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**Datasheet for the decision
of 22 November 2023**

Case Number: T 1660/22 - 3.3.05
Application Number: 14828653.7
Publication Number: 3024779
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C07C303/04, H01G11/58,
H01M10/052, H01G11/06
Language of the proceedings: EN

Title of invention:
SYNTHESIS OF HYDROGEN BIS (FLUOROSULFONYL) IMIDE

Patent Proprietor:
SES Holdings Pte. Ltd

Opponents:
Cabinet NONY
Strawman Limited

Headword:
SYNTHESIS OF HYDROGEN BIS (FLUOROSULFONYL) IMIDE/SES

Relevant legal provisions:
EPC Art. 100(c), 100(b), 123(2), 83, 54, 56
RPBA Art. 13(2)

Keyword:

Decisions cited:

G 0002/10

Catchword:



Beschwerdekammern

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Case Number: T 1660/22 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 22 November 2023

Appellant:
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Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office posted on 27 May 2022
rejecting the opposition filed against European
patent No. 3024779 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chair R. Winkelhofer
Members: J. Roider
 G. Glod

Summary of Facts and Submissions

I. The appeal from opponent 1 (appellant) lies from the decision of the opposition division to reject the two oppositions against European patent EP 3 024 779.

II. The following documents were cited by the parties:

D1/D1a CN 101654229 A / English machine translation

D2 CA 2 527 802 A1

D3 US 7,919,629 B2

D6 *Test of fluorination reaction according to patent EP'779, filed by the appellant on 14 April 2020*

D6a *Test of fluorination reaction according to patent EP'779, filed by the appellant on 8 November 2021*

D6b *Test of fluorination reaction according to patent EP'779, filed by the appellant on 26 September 2022*

III. Claim 1 of the main request in the appeal proceedings, i.e. the claim as granted, reads as follows:

"A method for producing a high yield of hydrogen bis(fluorosulfonyl)imide (HFSI) from hydrogen bis(halosulfonyl)imide (HXSI) using hydrogen fluoride, said method comprising reacting HXSI with HF under HF refluxing conditions that selectively remove HX that is produced in the reaction and that produce HFSI in at least 80% yield, wherein each X is independently Cl, Br, or I."

IV. With respect to the main request, the auxiliary requests 1-4 were *inter alia* amended as follows:

The subject-matter of claim 1 of auxiliary requests 1

and 2 was amended to add the following feature at the end:

" , wherein the HX is removed by simple distillation or evaporation".

The subject-matter of claim 1 of auxiliary requests 3 and 4 was amended to add the following feature at the end:

" , wherein refluxing conditions are those that allow condensing back the HF into the reaction mixture by using a condenser at an appropriate temperature.".

V. The subject-matter of claim 1 of auxiliary request 5 reads:

"A method for producing a high yield of hydrogen bis(fluorosulfonyl)imide (HFSI) from hydrogen bis(halosulfonyl)imide (HXSI) using hydrogen fluoride, said method comprising reacting HXSI with HF under HF refluxing conditions that selectively remove HX that is produced in the reaction and that produce HFSI in at least 80% yield, wherein each X is independently Cl, Br, or I, wherein refluxing conditions are those that allow condensing back the HF into the reaction mixture by using a condenser at an appropriate temperature; and wherein the reaction is carried out without catalyst.".

Claims 2-9 of auxiliary request 5 are dependent claims which relate to particular embodiments of claim 1.

VI. All the auxiliary requests (7 in total) were filed during the opposition proceedings, and were re-submitted with the reply to the appeal.

VII. The key arguments of the appellant (opponent 1) can be summarised as follows:

Article 100(b) EPC

D6 disclosed an autoclave equipped with a reflux condenser, the pressure being controlled via a valve at 10 bar and HCl being vented. D6 was a reproduction of the claimed process but it did not achieve the claimed yield, which showed that the patent was insufficiently disclosed.

Article 100(c) EPC

The combination of the features to "*selectively remove HX*" and "*under HF refluxing conditions*" contained in claim 1 was not originally disclosed. The removal of HX was not necessarily linked to refluxing conditions of HF. Paragraph [0017] also required that the reaction be carried out at atmospheric pressure.

Article 100(a) EPC / Article 56 EPC

If the system in example 1 was hermetically sealed, the amount of HF added raised the pressure in the equipment to 70 bar. In a laboratory, the skilled person would not carry out an experiment under this high a pressure because of its obvious danger in such an environment. Operation at atmospheric pressure was thus implied.

- VIII. The key arguments of the patent proprietor (respondent) can be summarised as follows:

Article 100(b) EPC

The patent in suit provided a number of examples. The fact that the claimed yield was not achieved in D6 showed only that the process in D6 was not covered by the subject-matter of claim 1. It did not demonstrate that the patent was insufficiently disclosed.

