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**D E C I S I O N**  
**of 6 February 2001**

**Case Number:** T 1117/97 - 3.2.5

**Application Number:** 91110237.4

**Publication Number:** 0464508

**IPC:** B29C 53/60

**Language of the proceedings:** EN

**Title of invention:**

Method for shaping tetrafluoroethylene resin pipe

**Patentees:**

NICHIAS CORPORATION  
DAIKIN INDUSTRIES, LTD

**Opponent:**

Compagnie Plastic Omnium

**Headword:**

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**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

"Inventive step (yes)"

**Decisions cited:**

-

**Catchword:**

-



Case Number: T 1117/97 - 3.2.5

**D E C I S I O N**  
**of the Technical Board of Appeal 3.2.5**  
**of 6 February 2001**

**Appellant:** Compagnie Plastic Omnium  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 10 September 1997  
rejecting the opposition filed against European  
patent No. 0 464 508 pursuant to Article 102(2)  
EPC.

**Composition of the Board:**

**Chairman:** A. Burkhart  
**Members:** W. R. Zellhuber  
H. Preglau

## Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal against the decision of the Opposition Division rejecting the opposition against European patent No. 0 464 508.
- II. Opposition was filed against the patent as a whole and based on Article 100(a) EPC (inventive step).

The Opposition Division held that the ground of opposition did not prejudice the maintenance of the patent as granted having regard to the cited prior art documents.

- III. Oral proceedings were held before the Board of Appeal on 6 February 2001.
- (i) The appellant requested that the decision under appeal be set aside and the patent be revoked.
- (ii) The respondent (patentee) requested that the appeal be dismissed (main request), or as an auxiliary request, that the decision under appeal be set aside and the patent maintained on the basis of claims 1 to 5, filed on 29 May 1997.

- IV. The following documents played a role in the appeal proceedings:

D1: ICI, Fluon polytétrafluoroéthylène, Notice technique F14-a, "Moulage isostatique des poudres PTFE", Août 1973;

D3: US-A-2 783 173;

D4: FR-A 2 218 987 and

D5: Hoechst, Matières plastiques Hoechst, Hostaflon,  
Edition: avril 1988, pages 39 to 41.

V. Claim 1 as granted (main request) reads as follows:

"1. A method for shaping a tetrafluoroethylene resin pipe which comprises:

(a) winding a porous sheet of tetrafluoroethylene resin which is not sintered around a mandrel,

(b) covering the wound sheet with an elastomeric material,

(c) isostatically pressing the wound sheet covered with the elastomeric material,

(d) removing the elastomeric material from the wound sheet, and

(e) sintering the wound sheet.

VI. The appellant argued essentially as follows:

The closest prior art was represented by document D3 which described a method for shaping a tetrafluoroethylene resin pipe, wherein sheets of polytetrafluoroethylene (PTFE) and thereon a glass fabric tape were tightly wrapped around a mandrel. During sintering, heat and pressure were applied to the thus formed assembly in that the glass fabric tape executed an isostatic pressure onto the PTFE sheets during heating due to the fact that the thermal

expansion of glass was less than that of PTFE.

However, as mentioned in the patent in suit, that method did not work when the wound TFE resin sheet was thin, because, in that case, sufficient pressure would not be created.

The object underlying the patent in suit, therefore, was seen in providing an alternative method of applying heat and pressure.

It was known, in particular from document D5, that in any method for shaping a PTFE pipe, heat and pressure had to be applied and that heat and pressure might be applied either simultaneously or consecutively.

Thus, a person skilled in the art would take into consideration the teaching of document D1 which described a method for shaping a PTFE pipe having thin walls and wherein PTFE material, here in form of powder, was firstly isostatically pressed in a mould and then sintered. The mould comprised elastic walls separating the fluid, used for isostatically pressing, from the PTFE powder material to be pressed.

Moreover, document D1 described how smooth surfaces might be achieved if more rigid materials were used as wall material.

