BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

A		B		C	X

File No.: T 0522/90 - 3.4.2

Application No.: 79 101 487.1

Publication No.: 0 005 536

Classification: B01D 13/04, C08J 5/18, C08L 77/00

Title of invention: Process for preparing polyamide membrane filter media and product as well as process for rating the effectiveness of a membrane sheet as a filter

D E C I S I O N
of 8 September 1993

Applicant:

Proprietor of the patent: Pall Corporation

Opponent: 02 Akzo Faser Aktiengesellschaft
03 Sartorius GmbH

Headword: -

EPC: Art. 54, 56

Keyword: "Novelty, inventive step: Process claims yes, product claims no" - "Prior disclosure enabling; reasonable likelihood of success"

Headnote
Catchwords

Case Number: T 0522/90 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 8 September 1993

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Decision under appeal:
Decision of the Opposition Division of the European Patent Office dated 10 May 1990 rejecting the oppositions filed against European patent No. 0 005 536 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: E. Turrini
Members: C. Black
C.V. Payraudeau
W.W.G. Hofmann
L.C. Mancini

Summary of Facts and Submissions

I. The Respondent is the proprietor of European patent No. 0 005 536 which was granted with 35 claims, of which Claims 1, 8 and 30 read as follows:

"1. A microporous hydrophilic, skinless alcohol-insoluble membrane sheet of polyhexamethylene adipamide, capable when completely immersed in water of being wetted through within no more than one second, and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water."

"8. A process for preparing a skinless, hydrophilic, microsporous membrane of polyhexamethylene adipamide, comprising the steps of preparing a solution of the polyamide in formic acid, adding a prescribed quantity of water with mixing in an in-line rotary mixer thereby inducing nucleation of the solution, forming a film of the nucleated solution on a substrate, immersing with as little delay as possible the film and substrate in a quench bath containing formic acid and water, removing the resultant membrane from the bath, washing to remove the formic acid from the membrane and finally drying the skinless, hydrophilic, microsporous membrane, wherein the substrate, unless porous, is wettable by the solution and the quench bath, and formic acid concentration in the quench bath is not less than 37% and not more than 50% and the formic acid concentration in the solution is 63 to 72%."

"30. A filter element comprising a microsporous hydrophilic skinless alcohol-insoluble polyhexamethylene adipamide membrane sheet according to any of Claims 1 to 7 formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight."

II. The patent was opposed by Cuno Incorporated (hereinafter Cuno), Enka AG, now Akzo Faser AG (hereinafter Akzo) and Sartorius GmbH, now Sartorius AG (hereinafter Sartorius). Cuno's grounds were that the subject-matter of the claims of the patent in suit was not novel or inventive having regard to the disclosure in US-A-3 876 738 (hereinafter Marinaccio following the practice of the Opposition Division and the UK High Court), public prior use of membranes made according to Marinaccio and distributed to customers of AMF (predecessor of Cuno) and public prior use by the Patentee's distribution to potential customers of membranes according to the patent in suit (hereinafter Pall).

Akzo also argued that the subject-matter of Pall, at least to the extent claimed in Claims 1 to 7, was not novel or inventive having regard *inter alia* to the disclosure in Marinaccio. Membranes having the properties required by Claim 1 of Pall had been prepared by routinely following the teaching of Marinaccio.

Sartorius also relied largely on Marinaccio, and submitted the results of tests purporting to demonstrate that when operating within the teaching of Marinaccio, membranes having the properties required by Claim 1 of Pall were obtained.

In seeking to refute the argumentation of the Opponents, the Patentee submitted that features required by Claim 1 were not explicitly disclosed in Marinaccio, nor was a membrane according to Claim 1 obtained following the teaching of Marinaccio so that said features were not implicit either. In this respect the attempts by Sartorius to reproduce Marinaccio used conditions which were different from those specifically disclosed in Marinaccio and came close to those required by Pall. The prior distribution of membranes of both Cuno and Pall was moreover confidential for testing purposes.

Both Cuno and the Patentee drew upon documents and evidence which had been produced during prosecution of the corresponding patents in national courts.

III. The Opposition Division rejected the oppositions. It found that while the features of Claim 1 were largely derivable explicitly or implicitly from Marinaccio, the requirement in Pall that the membrane should be skinless had to be interpreted, having recourse to the description, in a very narrow manner (see point 3.15 of the Reasons for the Decision) and skinlessness in this sense could not be derived from Marinaccio. The Division also found that public prior use had not been established.

The Patentee's objection to the purported reproduction of Marinaccio by Sartorius was noted in point 8.5 of the Summary of Facts and Submissions, but was not further commented upon, nor for that matter was Akzo's reproduction of Marinaccio. Shortly after the date of the decision, the withdrawal of Cuno's opposition was communicated to the EPO. Cuno therefore was not a party to the present appeal proceedings.

IV. In the grounds for the appeals, and in the Respondent's reply thereto, the arguments presented during the opposition procedure were amplified, taking into account the matter contained in the decision rejecting the oppositions. Sartorius further expressed the opinion that the Opposition Division had limited its considerations to the argumentation of Cuno, and in particular had not evaluated the Sartorius experiments seeking to carry out the teaching of Marinaccio. For this reason they requested refund of the appeal fee.

Subsequently Sartorius indicated the intention to have the teaching of Marinaccio carried out by an independent organisation and asked that for this purpose a period of six months should be allowed before oral proceedings were held.

V. The Board accepted this, for reasons which will be explained subsequently (see paragraph 3.10 below). The required experiments were carried out by the Institut für Polymerforschung, Dresden e.V., and the results were received by the Board with Sartorius' communication dated 17 March 1992 in the form of a Prüfbericht and appended thereto the Prüfprotokolle. The Prüfbericht also contained information concerning

three Maschinenversuche, described in greater detail in the said communication.

VI. At oral proceedings held on 29 April 1992, the case was discussed in detail. However, the Board did not come to a final decision at the end of the oral proceedings because it was of the opinion that certain criticisms of the Respondent concerning the Dresden tests required investigation. The Respondent had requested time to review the results of the said tests and in the circumstances the Board considered that this was not unreasonable. Nevertheless the Board wished to avoid the situation developing, whereby the said review would involve further tests seeking to reproduce Marinaccio, to which the Appellants might raise further objections.

As a consequence of the Board's finding at the oral proceedings, the next action was due to come from the parties themselves, that is, they were to define an agreed list of experiments, and choose a laboratory, which could be the Dresdner Institut, to carry them out. It was not foreseen that the Board should issue a reasoned immediate decision.

VII. After some months, during which time no progress appeared to be being made, the Board suggested that with the approval of all parties, the case might be decided on the facts as they stood, with the proviso that the Respondent should be given sufficient time to comment fully on the Dresden report and to explain why it was considered that the results did not prove that Marinaccio was an enabling disclosure. In a subsequent communication, the Board gave the name of a University

Research Department which was in principle prepared to undertake the required experiments.

