process steps necessary to arrive at such a difference in the product are not apparent from present claim 1. As a consequence the subject-matter of claim 1 is not novel (Art. 54 EPC).

The main request is therefore refused.

First auxiliary request

3. Novelty

The first auxiliary request differs from the main request in the definition of the molecular weight of the product. The definition of the process is however identical to that in the main request. The subject-matter of the first auxiliary request is therefore not novel for the same reasons as indicated for the main request (Art. 54 EPC).

The first auxiliary request is therefore refused.

Second auxiliary request

4. Novelty

Apart from doubts whether the specific combination of features of claim 1 of the second auxiliary request meets the requirements of Art. 123(2) EPC, the subject-matter of claim 1 of the second auxiliary request is in any case not novel.

In the example of D2, referred to in respect of the main request, a reaction medium (chloroform), a coupling agent ($FeCl_3$) and a coupling temperature (25°C) are employed that are all within the ranges specified for claim 1 of the second auxiliary request. Consequently the features introduced compared to the main request do not provide any distinction over the disclosure of D2 with the consequence that the subject-

matter of claim 1 of the second auxiliary request is also not novel.

The second auxiliary request is therefore refused.

Third auxiliary request

5. Novelty

Claim 1 of the third auxiliary request corresponds to a combination of claim 1 of the first and second auxiliary requests. The introduction of the number of repeating units is, as noted for the main request, not a feature relating to the process.

Consequently claim 1 of the third auxiliary request lacks novelty for the same reasons as given for the first and second auxiliary requests.

The third auxiliary request is therefore refused.

Fourth auxiliary request

6. Art. 123(2) EPC

Claim 1 of the fourth auxiliary request differs from claim 1 of the main request in specifying that the desired small molecular thiophene compound is preferentially formed in an amount of about 30% to about 90% by weight, that precipitation in the reaction mixture spontaneously occurs and that the precipitate contains the desired compound.

A further difference compared to the earlier requests is that the precursor is specified to contain an "optimal" divalent linkage rather than an "optional" divalent linkage. This final difference, which was not commented on by either party, appears to be in the nature of a typographical error. Consequently the Board does not intend to consider this matter further.

The first of the amendments (amount in which the small molecular thiophene compound is formed) is disclosed in originally filed claim 4.

The feature relating to precipitation is disclosed in original claim 9. However as original claim 9 was independent and hence was not dependent on claim 1 the structure of the claims does not provide a basis for the combination of features constituting the amendment.

The description also does not provide any basis for the claimed combination of features. In paragraph [0092] of the application as filed it is disclosed that the desired small molecular thiophene compound is **present** in an amount ranging from about 30% to 90% by weight **of the reaction mixture**, which is not identical to stating that it is **formed** in such amount and consequently does not correspond to what is now required by the claim.

In paragraph [0093] the possibility of spontaneous precipitation is discussed.

In paragraph [0094] it is disclosed that precipitation may spontaneously occur whereby, according to the final sentence of the paragraph, "Of all molecules **of the desired small thiophene compound in the reaction**

mixture, all or a portion thereof may precipitate, such as from about 30-100% by weight." (Board's emphasis). There is no feature corresponding to this disclosure in operative claim 1. Furthermore the property to which this range disclosed in paragraph [0094] relates is different to that given in paragraph [0092] of the original application. Paragraph [0094] specifies the proportion of the compound that is present which precipitates, without imposing any restriction on the amount of the compound that is present in the reaction mixture, i.e. is independent from the ranges given either in paragraph [0092] or in original claim 4.

Consequently the subject-matter of claim 1 of the fourth auxiliary request constitutes a combination of features that is not disclosed as such in the application as filed.

The subject-matter of claim 1 of the fourth auxiliary request therefore does not meet the requirements of Art. 123(2) EPC and has to be refused.

Fifth auxiliary request

7. The fifth auxiliary request corresponds to the second auxiliary request with the difference that the divalent linkage is mandatory, i.e. the wording "an optional" has been deleted.

Compared to the main request, claim 1 of the fifth auxiliary request specifies the reaction medium, the coupling agent, the coupling temperature and the mandatory presence of the linkage, i.e. three selections. The features of the reaction medium and the

coupling agent are disclosed in the application as originally filed in claims 5 and 6, each of which is individually dependent on claim 1. The reaction medium and coupling agent are further disclosed as possible embodiments in paragraphs [0098] and [0099] of the application as filed. The coupling temperature is disclosed at paragraph [0096] as a possible embodiment.

The feature that the linkage is mandatorily present amounts a further selection compared to the disclosure of the application as originally filed.

However the particular combination of embodiments as claimed is not itself directly and unambiguously disclosed in the application as originally filed. There is furthermore no other disclosure in the application as originally filed that can provide a basis, even implicit, for the particular combination as claimed.

The fifth auxiliary request therefore defines a nondisclosed combination of features and consequently does not meet the requirements of Art. 123(2) EPC.

The fifth auxiliary request is refused.

Sixth auxiliary request

8. The sixth auxiliary request specifies that the precursor is selected from a defined group of six members designated B1, B2, B4, B5, B6, and B7. Original claim 8 disclosed seven precursors B1-B7. The same disclosure is to be found on pages 5 and 6 (section numbered "(12)") and in paragraphs [0055]-[0057] of the originally filed application. The precursor B3 has been

eliminated from the list of precursors specified in operative claim 1. There is no statement in the originally filed description or claims which discloses the resulting set of the precursors, i.e. without B3.

Claim 1 of the sixth auxiliary request further defines that the coupling agent is selected from a closed group, which subject-matter was originally disclosed in claim 6, as well as on page 9, section numbered "(21)" and in paragraph [0099] of the application as filed.

The subject-matter of claim 1 therefore represents a combination of the subject-matter of original claims 1, part of the subject-matter of original claim 8 and the subject-matter of original claim 6, or the corresponding passages of the description.

Consequently with respect to the claims and the description as originally filed, the subject-matter of claim 1 of the sixth auxiliary request is the result of a plurality of selections. Claims 6 and 8 were each, independently dependent on claim 1. However their subject-matters in combination were not disclosed by the structure of the claims, or by the corresponding parts of the description.

There is therefore no basis in the application as filed for the combination of the subject-matter of claims 1, 6 and 8, and correspondingly no basis for a further restriction resulting from a selection within the subject-matter derivable from such combination of the claims.

Consequently the subject-matter of the sixth auxiliary request does not meet the requirements of Art 123(2) EPC and has to be refused.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar The Chairman

A. Counillon B. ter Laan