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**Datasheet for the decision  
of 15 September 2020**

**Case Number:** T 1110/16 - 3.3.02

**Application Number:** 08744593.8

**Publication Number:** 2271651

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**Language of the proceedings:** EN

**Title of invention:**

ISOTHERMAL PROCESS FOR PHOSPHOROMONOCHLORIDITE SYNTHESIS

**Patent Proprietor:**

Dow Global Technologies LLC

**Opponent:**

Evonik Operations GmbH

**Headword:**

**Relevant legal provisions:**

EPC Art. 100(b), 54, 56

**Keyword:**

Sufficiency of disclosure

Novelty

Inventive step

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**  
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Case Number: T 1110/16 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 15 September 2020**

**Appellant:** Dow Global Technologies LLC  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 10 March 2016  
revoking European patent No. 2271651 pursuant to  
Article 101(3) (b) EPC.**

**Composition of the Board:**

**Chairman** M. O. Müller  
**Members:** A. Lenzen  
P. de Heij

## **Summary of Facts and Submissions**

I. This decision concerns the appeal filed by the patent proprietor (appellant) against the decision of the opposition division (decision under appeal) to revoke its European patent No. 2 271 651 (patent in suit).

II. In its notice of opposition, the opponent (respondent) requested that the patent in suit be revoked in its entirety based on the grounds for opposition pursuant to Article 100(a) EPC (lack of novelty and lack of inventive step) and Article 100(b) EPC.

In its decision, the opposition division concluded that Article 100(b) EPC did not prejudice maintenance of the patent as granted. It also held that the claimed subject-matter of the patent as granted was novel, but that it did not involve an inventive step.

III. The following documents that were cited during the opposition proceedings are relevant to this decision:

D1 WO 2005/063776 A1  
D1a US 2007/0112219 A1  
D3 EP 0 349 895 A2  
D4 EP 0 312 915 A2

IV. With its statement of grounds of appeal, the appellant filed:

D5 L. Anschütz, W. Marquardt, Chem. Ber. 1956, 89,  
pages 1119 to 1123

- V. On 3 March 2020, the board issued a communication pursuant to Article 15(1) RPBA 2020 in preparation for the oral proceedings which had been scheduled at the parties' request.
- VI. By letter dated 15 July 2020, the appellant withdrew its request for oral proceedings and announced that it would not be attending them.
- VII. On 15 September 2020, oral proceedings before the board took place in the absence of the appellant. At the end of the oral proceedings, the board gave its decision.
- VIII. The parties' requests, where relevant to this decision, were as follows:

The appellant requested that the decision under appeal be set aside and that the patent in suit be maintained as granted.

The respondent requested that the appeal be dismissed.

- IX. The appellant's arguments, where relevant to the present decision, can be summarised as follows:

The skilled person would have had no difficulties in putting the invention of claim 1 into practice. There was no lack of sufficiency.

The use of a basic ion exchange resin comprising amino groups was a central aspect of the invention of D1a. Its purpose was to scavenge all of the HCl formed during the condensation reaction. In the process of D1a, the HCl gas was therefore not driven off from the reaction solution. Further, the amino groups of the resin corresponded to the nitrogen base of claim 1, and

the amount of the former was much higher than that provided for the latter in claim 1. The subject-matter of claim 1 was novel over D1a.

D4 and D3 were almost exclusively concerned with aromatic diols having two substituents next to each of the two hydroxy groups. These aromatic diols were distinctly different from those of claim 1. D4 and D3 were not suitable starting points for the discussion of inventive step. A comparison of D5 (page 1122, point 4; sentence bridging pages 1120 and 1121) and D4 (example 7) showed that 2,2'-bisphenol, a representative of the aromatic diols according to claim 1, was highly reactive and that the reaction product formed with  $\text{PCl}_3$  was prone to undergo a further reaction with unreacted 2,2'-bisphenol. This meant that the aromatic diols of claim 1 would give only a very low yield if reacted according to the general process of D4, and that this yield would be lower than that of example 1 in the patent in suit. The objective technical problem was to provide a process for preparing a phosphoromonochloridite from the unhindered aromatic diols of claim 1 which allowed a consistently high yield to be obtained, not depending on the particular batch of diol used, in which the formation of undesired overreaction products was reduced or avoided. Example 9 of D4 was only one of many, and did not teach that the addition of a feed solution of aromatic diol to  $\text{PCl}_3$  increased the yield of the phosphoromonochloridite. Although this link was established in D1a, it only applied to the specific invention of D1a, which, however, was incompatible with that of claim 1. The subject-matter of claim 1 and its dependent claims therefore involved an inventive step.