Article 100(c) EPC

Paragraph [0017] of the application as filed provided a basis for the amendments. Said paragraph mentioned the boiling point of HF at atmospheric pressure, but did not imply that the method was carried out at atmospheric pressure.

Article 100(a) EPC / Article 56 EPC

The patent provided a safe, simple and efficient process for producing hydrogen bis(fluorosulfonyl)imide (HFSI) from bis(halosulfonyl)imide and hydrogen fluoride (HF) in at least 80% yield.

The method was carried out in an open system, which was an essential feature.

The system in D1, example 1 could not work as an open system because, in view of the amount of HF added, the pressure had to be significantly higher than in D6 (8 bar). This was incompatible with an open system. Le Chatelier's Principle could not be implemented at elevated pressures.

In D1, example 1, all the hydrogen chloride (HCl) was removed only at the end of the experiment. The term "excessive" related to HF only, and not to HCl.

D1 only made reference to prior art document D2 with respect to temperature. It followed that the pressure was considered to be identical as in the autoclave of D2.

D3 disclosed in column 1 that the efforts to develop a direct synthesis failed, despite intensive collaboration between academic and industrial experts, and was eventually abandoned. The patent addressed a long felt need.

- IX. Opponent 2 (party as of right) did not file any observations.
- X. Requests with regard to substance:
- (a) The appellant requests that the decision under appeal be set aside and amended such that the patent be revoked.
 - (b) The respondent requests that the appeal be dismissed or that the patent be maintained on the basis of auxiliary requests 1 to 7, resubmitted with the reply to the appeal.

Reasons for the Decision

1. Main request
- 1.1 Sufficiency of disclosure, Article 100(b) EPC and Article 83 EPC

The patent in suit is directed to a manufacturing method for hydrogen bis(fluorosulfonyl)imide (HFSI) by reacting hydrogen bis(halosulfonyl)imide (HXSI) with hydrogen fluoride (HF). This reaction also produces hydrogen halide (HX).

According to the patent in suit, HX is removed from the reaction system. In line with Le Chatelier's Principle, removing HX from the reaction system allows the reaction to be shifted to the product side, such that the production of HFSI is enhanced (see paragraphs [0018] and [0030]).

The appellant alleged that in view of D6/D6a/D6b, they could not reproduce the claimed yield by removing HX.

Notwithstanding the admittance and consideration of D6a and D6b, D6/D6a/D6b are all incapable of showing that the subject matter in suit is insufficiently disclosed.

As is apparent from example 1 of the patent in suit, if the reaction temperature is too low, the reaction is negligible. Choosing the right reflux conditions is not sufficient to achieve the desired yield. The claimed yield contained in the subject-matter of claim 1 is thus a result to be achieved, as it implies that all the process conditions, not only those mentioned in the claim, have to be chosen such that the desired result is obtained.

However, the patent in suit discloses a number of examples, including details of the process parameters. In these examples, a high yield was obtained by removing HX after the reaction of HF and HXSI to HFSI and HX. They show how Le Chatelier's Principle can be exploited to shift the reaction to the HFSI side.

It is possible to select reaction conditions, e.g. temperatures, pressures and reaction times, which do not deliver the claimed yield. However, the skilled person is aware of such limits of chemical reactions. D6/D6a/D6b relate to a test carried out by the appellant. It starts with a pressure of 10 bar, which is substantially higher than the pressure used in the examples of the patent in suit. It also uses a considerably shorter reaction time. If such a test fails, it cannot be concluded that the skilled person is deprived of the promise of an invention. The skilled person would instead choose conditions similar to those of the examples.

The fact that the desired yield is not achieved for the

very specific set-up in D6/D6a/D6b does not demonstrate that the patent was insufficiently disclosed.

1.2 Amendments, Article 100(c) EPC and Article 123(2) EPC

Paragraph [0017] of the application as filed describes the method for separating HCl, HBr or HI under refluxing conditions of HF. The structural means mentioned in this paragraph, a cool condenser, is one option for implementing the method ("*can be used*"). The disclosed method is not limited to atmospheric pressure. The mention of the boiling point of HF at atmospheric pressure does not imply that the method must be carried out at atmospheric pressure.

Therefore, the subject-matter of claim 1 is directly and unambiguously derivable from the application as originally filed.

1.3 Novelty, Article 100(a) and Article 54(1) and (2) EPC

The appellant argued that D1, examples 1-4, 11, 12, 26 and 27 anticipated the novelty of claim 1.

They all yield 80% or more HFSl.