It was therefore obvious, to substitute the simultaneous application of pressure and heat described in document D3 by a consecutive application of pressure and heat as described in document D1 in order to produce PTFE pipes having thin walls and smooth surfaces, and thus to arrive at the process of

claim 1.

VII. The respondent argued essentially as follows:

The patent in suit was not directed to a method of shaping PTFE pipes having thin walls. This feature did not form part of claim 1 as granted.

Moreover, document D3 described a method wherein a fabric impregnated with resin was wound on a mandrel and document D3 did not disclose the feature of winding a porous sheet of PTFE around a mandrel.

Furthermore, document D3 taught the application of pressure in conjunction with high sintering temperatures in order to cause the PTFE in the impregnated fabric layers to fuse and, thus, to eliminate voids between the layers. This was contrary to the teaching of the patent in suit.

Therefore, the closest prior art was represented by document D4, which described the commonly known winding technique for shaping a PTFE pipe comprising the steps of winding a sheet of PTFE around a mandrel and sintering the wound sheet.

The problem underlying the patent in suit was to provide a method for shaping a PTFE pipe which was dense (free from voids) and smooth in its surface, and had a uniform wall thickness.

The problem was solved by a method as claimed in claim 1 which was not rendered obvious by the prior art.

Documents D3 and D4, which concerned the winding technique, did not suggest the step of isostatically pressing the wound sheet covered with an elastic material prior to sintering.

Documents D1 and D5 related to a different technique wherein the starting material was a PTFE powder and a preform was produced by, according to document D1, isostatically pressing the PTFE powder in a mould. The resulting preform was then sintered. Neither document D1 nor document D5 referred to the problems to be solved when preparing a PTFE pipe from unsintered PTFE sheets or ribbons by the winding method.

## **Reasons for the Decision**

### *1. Late filed documents*

Document EP-A 0 020 248 filed by the appellant on 4 January 2001 and document US-A-3 031 357 filed by the appellant on 6 February 2001 were disregarded and not introduced into the proceedings in accordance with Article 114(2) EPC, because they are not regarded as being of such technical relevance to have an impact on the decision to be taken.

Document EP-A 0 020 248 describes a mould comprising elastic and rigid walls as already known from document D1.

Document US-A-3 031 357 does not concern a method for shaping pipes. It describes a method of making a PTFE gasket envelope, wherein PTFE sheets, wound toroidally around a rigid ring mandrel, are pressed between plane

metal plates prior and after sintering which does not appear to be applicable in a method for shaping pipes.

2. *Novelty*

The process of claim 1 is novel, since none of the cited documents discloses a method according to claim 1 of the patent in suit, in particular, a method for shaping a tetrafluoroethylene resin pipe comprising in combination the steps of winding a porous sheet of tetrafluoroethylene resin which is not sintered around a mandrel, covering the wound sheet with an elastomeric material, and isostatically pressing the wound sheet covered with the elastomeric material.

Novelty, in fact, was not in dispute.

3. *Inventive step*

3.1 Closest prior art

The board is of the opinion that document D4 rather than document D3 represents the closest prior art for the following reasons:

- (i) Document D4 describes a method of shaping a PTFE pipe wherein an unsintered calendered TFE resin sheet is wound around a mandrel and then sintered. This is the technique which is also used in the method according to the patent in suit.

The problem, when making such PTFE pipes, is seen, among others, in producing pipes which are



dense, free from voids and smooth on their surface.

- (ii) Document D3 also describes a method of shaping a PTFE pipe wherein layers of unsintered PTFE film are wound around a mandrel and sintered.

However, in order to eliminate voids and delamination and to fuse these layers together with layers of fabric impregnated with PTFE, also wound around the mandrel, document D3 teaches the application of pressure in conjunction with sintering. Furthermore, in order to provide a smooth surface, a thin metal sheet additionally is wound around the PTFE sheets.