- X. The respondent's arguments, where relevant to the present decision, can be summarised as follows:

It was not clear from the patent in suit how a feed solution containing more than 98 weight percent of aromatic diol and less than 2 weight percent of solvent could be prepared. Further, the skilled person did not know how long the temperature had to be kept within  $\pm 5$  °C of the selected reaction temperature. Hence the invention as stipulated in claim 1 as granted was not sufficiently disclosed.

D1a, taken as a whole, disclosed a process as stipulated in claim 1 as granted. The basic ion exchange resin of D1a was not a nitrogen base within the meaning of the patent in suit. But in addition to the ion exchange resin D1a disclosed the use of an amine as nitrogen base. Furthermore, according to claim 1 of the patent in suit, HCl was driven off from the reaction solution. However, this feature also covered the scavenging reaction disclosed in D1a. Consequently, the subject-matter of claim 1 lacked novelty over D1a.

Both D4 and D3 were suitable starting points for the discussion of inventive step. The subject-matter of claim 1 differed from these documents in that a feed solution of the aromatic diol was added to the reaction zone comprising  $\text{PCl}_3$ , and in that the feed solution comprised greater than 98 weight per cent of the aromatic diol dissolved in a first organic solvent. No technical effect was associated with these differences. In particular, no technical effect could be derived from a comparison of the reactions of D5 (page 1122, point 4; sentence bridging pages 1120 and 1121) and D4 (example 7) because the reaction conditions were different. Even if a technical effect was acknowledged

for 2,2'-bisphenol, said effect could not be obtained over the whole breadth of claim 1. That was because the structural definition of the aromatic diols in claim 1 was very broad. Further, according to paragraph [0024] of the patent in suit, it was crucial, in order for a high yield to be obtained, for the aromatic diol not to accumulate in the reaction solution. However, that was not a feature of claim 1. There were conceivable variants of the process according to claim 1 that did not meet this requirement of paragraph [0024].

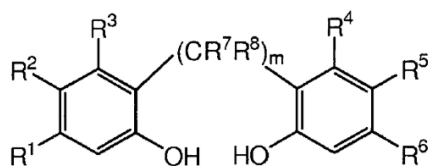
Thus the objective technical problem vis-à-vis D4 was merely to provide an alternative process. Modifying the process of D4 in such a way that a feed solution of the aromatic diol was added to  $\text{PCl}_3$  was routine practice for the skilled person and also obvious in view of example 9 of D4. The skilled person had only two possibilities: either the reaction vessel was first loaded with  $\text{PCl}_3$  or with the aromatic diol. It also followed from a combination of D4 with D1a because a direct link was established in D1a between the addition of a feed solution of aromatic diol to  $\text{PCl}_3$  and a very high yield.

### **Reasons for the Decision**

1. The set of claims as granted contains only one independent claim. It reads as follows:

*"A process for preparing a phosphoromonochloridite comprising, contacting an aromatic diol represented by the following formula:*





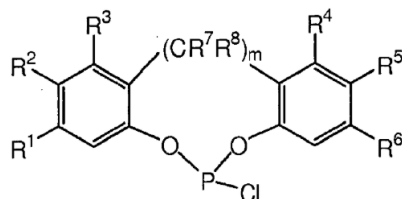
wherein:

$m$  is zero, 1, or 2;