VIII. The parties then agreed that the case should be decided on the facts as they stood, the Respondent moreover expressing disapproval of the Board's choice of institute.

IX. The subsequent procedure led to a second oral proceedings being held on 25 March 1993. At the end of the oral proceedings, the Appellant Akzo AG requested that the decision under appeal be set aside and the patent revoked to the extent of the Respondent's main request and auxiliary requests A, A1, B and C.

The Appellant Sartorius requested that the decision under appeal be set aside and the patent revoked in its entirety and also that the appeal fee be reimbursed.

The Respondent requested that the appeals be dismissed (main request) and, as auxiliary requests that the patent be maintained in amended form on the basis of requests A, A1, B, C and D submitted at the oral proceedings in that order.

X. Claim 1 according to the main request is set out in paragraph I above.

Claim 1 according to auxiliary request A reads as follows:

"A microsporous, hydrophilic, skinless, alcohol-insoluble membrane sheet of polyhexamethylene adipamide, capable when completely immersed in water of

being wetted through within no more than one second, having a pore structure from face to face such that when the membrane is subjected to air pressure the air flow in both directions gives flow pressure curves that are equal or nearly so, and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water."

Claim 1 according to auxiliary request A1 reads as follows:

"A microsporous, hydrophilic, skinless, alcohol-insoluble membrane sheet of polyhexamethylene adipamide, capable when completely immersed in water of being wetted through within no more than one second, having a pore structure from face to face such that when the membrane is subjected to air pressure the air flow in both directions gives flow pressure curves that are equal or nearly so, said membrane providing a sterile effluent when challenged by a given microorganism and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water.

Claim 1 according to auxiliary request B reads as follows:

"A filter element comprising a microsporous, hydrophilic, skinless, alcohol-insoluble membrane sheet of polyhexamethylene adipamide, capable when completely immersed in water of being wetted through within no more than one second, having a pore structure from face

to face such that when the membrane is subjected to air pressure the air flow in both directions gives flow pressure curves that are equal or nearly so, and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water, which sheet is formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight."

Claim 1 according to auxiliary request C reads as follows:

"A filter element comprising a microsporous, hydrophilic, skinless, alcohol-insoluble membrane sheet of polyhexamethylene adipamide, capable when completely immersed in water of being wetted through within no more than one second, having a pore structure from face to face such that when the membrane is subjected to air pressure the air flow in both directions gives flow pressure curves that are equal or nearly so, said membrane providing a sterile effluent when challenged by a given microorganism and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water, which sheet is formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight."

Claim 1 according to auxiliary request D corresponds to Claim 8 of the granted patent and is set out in paragraph I above.

XI. The Chairman of the Board then closed the proceedings, the Board reserving its decision.

Reasons for the Decision

1. The appeals are admissible.

2. As to formal matters, the objection raised by Sartorius under Article 123(2) to the main process claim during the opposition proceedings has not been repeated in the appeal proceedings. In this respect the Board sees no reason to disagree with the conclusion of the Opposition Division as set out in point 6 of the Reasons for the Decision.

3. *Main Request*

3.1 As regards patentability of Claim 1 according to the main request, the main point of contention is whether or not Marinaccio constitutes an enabling disclosure of the subject-matter claimed, so that the issue is one of novelty.

3.2 The membrane according to Claim 1 (main request) has the following features:

(i) microsporous
(ii) alcohol-insoluble and prepared from polyhexamethylene adipamide (nylon 6,6)

(iii) inherently hydrophilic, that is
(a) capable, when immersed in water, of wetting through within no more than one second
(b) reverting when heated to a temperature just below the softening temperature of the membrane, to a hydrophobic membrane no longer wettable by water
(iv) skinless.

3.3 Feature (i) does not, in the Board's view, give rise to problems of interpretation. Microsporous membranes are generally understood to have a particle size cut-off point lying between that of ultrafiltration membranes and macroporous filters, in numerical terms 0.01 to 10 µm, though there may be overlap at the ends of the range with that of ultrafiltration and macrofiltration. In this respect attention is drawn to Michaels, published 26 October 1971, therefore before the priority date of Marinaccio. Michaels, in discussing prior art, says: "One type has an isotropic, sometimes called homogeneous, structure whose flow and retention properties are independent of flow direction" (column 2, lines 8 to 10), and goes on to refer to these "aforesaid, filter-like microsporous membranes" (column 2, line 27). Pall, in addition to embracing such isotropic microsporous membranes, also includes those wherein the pores taper from one surface to the other (see e.g. the wording of Claims 2 and 3).

Feature (ii) requires no comment.

Feature (iii)(a) defines the required degree of hydrophilicity, the word hydrophilic being a relative term.

Feature (iii)(b) incorporates into the definition of the membrane a test for inherent hydrophilicity; membranes which have been rendered hydrophilic by treatment with a wetting agent do not pass this reversion test.

Feature (iv) however gives rise to contention. There would seem to be no doubt as to what a skinned membrane is in the case of a reverse osmosis membrane having a non-porous skin, which membrane functions by molecular diffusion. Similarly the isotropic membranes referred to above are clearly skinless. Between the two extremes there is a grey area within which from the history of the present case is clear that the terms "skinned" and "skinless" mean different things to different people. Some instances of this problem will be seen in the following.

One method of establishing whether a membrane is skinned or not is by examining a scanning electromicrograph (SEM) of its surface and cross-section. However in a trial before the UK High Court, three experts came to different conclusions as to what SEMs of membranes designated 5-19-102 and 5-20-100 showed. To quote from page 61 of Mr Justice Falconer's judgment as supplied to the Opposition Division with the Patentee's letter dated 8 August 1989:

> "Dr. Pall thought they showed a very minor skinning on one side, Dr. Kesting was unable to say whether the difference between the two surfaces was due to skinning or tapered pores and Professor Gryte thought the SEMs showed the material to be skinless."

Further, at the oral proceedings held on 29 April 1992 before the Board, Akzo referred to SEMs of a membrane identified as Enka 2D. Photographs (3A, 3B, 3C) of these SEMs accompanied Akzo's communication dated 2 November 1992. The upper surface of this membrane clearly shows a skinned membrane with pores. Nevertheless in a US arbitration process (see the latter communication), this membrane was considered to be skinless, using the doctrine of equivalents, apparently because the skinned surface did not dictate the properties of the membrane.