Examples 1-4, 11, 12 of D1 disclose an autoclave equipped with a reflux condenser.

It is disputed whether or not an autoclave necessarily implies a closed system.

While an autoclave as such can be considered a closed system, this is not necessarily the case for a modified autoclave, e.g. one equipped with a reflux condenser. However, the mere fact that an autoclave is equipped with a reflux condenser does not mean that the removal

of HX is implied. A reflux condenser can be used for a number of purposes.

The removal of volatile compounds with a higher boiling point than other components is just one possible use. Since D1 discloses neither the purpose of the reflux condenser nor details of its operation, the removal of HX is not disclosed.

Examples 26 and 27 disclose producing potassium bis(fluorosulfonyl)imide (KFSI) at a yield of 89% and 87% respectively. This is achieved by way of a Lewis base-HF complex. As is apparent from the reaction scheme in example 21, HFSI is not produced.

Thus, D1 does not directly and unambiguously disclose the subject-matter of claim 1.

- 1.4 Inventive step, Article 100(a) and Article 56 EPC
 - 1.4.1 As outlined above, the patent in suit is directed to a method for producing a high yield of hydrogen bis(fluorosulfonyl)imide (HFSI) by reacting hydrogen bis(halosulfonyl)imide (HXSI) with hydrogen fluoride (HF).
 - 1.4.2 D1, cited by the appellant, is also directed to a manufacturing method for hydrogen bis(fluorosulfonyl)imide (HFSI) by reacting hydrogen bis(halosulfonyl)imide (HXSI) with hydrogen fluoride (HF). It is a suitable starting point for an inventive-step objection.
 - 1.4.3 The respondent argued that the aim of the patent was to provide a safe and simple process for producing hydrogen bis(fluorosulfonyl)imide (HFSI) from

bis(halosulfonyl)imide and hydrogen fluoride in at least 80% yield. It was also more efficient, as was apparent from the reaction times.

However, claim 1 is open-ended with respect to pressure, temperature and the use of a toxic and corrosive catalyst.

A safe and simple process is thus not implied by the features contained in claim 1.

D1 also aims to avoid harsh reaction conditions, such as high temperatures (page 4, line 34 of the English translation). It also portrays high pressures as undesirable (page 2, lines 18-19 of the English translation).

Example 1 in D1 uses an even lower reaction temperature than the examples contained in the patent in suit. D1 thus also discloses a safe process by the standards of the patent in suit (see paragraphs [0004] to [0008]). It is not apparent that the claimed process was safer and simpler.

The process conditions used in the examples of the patent, such as the catalysts and the temperature, are different from those used in Example 1 of D1. The use of a different catalyst or a higher reaction temperature may increase the reaction speed of the chemical reaction under consideration in comparison with example 1 of D1. It is thus not possible to compare the efficiency of the processes in D1 and the patent in suit.

The yield achieved in D1 exceeds 80%. Achieving a yet higher yield cannot distinguish the subject-matter of claim 1 from D1.

Therefore, the problem as stated by the respondent is not solved by the features contained in claim 1. It must hence be reformulated to a less ambitious problem, which is that of providing an alternative process.

1.5 Example 1 of D1 discloses manufacturing HFSI by reacting HCSI with HF in the presence of a catalyst. The reaction is carried out in a PTFE-lined autoclave with a reflux condenser.

However, D1, example 1 is ambiguous as to how the reflux condenser was used.

The respondent was of the opinion that, as a further difference, D1, example 1 disclosed a method carried out at elevated pressure.

However, the subject-matter of claim 1 neither explicitly nor implicitly restricts the pressure of the method. The mere fact that HX, which are volatile substances, are separated under refluxing conditions, does not imply that the system for carrying out the method was open to atmospheric pressure. Refluxing conditions that selectively remove a non-condensable gas can also be implemented at elevated pressures. There is, moreover, no doubt that the skilled person is also able to selectively remove HX that is produced in the method at elevated pressures.

D6, for illustration, shows one possibility for eliminating HX from the system while carrying out the method at elevated pressures. It provides a pressure relief valve for that purpose, i.e. a pressure valve which opens automatically at a certain pressure (see lines 9-11).

Contrary to the respondent's opinion, a method exploiting Le Chatelier's Principle can thus also be implemented at higher pressures.

With respect to pressure, the subject-matter of claim 1 cannot be distinguished from D1, irrespective of the operating pressure in D1, example 1.

The respondent's reference to the pressure disclosed in D2 is not pertinent. It is moreover established jurisprudence that it is not permissible to combine separate items of prior art together when assessing the direct and unambiguous disclosure of one of them (Case Law of the Boards of Appeal, 10th ed., I.C.4.2). The disclosure of D1 cannot therefore be restricted by reference to D2.