$R^1$ ,  $R^2$ ,  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ ,  $R^7$  and  $R^8$  are each independently selected from hydrogen, halogen, and  $C_1$ - $C_{10}$  substituted or unsubstituted hydrocarbyl moieties;

optionally,  $R^2$  can be bonded to  $R^3$  to form a substituted or unsubstituted hydrocarbylene so as to form a 5- or 6-membered ring; and/or optionally,  $R^4$  can be bonded to  $R^5$  to form a substituted or unsubstituted hydrocarbylene so as to form a 5- or 6-membered ring;

with phosphorus trichloride ( $PCl_3$ ) in a reaction solution in a reaction zone, which solution comprises 0.01 to less than 5 mole percent of a nitrogen base, calculated on the moles of aromatic diol used, at a reaction temperature greater than  $40^\circ C$  to produce the phosphoromonochloridite represented by the following formula:



wherein  $m$  and  $R^1$  through  $R^8$  have the definitions given hereinabove; and to drive off  $HCl$  being produced from the reaction solution; wherein the contacting is carried out by adding a feed solution of the aromatic diol to the reaction zone comprising  $PCl_3$  to form the reaction solution, the addition being in such a rate

*that reaction temperature remains within  $\pm 5^{\circ}\text{C}$  of the selected reaction temperature, the feed solution comprising greater than 98 weight percent of the aromatic diol dissolved in a first organic solvent."*

Thus, in the process of claim 1,  $\text{PCl}_3$  is reacted with an aromatic diol, more specifically a bisphenol, to give the corresponding phosphoromonochloridite. The aromatic diol of claim 1 is characterised in that there is only one substituent next to each of the two hydroxy groups, namely the bridge  $(\text{CR}^7\text{R}^8)_m$ .

2. Sufficiency (Article 100(b) EPC)

2.1 Claim 1 states that the aromatic diol and  $\text{PCl}_3$  are contacted

*"by adding a feed solution of the aromatic diol to the reaction zone comprising  $\text{PCl}_3$  to form the reaction solution, [...] **the feed solution comprising greater than 98 weight percent of the aromatic diol dissolved in a first organic solvent.**" (emphasis added)*

The respondent argued that the feature emphasised above had to be understood as referring to a feed solution of 98 weight percent of aromatic diol in 2 weight percent of solvent. However, it was not clear from the patent in suit how such a highly concentrated solution could be prepared.

This is not convincing. The skilled person, reading claim 1 with a mind willing to understand, would readily recognise that the feature "*greater than 98 weight percent of the aromatic diol*" relates to 98 weight percent of the total amount of aromatic diol

used in the process. Claim 1 thus stipulates that more than 98 weight percent of the total amount of aromatic diol used in the process must be dissolved in the feed solution, and that less than 2 weight percent may be present either undissolved in the feed solution or in the reaction solution containing  $\text{PCl}_3$  at the beginning of the process.

2.2 Claim 1 also states that

*"the addition [of the feed solution is] in such a rate that reaction temperature remains within  $\pm 5^\circ\text{C}$  of the selected reaction temperature"*.

The respondent argued that the skilled person did not know how long the temperature had to be kept within  $\pm 5^\circ\text{C}$  of the selected reaction temperature.

This argument is not convincing either. In claim 1, the temperature range of  $\pm 5^\circ\text{C}$  is clearly related to the addition of the feed solution. It is therefore clear that the temperature has to be maintained within that range until all of the feed solution has been added.

2.3 The above reasoning (points 2.1 and 2.2) was already laid out in the board's communication pursuant to Article 15(1) RPBA 2020. During the oral proceedings before the board, the respondent refrained from commenting on it. It is therefore to be concluded that the ground for opposition pursuant to Article 100(b) EPC does not prejudice maintenance of the patent as granted.

3. Novelty (Article 54 EPC)

3.1 The respondent's only novelty objection was based on D1a. This document relates to (D1a: claim 1):

*"A process for preparing trivalent organophosphorus compounds by condensing phosphorus compounds of the formula i*



*[...] with organic compounds that have at least one OH group, the process comprising carrying out the condensation reaction **in the presence of at least one basic ion exchange resin.**"* (emphasis added)

As is clear from paragraphs [0067] and [0068] in D1a, the basic ion exchange resin serves to scavenge the hydrogen halide formed in the condensation reaction, more specifically to scavenge hydrogen chloride as  $\text{PCl}_3$  is used preferentially as the phosphorus compound of formula i. In order to achieve this, the resin is added in stoichiometric amounts such that at least one mole of free base is available on the resin for each mole of hydrogen chloride (D1a: paragraph [0070]).