A further complication is introduced by the phenomenon referred to by Sartorius, *inter alia* in the communication dated 26 March 1992, as "Verklebungen" (see page 10 thereof). This is a flattening of the surface of the membrane which occurs, after its formation, on drying in contact with e.g. a glass plate and in the view of the Appellant is to be distinguished from skinning. This phenomenon was also referred to by Cuno during the opposition procedure (letter dated 20 October 1989) and was demonstrated by experiments in which membranes which were dried under tension against a drum surface were compared with those dried on a hoop in air. SEMs (Exhibit Q accompanying said communication) show that the membranes dried on a hoop do not show the surface imperfections caused by flattening.

It is clear therefore that SEMs by themselves cannot be used to determine with certainty whether a membrane is skinless or not.

Now Pall does not contain what could be said to be a definition of what is meant by skinless, but rather seeks to explain skinlessness by reference to what is skinned. However the description does assist in this respect. Figure 3 is a graph showing a plot of the ratio air flow/air pressure applied against air pressure applied to a water-wet membrane. An unskinned uniform membrane has a liquid displacement curve as shown in Figure 3, the curve having a substantially horizontal portion until a pressure is reached (the K_L value) at which the curve changes sharply to substantially vertical (see page 11, lines 51 to 63). Skinless membranes having tapered pores are characterised by the fact that the curves obtained by reversing the direction of pressurisation do not coincide (page 15, lines 23 to 30). Skinned membranes however behave completely differently (page 12, lines 4 to 9), the curve sloping upward initially, with a gradual transition to a more vertical, but still sloping portion. The Board is satisfied therefore that with the aid of liquid displacement curves, a distinction can be drawn between unskinned and skinned membranes which is sufficient for the purposes of this decision.

3.4 The first question to be considered is the teaching which can be derived, explicitly or implicitly, by the person of average skill in the art reading Marinaccio.

In the first place Marinaccio clearly discloses microsporous membranes - cf. the wording of Claim 1, the title, the introduction and numerous references to microporosity throughout the description. Marinaccio indeed embraces film-forming polymers in general, but

the preferred film-forming polymers are nylon polymers, especially non-alcohol soluble nylons (column 5, lines 53, 54 and column 9, lines 18 to 20). Polyhexamethylene adipamide (nylon 6,6) is singled out for special mention in column 9, lines 11 to 17.

The membranes obtained are "generally ... more wettable than the prior art films (column 8, lines 40 to 42) arguably indicating that they can be hydrophilic, though the film can be treated with a wetting agent (column 6, last paragraph). This feature will be considered in more detail later (see paragraph 3.15 below).

Moreover the disclosure, logically interpreted, embraces membranes that are symmetric in that they do not have a graded cross-section and are therefore skinless. This is apparent in particular from column 4, last paragraph, wherein is stated: "The technique (that is, provision of a short air evaporation zone) could be used in those cases in which a graded cross-sectional structure is desired in the film" which is a clear indication that otherwise, a symmetric membrane is sought to be obtained.

3.5 Clearly, Marinaccio does not explicitly disclose a nylon 6,6 membrane (or any other membrane) having the specific hydrophilicity required by features (iii)(a) and (b) (see paragraph 3.2 above) of Claim 1. The question therefore arises whether membranes having this feature are inevitably obtained when carrying out a process which follows the teaching in Marinaccio. It will be noted from paragraph 3.4 above that it is the Board's opinion that Marinaccio discloses process

details intended preferably to result in a microsporous skinless membrane. Independently of this opinion, the question of skinlessness will also be answered in establishing what membranes are inevitably produced in following the teaching of Marinaccio.

3.6 Both of the present Appellants produced during the opposition proceedings the results of experiments seeking to demonstrate the above-mentioned inevitability.

Akzo (see grounds of opposition dated 5 February 1988) repeated the teaching of Example 1 of Marinaccio with a nylon 6 comparable to that used in Example 1 and also with a nylon 6,6. The membranes produced were immediately water-wettable and showed a reversion to non-wettability on heat treatment with a hair dryer. The accompanying SEMs, in the Board's view, show no indication of skin on the surfaces of either the nylon 6 or nylon 6,6 membrane.

Sartorius, with the grounds of opposition dated 12 February 1988, also submitted the results of experiments having the same end in view. Nylon 6,6 was used and membranes were prepared by processes falling within the scope of Claims 1, 2, 4, 5 and 9 of Marinaccio. The membranes prepared were spontaneously wettable, showed the reversion effect and were microsporous. SEMs showed no skin on either surface and the substantial uniformity of the cross-section. Bubble point and water-permeability determinations showed the membranes to be comparable to commercial Pall membranes, and those membranes having a nominal pore

diameter of 0.2 and 0.1 µm were sterile to *Pseudonomas Diminuta*.

3.7 In both the opposition proceedings and appeal proceedings the Respondent questioned these results. As regards Akzo's experiments, the Respondent, in the communication dated 16 February 1989 (opposition proceedings) objected that insufficient experimental detail was given, that no samples were provided to the Patentee and that the membranes obtained were in any case skinned on both surfaces. In the Board's opinion, the experimental detail was substantially the same as in Example 1 of Marinaccio; in the case of nylon 6,6 the proportion thereof had to be altered because of its different solubility in formic acid. As indicated above, moreover, the SEMs did not, in the Board's view, show a skin on either surface. Detailed criticism of the Sartorius experiments came mainly in the response to the grounds of the appeal (communication dated 21 June 1991, pages 29 to 34). The objections, briefly summarised are: use of nylon 6,6, as in Pall, rather than nylon 6, as in Examples 1 to 7 of Marinaccio; use of water as non-solvent as in Pall rather than methanol or glycerol as in Marinaccio; use of 47 parts by weight formic acid and 53 parts by weight water as the quench bath, this being within the quench bath composition required by Pall, whereas in the Examples in Marinaccio no solvent is added to the quench bath; use of critical process parameters not disclosed in Marinaccio, namely, temperature control, controlled mixing of casting solution, high purity ingredients and specific order of adding ingredients in preparing the casting solution. Further objections were that the Patentee was not present during the experimental work, therefore it is

not known how many unsuccessful experiments were carried out, and the qualifications of the experimenters was not stated. Finally the SEMs show the membranes to be skinned.

3.8 In the communication issued by the Board accompanying the summons to the oral proceedings held on 29 April 1992, the opinion was given in effect that the detailed information concerning the Sartorius experiments did not go beyond the teaching of Marinaccio, but merely represented the accurate recording of what actually was being done, this being to be expected of the competent laboratory chemist.