- (iii) In contrast hereto, the patent in suit neither makes use of the concept of applying pressure in conjunction with heat nor does it teach the use of an outer metal sheet. Document D3, thus, teaches a method which differs significantly from that suggested in the patent in suit and which leads a person skilled in the art in another direction.

Therefore, document D3 does not appear to represent the closest prior art and to be an appropriate starting point for assessing the question of inventive step.

### 3.2 Problem-Solution

Starting from document D4 as representing the closest prior art, the problem underlying the patent in suit

is to provide a method for shaping a TFE resin pipe which is dense, free from voids and smooth on its surface, keeping the advantages of the known winding processes, cf. page 1, lines 27 to 28 and lines 33 to 34 of the patent in suit.

The winding method is regarded as superior to other methods because it is possible to obtain a pipe having a desired length or a desired thickness by controlling the amount of the TFE resin sheet to be wound, to obtain a pipe having a desired inner diameter according to an external shape of a mandrel, to easily obtain laminated pipes, and to obtain a circular and thin pipe, cf. page 1, lines 14 to 18 of the patent in suit.

According to the patent in suit, the problem is solved by a method as described in claim 1, in particular, in that, after winding a porous sheet of TFE resin around a mandrel, the wound sheet is covered with an elastomeric material and isostatically pressed before sintering.

The term "isostatically pressed" means that "a substantially isostatical pressure is applied to the whole of the wound sheet in the axial direction of the mandrel and the perpendicular direction to the axis" by utilizing a liquid or gas for applying pressure onto the wound sheet, which is separated from these pressure mediums by an elastic cover material. When, for example, liquid pressure is utilized the wound sheet is put in a pressure vessel comprising water or an oily liquid under pressure, cf. page 5, lines 25 to 48 of the patent in suit.

By the step of isostatically pressing the wound sheet before sintering, the sintered pipe can have a high bulk density and is uniform in wall thickness. Because the wound sheet is covered with elastic material, the pipe has a smooth surface, cf. page 1, lines 46 to 55 of the patent in suit.

3.3 The subject matter of claim 1 is not rendered obvious by the prior art as disclosed in the cited documents:

- (i) As already mentioned above, document D3 teaches the application of pressure in conjunction with sintering, and, throughout the whole document, it is emphasized that simultaneous application of pressure and heat is necessary to bond or fuse together the layers wound on the mandrel, cf. column 1, lines 25 to 29 and 53 to 55; column 2, lines 61 to 66; column 3, lines 31 to 37 and the claims.

Thus, the teaching of document D3 leads a person skilled in the art in another direction and away from the teaching of the patent in suit.

Furthermore, document D3 does not suggest the use of a liquid or gas for applying pressure onto the wound sheet and it is silent about isostatically pressing it. According to the method described in document D3 the outer glass fabric tape executes a pressure onto the PTFE sheets during heating due to the fact that the thermal expansion of glass is less than that of PTFE, which appears to result in a pressure acting solely in a direction perpendicular to the axis of the mandrel.

- (ii) Document D1 describes a method for shaping PTFE pipes, wherein PTFE powder material is filled in a mould and compressed within the mould to obtain a preform. Document D1 teaches, in particular, isostatically moulding of PTFE powder. Accordingly, the mould is provided with elastic walls separating the powder to be pressed from the liquid used for isostatically pressing. After moulding, the preform is taken out of the mould and sintered.

Thus, document D1 concerns another technique for shaping articles made of PTFE, wherein the starting material is a powder and, consequently, firstly a preform has to be produced in a mould. Isostatically pressing is used for compressing powder material in the mould for forming such a preform.

According to the patent in suit, however, the starting material is an already "preformed" PTFE material, namely a compressed, calendered, but unsintered PTFE sheet material, cf. page 4, lines 23 to 34 and claims 1 and 3 of the patent in suit.