3.2 The respondent argued that D1a anticipated the novelty of claim 1 because the feature "*and to drive off HCl being produced from the reaction solution*" of claim 1 had to be construed broadly and thus covered the scavenging reaction of D1a as outlined above.

However, driving off HCl means that HCl leaves the reaction mixture as a gas, which is different from being scavenged by a basic ion exchange resin. The board could not find any basis in the description of

the patent in suit for the respondent's allegation that the term "driving off" had to cover the scavenging reaction of D1a, and none was cited by the respondent. The respondent's argument is therefore not persuasive. This reasoning was already laid out in the board's communication pursuant to Article 15(1) RPBA 2020. During the oral proceedings before the board, the respondent refrained from commenting on it. Thus for this reason alone it is to be concluded that the subject-matter of claim 1 is novel over D1a.

- 3.3 Novelty of the subject-matter of claim 1 over D1a must also be acknowledged for another reason. The alkaline properties of the basic ion exchange resin of D1a are due to amino groups (D1a: paragraphs [0067] and [0068]). Upon the scavenging of HCl, each amino group is transformed into its corresponding hydrochloride salt. It follows that each of the amino groups of the basic ion exchange resin is a nitrogen base according to claim 1 (see paragraph [0012] of the patent in suit, which defines a nitrogen base as a nitrogen-containing compound that is capable of neutralising HCl to form a salt). In view of the function of the basic ion exchange resin of scavenging all of the HCl formed during the reaction (see preceding point), there must be at least as many moles of amino groups introduced into the reaction mixture using said resin as there are moles of hydroxy groups introduced with the organic compound having at least one OH group. The amount of nitrogen base, calculated on the moles of aromatic diol, is therefore much higher in D1a than in claim 1 (*"0.01 to less than 5 mole percent of a nitrogen base, calculated on the moles of aromatic diol used"*).

The respondent held that the basic ion exchange resin of D1a was not a nitrogen base within the meaning of

the patent in suit. This was because D1a (paragraph [0023]) considered the avoidance of "**saltlike** by-products" (emphasis added) to be one of the advantages of its process. The scavenging product resulting from the reaction between the basic ion exchange resin and HCl therefore could not be a salt. However, this argument takes only part of paragraph [0023] into account. Said paragraph reads:

*"a) There are no saltlike by-products which can only be removed with difficulty from the target product."*

Reading paragraph [0023] as a whole, it is to be understood as not addressing the avoidance of salts *per se*, but the avoidance of those salts which are difficult to remove. This is exactly what is achieved by the invention of D1a: unlike the salts formed in processes of the prior art, the salts formed with the basic ion exchange resin can be filtered out easily.

3.4 In summary, the subject-matter of claim 1 and its dependent claims 2 to 9 is novel over D1a.

4. Inventive step (Article 56 EPC)

4.1 D4 (claim 1) discloses a process for making phosphoromonochloridites (referred to as cyclic chlorophosphites in D4) by reacting  $\text{PCl}_3$  with a 2,2'-bridged bisphenol in an inert solvent and in the presence of a catalytic amount of a *tert*-amine or hydrogen chloride complex thereof. Hence, D4 relates to a process for making the same type of compounds as claim 1. The board therefore agrees with the respondent that D4 may in fact be taken as the closest prior art for the subject-matter of claim 1.

4.2 The list of examples of suitable 2,2'-bridged bisphenols in D4 includes 2,2'-bisphenol and 2,2'-ethylidenebis(4-*tert*-butylphenol) (D4: page 2, line 34 to page 3, line 13; page 2, line 38; page 3, line 8). These two bisphenols have only one substituent next to each of the two hydroxy groups. They are aromatic diols according to claim 1 (2,2'-bisphenol:  $m = 0$ ,  $R^1$  to  $R^6 = H$ ; 2,2'-ethylidenebis(4-*tert*-butylphenol):  $m = 1$ ,  $CR^7R^8 = CH(CH_3)$ ,  $R^1 = R^3 = R^4 = R^6 = H$ ,  $R^2 = R^5 = \textit{tert}-butyl). However, D4 also makes it clear that bisphenols having two substituents next to each of the two hydroxy groups are far more preferred (D4: page 3, lines 10 to 13). Fully in line with this, only one specific bisphenol with two substituents is used in the examples, namely 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol). Because of their two substituents, these more preferred bisphenols are not according to claim 1. In its inventive step objection, the respondent started from 2,2'-bisphenol or 2,2'-ethylidene bis(4-*tert*-butylphenol), i.e. those bisphenols of D4 which are aromatic diols according to claim 1.$