At this point it is convenient to indicate the Board's view as to what Marinaccio says about temperature. There are three passages of interest in this respect. Column 2, lines 19 to 25, states that by controlled variation ... of the quench bath temperature ... the properties of the resulting film can be altered. This is repeated in column 4, lines 55 to 59. The person of average skill in the art therefore learns that at least the quench bath temperature has a role to play in the structure of the membrane, and even though Marinaccio does not in so many words say that temperature control is necessary, it is clear to the average skilled person from the foregoing that it should be given some attention. Column 7, first paragraph, however, relates to something which is completely different from temperature control. It states that since special conditions of temperature or pressure are not necessary, it is convenient to operate at or near room temperature. Pall contains similar statements, namely, that the solvent for the polyhexamethylene adipamide is

formic acid at any temperature from freezing to boiling (page 6, lines 7, 8) and the temperature of the casting resin solution is not critical (page 8, line 58). It is noted that in his evidence before the UK High Court, Mr Marinaccio, referring to prior art processes for making reverse osmosis membranes, stated that these required up to 30 minutes' evaporation time and iced water to do the quenching. This appears to the Board to be an example of what would be intended by special conditions of temperature. Accordingly the references to precise temperatures in the Sartorius experiments are not seen as going beyond the teaching of Marinaccio.

In the said experiments, formic acid is used as solvent for nylon and water as non-solvent. Nothing contentious arises from the use of formic acid as solvent in the casting solution since it is a well-known solvent for nylon, is used in Examples 1 to 7 and specifically mentioned in Claim 4. However Sartorius uses only water as non-solvent in the casting solution, whereas Marinaccio in the Examples uses methanol (Examples 1, 5 and 6), a mixture of methylformate and water (Examples 2 and 3) and glycerol (Example 4). Further Sartorius adds formic acid to the quench solution in the proportion 47 parts by weight formic acid to 53 parts by weight water. In the Marinaccio Examples no solvent is added to the quench solution.

However, quoting Technical Board of Appeal Decision T 12/81,

> "The teaching of a cited document is not confined to the detailed information given in the examples

> of how the invention is carried out, but embraces any information in the claims and descriptions enabling a person skilled in the art to carry out the invention."

Now, Marinaccio, in column 6, lines 4 *et seq*, states that the nylon solutions may be diluted with non-solvent for nylon, up to the point of incipient precipitation of nylon but not beyond. It goes on to say that where water-mixable nylon solvents are employed (formic acid being such a solvent), water can be the added non-solvent. The quenching bath can consist of the same non-solvent selected for preparation of the nylon solution, and may contain small amounts of the solvent employed. This gives rise to some difficulty in interpretation, because, on the other hand, the only stated limitation of the said small amount is that the ratio of solvent to non-solvent is lower in the quenching bath than in the casting solution, a feature which is moreover the subject-matter of Claim 9. Sartorius was working wholly within the latter teaching of Marinaccio. Nevertheless to the extent that Sartorius used a relatively large proportion of formic acid in the quench solution, as does Pall, rather than the small amount referred to above, or none as in the Examples, the Board's provisional view was that the Respondent's objections had in this respect some foundation, although as argued by Sartorius, the average skilled person carrying out the teaching of Marinaccio could experiment with any amount of formic acid in the quench bath between zero and the above-indicated upper limit. In this respect the Board was interpreting Marinaccio in favour of the Respondent, a point which should be stressed because

the Respondent has at times implied that the Board was interpreting Marinaccio in the Appellant's favour.

3.10 It was not necessary for the Board to decide finally on this point because Sartorius in the communication dated 12 August 1991, indicated the intention to have the teaching of Marinaccio repeated by an independent organisation, requesting a period of six months to have this carried out. The Board agreed to this, in view of the fact that oral proceedings requested by the parties could not reasonably have taken place much earlier. In agreeing to further experiments, the Board is of the opinion that this was not giving the Appellant a further opportunity at a late stage in the proceedings to make good an unconvincing argument. The first tests were arguably convincing, and the results are corroborated by the results of the Akzo experiments (see above) and also by much of the evidence submitted by Cuno during the opposition proceedings, of which more will be said later (see paragraph 3.15 below).

3.11 The Dresden Institute's experiments (see "Prüfbericht" and "Prüfprotokolle" accompanying Sartorius' communication dated 17 March 1992) resulted in the production of 26 membranes plus a further three (Maschinenversuche), whose properties were compared with those of three Pall commercial membranes, which can be considered to have the properties required by Claim 1 of Pall since this has not been disputed. All of the membranes had K_L curves corresponding to that of a non-skinned microsporous membrane (see paragraph 3.3 above), that is, to the only non-subjective criterion for skinlessness. It is true that in the case of membranes 14 and 15, the second portion of the curve is

some way from vertical; however in both cases the first portion is substantially horizontal and there is no large radius transition from one portion to the other which would be an indication of skinning (cf. Pall, page 12, lines 4 to 7). SEMs were obtained for five of the said membranes as well as for the three Pall membranes Ultipor N6,6 having nominal pore diameters of 1.2 µm, 3 µm and 5 µm respectively. The Board can share the view of the Appellants that none of the said five SEMs shows a skin, those corresponding to Prüfprotokoll 4 and 13 showing, on the side which was formed in contact with a glass plate, the flattening effect referred to in paragraph 3.3 above in the discussion of the meaning of skinless. In this respect the Board has compared these SEMs with the SEMs submitted as Exhibit 1 with Akzo's grounds of appeal and as Anlage 1 with Akzo's communication dated 2 November 1992, and also with a SEM bearing the number 144491 on page 21 of a red folder labelled Bundle Y, File B, which was filed by the Respondent during the opposition proceedings. In the Board's view, this SEM shows a gradation from skinned at the left hand side to skinless at the right hand side. The Board also compared the SEMs with those corresponding to Figs. 8 and 9 of Pall, submitted with Dr. Kesting's Report of Review dated 31 July 1992 and said to show a lightly and heavily skinned membrane respectively. It is true that the SEMs of Prüfprotokoll 20 and 28 show the so-called tennis ball structure. However the SEMs of the three Pall membranes also show such a structure. Further it has not been proved that membranes with such a structure cannot function as membranes, even taking into account that in general synthetic membranes show a spectrum of structures with a gradation from closed cell passing through

interconnected cell and reticulated to fused sphere (tennis ball) and that the next stage is disintegration to powder.

All of the membranes were moreover hydrophilic, wetting through within a second, and all five membranes submitted to the reversion test became hydrophobic.

Prüfprotokoll No. 30 gives the results of experiments based on Marinaccio Example 2, but using nylon 6,6 instead of nylon 6. The casting solution contained as non-solvent a mixture of methyl formate and water, and while maintaining the ratio of these two constituents the same as in Example 2, different amounts of the non-solvent were added to the casting solution. This is a reasonable departure from Example 2 since a different nylon was being used. Similarly in addition to a quench solution containing 50:50 methanol/water as in Example 2, 30:70 and 70:30 methanol/water quench solutions were also tested, these being the only other quench solutions used in other Marinaccio examples. On the basis of the results, three continuous runs (Maschinenversuche) were made, using in all cases 70:30 methanol/water as quench solution. The membrane obtained in Maschinenversuch III was skinless as shown by the K_L diagram and SEM of its cross-section, had a bubble point corresponding to that of a 0.2 µm membrane and was sterile to *Pseudomonas diminuta*. Maschinenversuch II also appeared skinless from SEMs accompanying Akzo's communication dated 2 November 1992 and, although not sterile to *Pseudomonas diminuta*, otherwise was stated to come close to the requirements of a 0.45 µm membrane. Maschinenversuch I presumably failed.