Thus, the person skilled in the art is in a situation different from that described in document D1 and the cited prior art does not indicate that the problems arising from the winding technique (creation of voids and delamination), may be solved by additionally pressing, in particular by isostatically pressing, the wound sheets before sintering.

Furthermore, document D1 teaches the use of a more rigid material in order to get a more smooth surface, which appears to lead away from the concept of isostatically moulding. In fact, document D1 teaches that by using a mould comprising a cylindrical tube of polished metal, the surface of the preform facing said metallic tube would be smooth, cf. page 18, fig, 13.

Thus, document D1 further does not indicate that a smooth surface also may be achieved by the method as claimed in claim 1 of the patent in suit, in particular, in that a porous sheet material is wound around a mandrel, covered with an elastomeric material and isostatically pressed.

- (iii) Document D5 also concerns the moulding technique, wherein PTFE powder is pressed into a mould. Heat and pressure might be applied either simultaneously (sintering under pressure) or consecutively (sintering after demoulding). Document D5 does not suggest isostatically pressing and is silent about any problems arising from the winding technique.
- (iv) To sum up, documents D1 and D5, on the one hand, and documents D3 and D4, on the other, concern different processes for shaping PTFE pipes and the respective teachings have to be seen separately. Consequently, the prior art does not suggest the step of isostatically pressing a TFE resin sheet material wound around a mandrel before sintering as claimed in the patent in suit in order to obtain a TFE resin pipe, which

is dense, free from voids and has smooth surfaces.

- 3.4 The appellant regarded document D3 as representing the closest prior art. Starting from that prior art, the problem underlying the patent in suit was seen in that the method described in document D3 was not suitable for producing PTFE pipes having thin walls, because, in that case, sufficient pressure could not be achieved. Consequently, the object was to provide an alternative method of applying pressure and an appropriate method was shown in document D1.

Although document D3 teaches that a pipe fabricated according to the method as described therein "may have a wall which is very thin relative to the diameter", cf. column 3, lines 6 to 9, the patent in suit mentions the above mentioned problem and the respondent confirmed, for example in the submission filed on 3 August 1998, page 3 at the bottom, that this problem may be regarded as being one of the problems to be solved by the patent in suit.

Thus, it appears to be correct to focus on the problem of providing a method which is applicable to the preparation of thin-walled pipes.

Starting from document D3 as closest prior art and avoiding any ex post facto considerations, the board comes to the conclusion that a person skilled in the art would have to take a number of steps, which are not regarded as being obvious.

In order to solve that problem and to come from the prior art as described in document D3 to the subject-

matter of claim 1 of the patent in suit, a person skilled in the art, firstly, would have to find out that the problem can be solved only by abandoning the concept of simultaneously applying heat and pressure, which would be contrary to the teaching of document D3. It is not clear, why a person skilled in the art should take that way and not consider, for example, measures which lead to an increase of the pressure during sintering.

Secondly, the person skilled in the art would have to decide that he may find a solution in the field of the moulding technique.

Thirdly, he would have to consider not applying the moulding technique for shaping thin-walled pipes, but to pick out the step of isostatically pressing prior to sintering, which is used, according to document D1, to compress PTFE powder material for the preparation of a preform.

Finally, he would have to consider that this form of pressing would be suitable for eliminating voids within sheets wound around a mandrel and would permit obtaining pipes having smooth surfaces, although the cited prior art is silent about any effect the step of isostatically pressing may have on TFE resin sheets wound around a mandrel.

To sum up, document D3 does not seem to represent the closest prior art as shown in paragraph 3.1 above and when taking document D3 as closest prior art, the way from that prior art towards the subject-matter of claim 1 of the patent in suit includes a number of steps which are not regarded as being obvious.

4. Therefore, the subject-matter of claim 1 as granted involves an inventive step. The subject-matter of claims 2 to 6 which are appendant to this claim 1 similarly involves an inventive step.

Consequently, the auxiliary request of the respondent that the patent be maintained in amended form was not considered.

## **Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

M. Dainese

A. Burkhart