The description of D4 (page 3, lines 53 to 57) discloses in only very general terms how the reaction between 2,2'-bridged bisphenols,  $PCl_3$  and the catalyst pyridine (or pyridine hydrochloride) can be carried out. The reactants are mixed and the resulting mixture is stirred at a reaction temperature until the reaction is complete (this is referred to as the "general process" hereinafter). Furthermore, D4 (page 3, line 58) refers to its examples in this context. These examples, however, only describe reactions of 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol), i.e. an entirely different bisphenol (see above). Thus, as regards the reaction of the two bisphenols on which the

respondent based its inventive step objection, D4 only discloses their reaction according to the general process. The order of addition and the amount of bisphenol in the feed solution is not disclosed for this general process in D4.

Against this background, the respondent argued that the subject-matter of claim 1 differed from D4 only

- (i) in that a feed solution of the aromatic diol is added to the reaction zone comprising  $\text{PCl}_3$

and

- (ii) in that the feed solution comprises greater than 98 weight percent of the aromatic diol dissolved in a first organic solvent.

It is assumed in the following, in the respondent's favour, that this is correct.

#### 4.3 Technical effect linked to the distinguishing features

4.3.1 In order to show that distinguishing features (i) and (ii) are linked to a technical effect, the appellant compared the reactions of  $\text{PCl}_3$  with two aromatic diols disclosed in the prior art, namely 2,2'-bisphenol and 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol). As outlined further above, 2,2-bisphenol has only one substituent next to each of the two hydroxy groups (namely the other aromatic ring). It is an aromatic diol according to claim 1. 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol), however, has two of these substituents (namely the bridge  $\text{CH}(\text{CH}_3)$  and a *tert*-butyl group). Consequently, it is not an aromatic diol according to claim 1.



More specifically, the reactions compared by the appellant are as follows:

(a) 2,2'-bisphenol

In D5 (page 1122, point 4; sentence bridging pages 1120 and 1121),  $\text{PCl}_3$  is added to a suspension of 2,2'-bisphenol in benzene at ambient temperature. At once, vigorous generation of HCl gas is observed. The reaction mixture is heated to reflux for 5 hours and then allowed to stand for 14 hours at ambient temperature. The desired phosphoromonochloridite is obtained in a 57% yield together with a by-product. This by-product is the result of an overreaction of the phosphoromonochloridite with 2,2'-bisphenol.

This reaction is also referred to in D1 (page 27, lines 9 to 14) and D1a (paragraph [0088]).

(b) 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol)

In D4 (example 7),  $\text{PCl}_3$  is added at 90 °C to 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol) in heptane. The reaction mixture is kept at 90 °C for 3 hours. Afterwards, no product can be detected.

These reactions are not according to the process of D4 or that of claim 1 of the patent in suit because they do not use a catalyst or a nitrogen base as required by D4 and the patent in suit, respectively. Furthermore, the actual reaction conditions in both cases are different. Nevertheless, it can be concluded from this comparison that 2,2'-bisphenol is much more reactive towards  $\text{PCl}_3$  than 2,2'-ethylidenebis(4,6-di-*tert*-

butylphenol). This is simply because 2,2-bisphenol and  $\text{PCl}_3$  **react with each other at once after having been combined at ambient temperature**, whereas the mixture of 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol) and  $\text{PCl}_3$  **shows no reaction after heating for 3 hours at 90 °C**. This comparison also shows that the phosphoromonochloridite formed from 2,2'-bisphenol is still reactive, and liable to undergo a further reaction with still unreacted 2,2'-bisphenol.