3.12 The Board is satisfied that the Dresden experiments did not deviate from the teaching of Marinaccio, any differences being dictated by the use of nylon 6,6, which as previously indicated, is singled out for mention in Marinaccio, column 9, lines 15 to 17, or a different nylon 6. No teaching has been borrowed from Pall, which uses only water as non-solvent in the casting and quench solutions. More significantly, in the Dresden experiments, the non-solvent is stirred into the casting solution using a glass rod, which is quite different from the in-line rotary mixer used in Pall so as to induce the nucleation which, as will be seen , is in the Board's view the key feature of the Pall process.

In the Dresden experiments, the nylon solution was cast on to a glass plate, that is to say the continuous casting apparatus according to Figures 1 and 2 of Marinaccio was not used. This again is seen as a measure which the experimenter would adopt on a laboratory scale, and not as a departure from the Marinaccio teaching. In any case, Example 8 describes casting on to a glass plate followed by immediate quenching, admittedly for the preparation of a polystyrene membrane, but there is nothing in Marinaccio to suggest that the apparatus of Figures 1 and 2 is limited to the preparation of nylon membranes and the glass plate casting to the preparation of polystyrene resins.

3.13 The Dresden experiments were reviewed by the Respondent's acknowledged expert Dr. Kesting. One of his criticisms was that the Dresden Institute was provided with Pall as well as Marinaccio and therefore

was inevitably influenced by the Pall teaching. As indicated above, the Board can see no borrowing from Pall in the Dresden experiments. Dr. Kesting referred in particular to the use of 98% formic acid (Pall uses 98.5%), arguing that in the 1970s the most common laboratory grade was only 90% pure. However, according to the evidence of Mr. Knight, co-inventor with Mr. Marinaccio, on day twelve of the UK trial, the grade of formic acid being used in the work leading to Marinaccio was Eastman Kodak 97+ (page 48 of transcript). No serious difference can be seen here. In any case, while the use of formic acid of accurately known purity would be an aid to reproducibility, it would not in itself in the Board's view guarantee the production of a microsporous, skinless, hydrophilic membrane.

That Eastman Kodak 97% formic acid was being used as early as 1970, and that this was known to the Respondent, is confirmed in Appendix II to the Respondent's letter dated 16 March 1992.

Other instances of departures from Marinaccio in the opinion of Dr. Kesting are aging of the casting solution, casting in air and addition to the casting solution of amounts of methyl formate and water nowhere disclosed in Marinaccio.

As to aging, Marinaccio states, in column 6, lines 18 to 27, that the casting solution is sometimes aged before casting, variation in the aging period leading to variation in the properties of the eventual membrane. Aging should not take place over an excessive period since nylon may separate out, but in general can

be extended for 5 to 8 days or even indefinitely. Accordingly, aging of the casting solution is not seen as departing from the teaching of Marinaccio. The experimenter, having made up a batch of casting solution, is free to use it for as long as nylon does not separate out. However, having noted the above-mentioned passage in Marinaccio, it is proper for him to record the age of the casting solution.

In any case, in the Board's view, aging leads to equilibration of the constituents of the casting solution and is therefore one of the factors playing a role in reproducibility, that is producing substantially identical membranes, whether good or poor, from different runs. It is not in itself a guarantee that a good membrane will be obtained, though it is one of the factors affecting pore size.

By casting in air is meant in the Dresden tests casting in an atmosphere saturated with formic acid followed by immediate quenching - see Prüfbericht, page 7, middle paragraph, page 11, last paragraph and Figure 7. Such a measure is also referred to in Marinaccio, page 6, lines 56 to 61.

In the Dresden tests, the ratio of methyl formate to water in the non-solvent added to the casting solution is maintained constant, said ratio corresponding to that of the Examples in Marinaccio. The amount is varied, as is reasonable taking into account the fact that different nylons are being used, and is justified by the Examples. For example in Example 5 of Marinaccio, 80% of non-solvent methanol is added to the casting solution as compared with Example 1. Similarly

Maschinenversuch II uses 80% of non-solvent as compared with Example 2. Dr. Kesting also suggested that at least 90% of the Dresden experiments and results were suppressed. Sartorius have pointed out in the communication dated 6 November 1992, that had this been the case, more cunning would have been employed in formulating the results. Sartorius further indicated that the casting solutions were given numbers in sequence. From a study of the Prüfbericht it appears that solutions of nylon in formic acid were prepared in 1 litre flasks, therefore presumably in about 500 ml batches. If from these solutions more than one casting solution was prepared (by addition of different amounts of non-solvent) these were identified by the letters a, b, c, otherwise not - cf. solution 2. The sequence of numbers goes up to 13 and while there could be further, unrecorded, numbers, it appears from the unbroken sequence 10 to 13 that any teething troubles had been overcome, so that 13 is probably the final number. Therefore membranes, 23 in all, were prepared from casting solutions 2, 8b, 8c, 10c, 11c, 12a, 13a and 13b, but not from the missing numbers 1, 3, 4, 5, 6, 7 and 9, or for that matter from at least 8a, 10a, 10b, 11a, 11b and 12b. However the Board accepts that the Dresden experimenters were starting from scratch and had to gain experience. Since they were obliged to use a different nylon 6 from that disclosed in Marinaccio and further were using nylon 6,6 it is clear that some experimentation was required in order to obtain nylon solutions. Further it can be assumed that at times the selected amount of non-solvent in the casting solution caused precipitation. No doubt also in other cases membranes were not obtained. However although negative results have not been recorded, these have, in the

Board's view, not been suppressed, and the Respondent's accusation of dishonesty is without foundation. Moreover, comparing the positive results with the estimated negative results, the Dresden experiments involve no more than the reasonable trial and error permitted to the average skilled person seeking to repeat a technical teaching, particularly in a field such as the present one where at least at the time of Marinaccio results are less predictable than in more conventional chemical reactions. In this respect the Respondent has argued that the fact that the Dresden tests required 6 months is an indication of undue experimentation. However it emerges from the Prüfprotokolle that apart from No. 30, all the recorded preparations and tests had been completed by 13 December 1991, that is, within about 2 months. Prüfprotokoll No. 30, which, it will be recalled, gives the results of the experiments leading to the Maschinenversuche, was completed mid-February 1992. Since any remaining time can be accounted for in collating and discussing results, the Board sees no evidence of undue experimentation here.