The boiling temperature of HF (19.5°C) is above the operating temperature of the reflux condenser (-20°C) in D1, example 1, while the boiling temperature of HCl (-85,05°C) is below.

The skilled person is familiar with Le Chatelier's Principle. In view of the yield achieved in D1, example 1, the skilled person would immediately also consider the possibility of removing some of the gaseous reaction product, HCl, via the reflux condenser and of removing the excess of HCl by stripping with nitrogen.

Starting from D1, the skilled person would, when considering an alternative process, immediately recognise that HF could be refluxed while HCl could be removed, thereby arriving at the subject-matter of claim 1 in an obvious, non-inventive way.

It is acknowledged that the term "excessive" in D1, example 1 could relate to HF only. However, the

interpretation that it relates to both HF and HCl is equally valid. The skilled person would thus merely recognise yet another process disclosed in D1. When tasked with providing an alternative process, the skilled person would nonetheless consider the claimed process despite this additional possibility.

The respondent argued that the claimed invention satisfied a long-felt need. The arguments rest on a statement in D3, which relates to the industrial implementation of HFSl synthesis (column 1, last paragraph). An industrial implementation is however not claimed. D3 moreover states that the synthesis was abandoned by two important industrial specialists also because the raw product, HCSI, is difficult to access on an industrial scale (column 1, line 49). The patent in suit does not address this issue, however. The satisfaction of a long-felt need can therefore not be acknowledged, and such would also not inevitably suffice for an inventive step.

2. Auxiliary requests 1 and 2, Article 56 EPC

- 2.1 The added feature describes nothing more than part of the working principle of a reflux condenser when used for removing more volatile vapour constituents.

Claim 1 of these requests thus does not fulfill the requirements of Article 56 EPC for the same reasons as claim 1 of the main request.

3. Auxiliary requests 3 and 4, Article 56 EPC

The boiling temperature of HF (19.5°C) is above the

operating temperature of the reflux condenser (-20°C) in D1, example 1, while the boiling temperature of HCl ($-85,05^{\circ}\text{C}$) is below it. D1, example 1, thus discloses the appropriate temperature.

Claim 1 of auxiliary requests 3 and 4 does thus not fulfill the requirements of Article 56 EPC for the same reasons as claim 1 of the main request.

4. Auxiliary request 5

4.1 Amendments, Article 123(2) EPC

The subject-matter of claim 1 contains a (disclosed) disclaimer.

The question to be assessed is whether the remaining claimed subject-matter was directly and unambiguously disclosed in the application as filed (G 2/10 order; Case Law of the Boards of Appeal, 10th ed., II.E.1.7.2 b)).

The original disclosure also contained the method for producing HFSI without a catalyst, as is apparent from the published original application (A1). A1, paragraphs [0024], [0025], [0028] and [0032] disclose that a catalyst is optional. Paragraph [0031] even discloses that the reaction does not require a catalyst to give acceptable results. Example 2, carried out without a catalyst and showing a yield of 98%, supports this statement.

Therefore, the remaining subject-matter, i.e. the method for producing HFSI at a high yield by reacting HXSI with HF under reflux conditions to remove HX, in

the absence of a catalyst, is directly and unambiguously derivable from the application as originally filed.

The dependent claims do not add subject-matter either.

4.2 Inventive step, Article 56 EPC, Article 13(2) RPBA 2020

In the statement of grounds of appeal, the appellant merely attacked the dependent claims of the main request. The disclaimer contained in claim 1 of auxiliary request 5 was, however, not contained therein.

Moreover, the appellant did not submit arguments against the auxiliary requests as filed during the opposition proceedings and as resubmitted with the reply to the appeal.

The appellant's submissions in particular did not address an embodiment without a catalyst.

Only during the oral proceedings before the board did the appellant argue against the inventive step of claim 1 of auxiliary request 5.

They argued that the objection should be admitted because it was based on the documents on file.

The objection against claim 1 of auxiliary request 5 under Article 56 EPC is an amendment to the appellant's case.

At this stage of the proceedings, the consideration of a request is subject to Article 13(2) RPBA 2020, according to which an amendment shall not be taken into account unless there are exceptional circumstances which have been justified with cogent reasons.

The use of documents already on file for a new attack

does not qualify as exceptional circumstances, nor are such apparent.

The objection under Article 56 EPC against auxiliary request 5 can thus not be taken into account.

4.3 The subject-matter of auxiliary request 5 is thus patentable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent on the basis of auxiliary request 5 as resubmitted with the reply to the appeal, and the description to be adapted.

The Registrar:

The Chair:



C. Vodz

R. Winkelhofer

Decision electronically authenticated