Further, this conclusion applies not only to 2,2'-bisphenol but to all aromatic diols according to claim 1. This class of aromatic diols has only one substituent next to each of the two hydroxy groups. This renders their hydroxy groups sterically much more accessible and thus much more reactive than those which have two substituents next to them, such as in 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol). Given that the aromatic diols of claim 1 are highly reactive, it follows

- that only a low yield of phosphoromonochloridite would be obtained if the aromatic diols of claim 1 were reacted according to the general process of D4 (see above), i.e. according to a process that does not take any precautions to prevent e.g. an overreaction, but simply mixes all reactants together,
- that such a yield would be lower than that obtained by the process of claim 1, in which a feed solution of the aromatic diol is added to the reaction zone comprising  $\text{PCl}_3$  (see example 1 of the patent in suit, which gives the corresponding product in a 97% yield).

Thus, while the comparison of reactions of the prior art as explained above is *sensu stricto* not a comparison between the process of claim 1 and that of the closest prior art document D4, the board nevertheless accepts the appellant's argument that it allows a conclusion to be drawn about such a comparison, namely that the order of process steps as claimed results in an increased yield.

4.3.2 In order to counter the above, the respondent argued as follows:

- The above conclusion based on a comparison of the reactions of  $\text{PCl}_3$  with 2,2'-bisphenol and 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol) could not be generalised beyond 2,2'-bisphenol. This was because the reactivity of aromatic diols depended not only on the steric demand of their substituents but also on their M and/or I effect(s). The size of the bridge might also be significant. Therefore, it could not reasonably be expected that a higher yield would be obtained with every aromatic diol falling within the definition given for it in claim 1.
- The respondent also referred to the patent in suit (paragraph [0024]), which allegedly taught that in order to achieve a high yield of phosphoromonochloridite it was important to avoid an accumulation of aromatic diol in the reaction solution. This, however, was not a feature of the claims, but carrying out the reaction isothermally, i.e. within  $\pm 5$  °C of a selected reaction temperature, was. The respondent presented two prophetic examples which allegedly fulfilled the requirement of claim 1 (isothermal reaction), but not that of paragraph [0024] (no accumulation of

aromatic diol in the reaction solution), and concluded that it could not reasonably be expected that a higher yield would be obtained with every individual process variant falling within the scope of claim 1.

However, as discussed during the oral proceedings, the respondent's considerations were not supported by tangible evidence, such as experimental results supporting the allegations made. The arguments based on these considerations are therefore not convincing.

4.3.3 In summary, distinguishing features (i) and (ii) are linked to the technical effect that a higher yield of phosphoromonochloridite is obtained from the aromatic diols of claim 1.

4.4 Objective technical problem

Based on the above, the objective technical problem vis-à-vis D4 cannot merely lie in providing an alternative process, as argued by the respondent. Rather, it lies in providing a process for preparing a phosphoromonochloridite from the aromatic diols having only one substituent next to each of the two hydroxy groups which allows a higher yield to be obtained.

4.5 Obviousness

4.5.1 In its submissions, the respondent only ever argued that the objective technical problem lay in providing an alternative to the process of D4. However, the objective technical problem has to be formulated in more ambitious terms as providing a process giving a higher yield (see above). For that reason alone, an inventive step is to be acknowledged. Furthermore, as

will be explained below, even disregarding the fact that the respondent's arguments have been made in relation to the problem of providing an alternative process only, and taking these arguments into account for the objective technical problem defined by the board above, inventive step has to be acknowledged.

- 4.5.2 The respondent argued that the subject-matter of claim 1 was obvious based on D4 alone. In D4, example 9, a feed solution of 2,2'-ethylidenebis(4,6-di-*tert*-butylphenol) was added to PCl<sub>3</sub>. That was the same approach as in claim 1. It would therefore have been obvious to the skilled person to apply this approach to 2,2'-bisphenol as well.