Dr. Kesting observed further that SEMs and reversion tests were carried out on only five of the membranes. As explained in the Prüfbericht, not all of the features of every membrane prepared were investigated because of lack of time. However, as pointed out by Sartorius, the K_L diagram was established for every membrane, since this was the only objectively verifiable criterion for skinlessness, an opinion shared by the Board. Further, every membrane was found to be hydrophilic in the sense that it was wet through within 1 second. Since the reversion test is merely a

test of the inherency of the hydrophilicity of the membrane, and not in itself a useful property of the membrane, it seems reasonable, in the absence of negative indications, to limit the application of tests and to rely on the demonstrated inherent hydrophilicity of the membranes.

Dr. Kesting also suggested that the SEMs might have been carried out on selected portions of the membrane and not be representative of the membrane as a whole. As pointed out by Sartorius, the complete scan of one surface of a 20 x 20 cm membrane would involve 16 million individual points. In any case the SEMs are only seen as corroborating the K_L diagrams.

Dr. Kesting repeated the objection, raised several times by the Respondent, that no samples of membranes made by the Appellants had been given to the Respondent for testing. During the second oral proceedings, Sartorius commented that no actual request for samples had been made, and the Respondent did not contradict this. It is noted moreover that page 2 of the Prüfprotokolle refers to three membranes prepared as in Prüfprotokolle 6, 12 and 27 with a view to handing over to Pall. Dr. Kesting also drew attention to the fact that only two membranes were tested for alcohol insolubility. These were prepared from Ultramid A5 (a nylon 6,6) and Miramid SH3 (a nylon 6). Since these were the only two nylons used, it was considered sufficient to confine the test to two membranes (page 19 of the Prüfbericht) and the Board can agree with this.

3.14 Accordingly, the Board is satisfied that the disclosure in Marinaccio is sufficient to enable the average skilled person to prepare, with a reasonable degree of certainty, membranes falling within the scope of Claim 1 according to the Respondent's main request, without using knowledge going beyond that obtaining at the publication date of Marinaccio.

3.15 Now if this conclusion were wholly at odds with other evidence adduced during the prosecution of the case, there would be grounds for questioning its validity. In the Board's opinion this is not so, as will emerge from an examination of said evidence insofar as it relates to the question of whether the process disclosed in Marinaccio leads to a skinless, inherently hydrophilic membrane, since the other features (i) and (ii) of Claim 1 (see paragraph 3.2 above) do not, in the Board's view, give rise to problems as regards the disclosure in Marinaccio. Hydrophilicity can be disposed of first. The Marinaccio disclosure in this respect has been set out in paragraph 3.4 above. Marinaccio clearly says nothing about a degree of hydrophilicity as is required by Claim 1, only that the membranes are generally more readily wettable than the prior art films and, from the wording "can be treated with wetting agent", do not necessarily have to be so treated. However, page 23 of Cuno's grounds of opposition refers to their accompanying Exhibit D, which is the minutes of a meeting of staff of AMF Cuno which discussed *inter alia* the project leading to Marinaccio. On page 2, it is said that one advantage of the membrane, admittedly prepared from Nylon 6, over Millipore (a commercial membrane) was that it was inherently water-wetting (hydrophilic). This is

confirmed by Mr. Marinaccio's evidence before the UK Court, day nine, page 28 of transcript, from which it further emerges that he and his co-workers were more excited about being able to produce a microsporous film than about its wettability, which could explain the lack of detail in the patent. As to the optional treatment with a wetting agent, it should be noted that Marinaccio embraces membranes made from other polymers such as polystyrene and cellulose acetate, the latter at least being known to require wetting agents.

As regards the reversion test, as stated above this is not a useful property of the membrane, because it would be just as good a membrane if it did not revert to the hydrophobic state, or even better because it could then be heated to a relatively high temperature with impunity. It is merely a test, albeit imaginative, for inherent hydrophilicity, and since some at least of Mr. Marinaccio's membranes had this property, there was no need for him to think of an additional test to prove it.

Accordingly, in respect of features (iii)(a) and (b), the Board's conclusion is consistent with other evidence.

Much of the argumentation of the Respondent resides in the contention that in the period 1970-1973 leading to the Marinaccio patent, AMF Cuno were never able to make a skinless membrane, that the project was terminated because of the skinning problem and that when it was resurrected in 1978, development to a marketable product cost about three million dollars and required about ten man years. The Board is not persuaded that

AMF Cuno never made a skinless membrane in the 1970-1973 period. Exhibit B (a red file) filed by Cuno with the grounds of opposition and commented on by the Patentee in Annexes I and II to the counterstatement dated 9 October 1989 contains a number of samples and SEMs of membranes made in the period 1972-1973. A copy of the inventory of these made by Mr. Knight on 15 October 1973, is to be found in a black file described as Counterstatement, Annex I, Exhibits. The Patentee also filed with the communication dated 21 September 1989 the aforementioned Bundle Y which comprised *inter alia* black file A and red file B also containing SEMs of Cuno membranes. Of all of these SEMs some 50% are in the Board's view clearly unskinned, 25% clearly skinned and the remainder difficult to judge, based on the SEMs. Of these, DR153, DR197, DR200, DR212, DR220, DR228, DR233 and DR239 are particularly impressive, as is also DR226/227; the latter is however not mentioned in the inventory. All were prepared according to Example 2 of Marinaccio using nylon 6, variations being concentration of nylon, the way in which non-solvent is added and proportion of methyl formate to water in the non-solvent. In the preparation of DR153, DR220 and DR228 the amounts of methyl formate and water stated in Example 2 were used. The deviations from Example 2 do not go beyond the teaching of Marinaccio as a whole nor beyond routine experimentation. However it is not important to go into this in detail, because the Board looked at these SEMs only because of the Respondent's argumentation that it was "wholly illogical" that Akzo and Sartorius could have prepared skinless membranes using the teaching of Marinaccio when this had never been done before. In the Board's view, the result of inspecting the said SEMs

indicates that it was in no way surprising that Akzo and Sartorius succeeded.

The Board notes that Mr. Justice Falconer found that membrane DRLBI was slightly skinned on one surface. DRLBI is one of the membranes that the Board found difficult to decide on, however Exhibit R accompanying Cuno's letter dated 20 October 1989 shows that its K_L diagram is that of a non-skinned membrane. Justice Falconer however took the view that, whether skinless or not, DRLBI had not been prepared according to Marinaccio, because the preparation included a regeneration system for the quench bath, the subject of another patent but not mentioned in Marinaccio. However the quench bath regeneration system is only a means for ensuring that the composition of the quench bath remains substantially constant for the duration of a run, thus contributing to ensuring that the properties of the membrane at the end of the run remain the same as those as the beginning. Otherwise the composition of the quench bath changes as the casting solution, of different composition, is run into it. The quench bath regeneration system therefore does not in itself dictate whether a porous or non-porous, skinless or non-skinless membrane is obtained. In fact it could be seen as reducing the likelihood of obtaining a membrane with particular properties, because allowing the composition of the quench bath to change could result in a non-uniform membrane, part of which had the desired properties. Accordingly the use of the quench regeneration system, although outside the teaching of Marinaccio, is not a feature which when added to Marinaccio makes the difference between success and failure. This also deals with the Respondent's argument

that the drum run preparation of membranes after DRLBI, therefore all of the Exhibit B membranes, would have used quench bath regeneration, and thus that these were not prepared according to Marinaccio.

The Board is moreover not convinced that, as contended by the Respondent, the AMF Cuno 1970-1973 project was terminated because of the problem of skinning. It appears rather, from Tab 12 accompanying the Respondent's outline presented at the oral proceedings of 29 April 1992, that the membrane was generally comparable to that produced by the competition, but not a clearly superior product. It emerges clearly from the various AMF Cuno Status Reports that the main problem was reproducibility, either within a run or run to run so that commercial yields were not obtainable. It also appears that the desirable 293 mm discs could not be obtained (see above-mentioned Tab 12). It is true that said reports refer at times to a skinning problem, but not in terms suggesting that only skinned membranes were being obtained. Moreover as pointed out by Mr Marinaccio in his evidence before the UK High Court, the word skin was being used rather loosely at the time. He preferred to restrict the use to the skin which is characteristic of reverse osmosis membranes. At the other extreme, certain of his colleagues ascribed a skin to any membrane whose flow properties differed from what was expected.

The Respondent has referred repeatedly to the Monthly Status Report, October 22 - November 19, 1971 (see for example Tab 5 accompanying the outline presented at the

oral proceedings of 25 March 1993). Here however the expression "sometime sort of thing" refers to the ability to **reproduce** a **given** AMF microsporous film. The summary goes on to refer to lack of reproducibility of pore size, but makes no mention of skinning.

3.16 Certain other aspects of the Respondent's counter-argumentation can be summarised as follows.

In Dr. Kesting's Report of Review dated 31 July 1992, it is stated on page 11 that "It is simply not correct, historically and scientifically to equate the microsporous membranes of the early to mid-1970s, i.e. the Marinaccio use of that term, with the skinless membranes of the Pall invention" and on page 19: "To scientists such as myself and Mr Marinaccio and his colleagues, the term microsporous in the 1970s and today was and is not an indication of skinlessness in the sense of the Pall patent definition". This is not consistent with the passage in Michaels (application date 1968) quoted in paragraph 3.3 above, or for that matter with Tab 5 annexed to the said report, this being a memo from Mr Marinaccio in 1970 distinguishing between skinned and unskinned membranes.

On page 9 of Dr. Kesting's report it is stated that structural imperfections such as macrovoids, which can be tear-dropped, spherical, ellipsoidal or finger-like in shape (see also Tab E, point 5.09 annexed to Pall's letter of 19 March 1993) are frequently found in skinned membranes. No such macrovoids can be seen in any of the cross-section SEMs submitted during the prosecution of this case. On page 5 of the outline presented by the Respondent at the oral proceedings

held on 25 March 1993, paragraph 3d, there are listed "necessary and unobvious features" not disclosed in Marinaccio. Apart from restrained drying, these have already been dealt with. In the absence of restrained drying, the membrane will shrink in an uncontrolled manner, so that restrained drying can be seen as another feature contributing to reproducibility, but not determining whether or not the membrane is skinless. It is true that Tab 10 of the Respondent's outline presented at the oral proceedings held on 29 April 1992 refers to a skinned membrane which had been dried under non-restrained conditions. However this was not compared with a control, therefore cannot be said to show that non-restrained drying results in a skinned membrane. In any case Cuno's experiment referred to in paragraph 3.3 above, in which membranes were dried on a hoop in air, and therefore presumably non-restrained, resulted in skinless membranes.

The said paragraph 3d goes on to refer to solubility parameters, stated in Marinaccio to provide guidance for selecting suitable solvents and non-solvents but in the Respondent's view being useless for this function. This may or may not be the case, but the reader of Marinaccio is given sufficient other guidance in the form of lists of solvents and non-solvents.

As to the Respondent's objections to certain procedural matters, the Board observes the following.

Ideally the repetition of the Marinaccio teaching by the Dresden Institute should have been carried out without knowledge of Pall. However as indicated above the Board is satisfied that nothing was borrowed from

Pall in the Dresden experiments. It is true that, by being provided with Pall, they became aware that the object was to prepare a microsporous skinless resin. However as indicated in paragraph 3.4 above, the average skilled person derives this information from Marinaccio. Knowledge of Pall merely compensated for the fact that the Dresden Institute had not yet reached the state of being of average skill in the art or having the corresponding knowledge. The Board notes in this respect that before embarking on the project leading to his patent, Mr Marinaccio spent six months reading the pertinent literature, a luxury which was denied to the Dresden Institute in view of the time factor.

It would also have been ideal if the Respondent had been present during the experiments, at least at critical stages. This however has never been a requirement in proceedings before the EPO. In any case the Respondent elected to forgo the opportunity to have further experiments carried out in the presence of all parties and a member of the Board.

The Respondent also argued that the Board should require all of the laboratory note-books of the Dresden experimenters, as well as their qualifications to be submitted to it. The Board is of the opinion that this was unnecessary, the evidence before it being sufficient in itself.

3.17 In summary, the conclusion stated in paragraph 3.14 above is consistent with other evidence adduced during the opposition and appeal proceedings and further the Board is satisfied that no valid objections arise in

respect of procedural matters. Moreover, as regards the decision under appeal, the Board's decision differs from that of the Opposition Division largely in the interpretation of skinless - see paragraph 3.15 of the said decision and the paragraphs leading up to it.

Claim 1 according to the Respondent's main request is therefore not allowable, because its subject-matter is not novel - Article 54 EPC.

4. *Auxiliary Request A*

This differs from the main request essentially in that in Claim 1 there has been inserted the wording "having a pore structure from face to face such that when the membrane is subjected to air pressure flow the air flow in both directions gives flow pressure curves that are equal or nearly so". This according to the description is a criterion for uniform pores (page 15, lines 31 to 35), and could be seen as adding a *desideratum* to the subject-matter of Claim 1, which itself could be considered to consist largely of *desiderata*. However it is not necessary to go into this aspect of the auxiliary request A, or to decide what is meant by "or nearly so", because at the oral proceedings held on 25 March 1993, Sartorius submitted, in response to this request, K_L diagrams on 142 mm membranes prepared in Maschinenversuch II, which demonstrated that two samples (one measured twice) met the additional requirement of auxiliary request A. The added feature therefore does not contribute anything which would confer novelty.