However, while it is true that D4, example 9, adds a feed solution of bisphenol to PCl<sub>3</sub>, and thus applies an order of process steps as claimed, said example is the only one of a total of 11 examples which follows this approach. Moreover, said example does not link this approach to any particular technical effect, let alone the effect of a higher yield. While D4 refers to "*the following table [showing] the reaction composition (excluding solvent and pyridine hydrochloride) 1 hour after completing the addition of the solution*", no such table is in fact shown. Hence there are no data in D4 about the yield obtained in example 9 of this document. Thus, faced with the objective technical problem above, there would not have been a reason for the skilled person to turn to the order of process steps disclosed in D4, example 9. Consequently, the subject-matter of claim 1 cannot be derived in an obvious manner from D4 alone.

Similarly, the subject-matter of claim 1 cannot be devoid of inventive step simply because, as argued by

the respondent, the skilled person would allegedly have had only two possible ways of combining the aromatic diol and  $\text{PCl}_3$  (namely either by adding the aromatic diol to  $\text{PCl}_3$  or by adding  $\text{PCl}_3$  to the aromatic diol). Again, this argument too disregards the fact that the skilled person would have had no reason to do so in an attempt to obtain a higher yield.

- 4.5.3 The respondent also referred to D1a. D1a (paragraphs [0055], [0063] and [0064]) taught that for a very high yield to be obtained a feed of the aromatic diol had to be added to  $\text{PCl}_3$ . That was the same approach as in claim 1. By combining D4 with D1a, the skilled person would thus have arrived at the subject-matter of claim 1 without having to apply inventive skills.

Although the board agrees with the respondent on the disclosure of D1a in paragraphs [0055], [0063] and [0064], it cannot share its view that the combination of D4 and D1a would have led the skilled person to the subject-matter of claim 1 in an obvious manner. As explained above, the invention of D1a consists precisely in using a basic ion exchange resin containing amino groups. It takes part in the reaction as it binds all the  $\text{HCl}$  formed during the condensation as hydrochloride. As laid out above, the  $\text{HCl}$  gas is not driven off from the reaction solution (contrary to what is required according to claim 1), and the amount of amino groups, i.e. the nitrogen base within the meaning of the patent in suit, relative to the aromatic diol is much higher than provided for in claim 1. This central aspect of the invention of D1a, i.e. the use of a basic ion exchange resin, is incompatible with the process of claim 1. Thus, in order to arrive at the subject matter of claim 1, the skilled person would have had to isolate the teaching of paragraphs [0055], [0063] and

[0064] of D1a from this central aspect of that document. The skilled person might have contemplated doing so, but there are serious doubts as to whether they would have done so. Firstly, this teaching is embedded in the description of the invention in D1a and there is at least no literal indication that it could be applicable beyond the process of D1a. Secondly, this teaching concerns the course and the outcome of the reaction of D1a, but that also applies to the basic ion exchange resin. Both are obviously linked, and to say that the skilled person would have considered isolating this teaching is tantamount to hindsight. Consequently, the subject-matter of claim 1 cannot be derived in an obvious manner from a combination of D4 and D1a.

4.6 In an alternative line of argument presented in written proceedings only, the respondent started from D3 as the closest prior art.

It argued that D4 and D3 were very similar. D3 also disclosed a process for making cyclic chlorophosphites by reacting  $\text{PCl}_3$  with a 2,2'-bridged bisphenol in the presence of a catalyst. The only difference between these two documents lay in the structure of the catalyst. Whereas D4 employed a *tert*-amine or hydrogen chloride complex thereof, D3 made use of a cross-linked polyvinylpyridine resin. The features distinguishing claim 1 from D3, and thus also the objective technical problem, were the same as those identified for D4. The subject-matter of claim 1 therefore did not involve an inventive step over D3 alone or a combination of D3 with D1a.

If it is assumed in the respondent's favour that this argumentation is correct, it can still not be concluded that claim 1 does not involve an inventive step,

because the above reasoning starting from D4 applies *mutatis mutandis*. Hence the subject-matter of claim 1 involves an inventive step over D3 alone and over the combination of D3 with D1a.

- 4.7 In the absence of further prior art linking the approach of claim 1 (addition of a feed solution of aromatic diol to  $\text{PCl}_3$ ) to a higher yield, it must be concluded that the subject-matter of claim 1 and its dependent claims 2 to 9 does involve an inventive step.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is maintained as granted.

The Registrar:

The Chairman:



N. Maslin

M. O. Müller

Decision electronically authenticated