5. *Auxiliary Request A1*

As compared to Auxiliary request A, Claim 1 contains the further feature that the membrane "provides a sterile effluent when challenged by a given micro-organism", that is, another *desideratum*. Moreover, as pointed out by the Appellants, the question of whether a membrane falls within the scope of the claim or not depends on the micro-organism used, so that in this respect the claim is not clear and therefore not allowable (Article 84 EPC).

6. *Auxiliary Request B*

In this request there is added to Claim 1 according to Auxiliary request A the feature, subject-matter of Claim 30 of the main request, that the sheet is formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight.

The Respondent, in the opposition proceedings, acknowledged, in the full counterstatement dated 5 October 1989, that the formation of membranes into filter cartridges was common practice in the art at the priority date of the patent in suit and moreover the said feature of Claim 30 is known from US-A-3 457 339, see in particular Figure 5 and the corresponding description. It is therefore *prima facie* obvious to form the membrane according to Claim 1 of auxiliary request A into such a cartridge. The Respondent argues that it is the surprising flexibility of the Pall membranes which permits this, whereas the Marinaccio membranes are brittle. It is true that these can be

brittle - see Cuno's Exhibit H accompanying grounds of opposition. However Exhibit D filed at the same time indicates that one advantage of the Marinaccio membranes over a then commercially available membrane was better strength and flexibility. Moreover, during Mr. Marinaccio's evidence before the UK High Court, he stated, with regard to the AMF Cuno membrane material, that "you could take and crunch and open it up and have a continuous sheet, so it was very obvious to us that we had something that was drastically different in strength and flexibility". Again in Tab F5 of the above-mentioned Annex I - Exhibits, third page, the membrane is stated to be readily pleated into cartridge form.

In view of the foregoing, Claim 1 according to auxiliary request B is also not allowable, as lacking inventive step (Article 56 EPC).

7. *Auxiliary Request C*

Claim 1 according to this request adds to Claim 1 of auxiliary request B the feature concerning sterility on challenge by a given micro-organism. This feature was dealt with in paragraph 5 above and for the reasons given there, its incorporation in the claim now under consideration does not confer patentability thereto.

8. *Auxiliary Request D*

8.1 Claim 1 of this request corresponds to Claim 8 of the granted patent. Sartorius argues that the subject-matter of this claim is not novel or is obvious having regard to the disclosure in Marinaccio or US-A-

3 208 875 (Holden) or a combination of the two. In particular Sartorius argues that the features of the claim fall wholly within the teaching of Marinaccio. This is to some extent true, but requires equating the reference to aggregation in Marinaccio, column 3, lines 6, 7 and 38 to 48, column 4, lines 12 to 40, with the nucleation required by Pall. The Board is not convinced that this can be done. It is true that the reference to nucleation in the claim is couched in somewhat vague and general terms; however the description, pages 6 to 8, goes into great detail as to what is meant by nucleation, and in particular instructs the reader in what direction to adjust various variables in order to achieve the desired nucleation. It would be unreasonable to require the Respondent to incorporate all of the matter contained in pages 6 to 8 into the claim wording, so that the claim is considered to be as clear as it can be in the circumstances, its meaning being ascertainable by reference to the description. Marinaccio contains no such information in respect of aggregation. Further the claim requires a specific range of concentration for formic acid and water (the only non-solvent required by Pall) in the casting and quench solutions, and while these fall within the general teaching given in Marinaccio, they are nowhere specifically disclosed. Holden predates most of the work on synthetic membranes and while it is directed to vapour permeable sheet materials to be used as substitutes for leather or the like, it has been considered to be prior art of interest in patents relating to membranes. However Holden relates to products which would be expected to be hydrophobic (leather substitutes, battery separators) and mentions polyamides only incidentally

in column 5, line 16. Moreover while Holden contains a lot of information about the effect of adding non-solvent to the casting solution and solvent to the quenching solution, 40 to 95% of the amount of non-solvent required for colloid formation can be added to the casting solution and the quenching solution can contain up to 95% solvent, in both cases much wider than the ranges required by Pall. Holden indeed states in column 7, lines 18 *et seq* that an experienced operator will have little difficulty in estimating the best amount of non-solvent to be added to a solution of a particular type of polymer for the production of a particular type of product, and that an inexperienced operator can readily determine a desired non-solvent range by making a small trial run. This information, from 1965, is of interest as confirming the Board's view concerning the amount of trial and error permissible in seeking to repeat the teaching of Marinaccio. However, all in all, the Board is of the opinion that Claim 1 of auxiliary request D is both novel and non-obvious, in particular because of the requirement for nucleation. The Board is moreover satisfied that as the result of the claimed process features, a desirable membrane can be obtained reproducibly, that is to say having desired properties which are uniform from run to run and within a run, and therefore in high yield. Moreover, uniformity within a run means that relatively large diameter membranes (e.g. 297 mm) can be cut, which is something that, in addition to lack of reproducibility, appears to have eluded AMF Cuno in the 1970-1973 period. In the Board's view the commercial success of the Pall membranes can largely be attributed to the process.

The auxiliary request D can therefore be allowed.

8.2 In view of the numerous requests under discussion, the Board did not require an adapted description to be filed for each of the corresponding sets of claims. Therefore, the adaptation of the description as granted remains to be performed before the Opposition Division.

9. *Reimbursement of appeal fee*

9.1 The Appellant Sartorius has requested refund of the appeal fee on the ground of a substantial procedural violation. Sartorius argues that the Opposition Division, in coming to its decision, considered almost exclusively the argumentation of the Opponent Cuno and in particular did not appear to take into account the experiments carried out by Sartorius (see paragraphs II and 3.6 above).

The Opposition Division referred to the Sartorius experiments in paragraph 8.5 of the Summary of Facts and Submissions, and noted the Patent Proprietor's argument that the conditions of the Sartorius experiments diverged from Marinaccio and came close to those of the patent in suit. In the reasons for the decision however, the said experiments were not further commented upon, nor were those of Akzo (Enka) and the Board can agree that, at least in respect of the product claims, the Opposition Division considered exclusively the argumentation of Cuno. The requirement of Rule 68(2) EPC can only be said to be met when the chain of reasoning in the decision is complete, which means that no relevant evidence present in the proceedings and possibly having an influence on the

result of the reasoning, has been omitted. In the Board's view, this requirement was not met here. Reimbursement of the appeal fee of both Appellants is therefore equitable by reason of a substantial procedural violation.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The Respondent's main request and auxiliary requests A, A1, B and C are rejected.

3. The case is remitted to the Opposition Division with the order to maintain the patent in amended form on the basis of the claims according to auxiliary request D and a description to be amended for conformity.

4. The appeal fee of both Appellants is to be reimbursed.

The Registrar: The Chairman:

P. Martorana E. Turrini