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D E C I S I O N
of 4 March 1999

Case Number: T 0024/96 - 3.2.4

Application Number: 89103895.2

Publication Number: 0332107

IPC: F04D 19/04

Language of the proceedings: EN

Title of invention:
Turbomolecular pump and method of operating the same

Patentee:
Kabushiki Kaisha Toshiba, et al

Opponent:
Leybold Aktiengesellschaft

Headword:
-

Relevant legal provisions:
EPC R. 57a

Keyword:
"Amendment by introducing new dependent claims - neither appropriate nor necessary - section V"
"Novelty and inventive step - yes"

Decisions cited:
T 0829/93

Catchword:
-

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Case Number: T 0024/96 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 4 March 1999

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 27 October 1995 revoking European patent No. 0 332 107 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. A. J. Andries
Members: M. G. Hatherly
J. P. B. Seitz

Summary of Facts and Submissions

I. European patent No. 0 332 107 was revoked by the opposition division's decision dispatched on 27 October 1995.

The proprietor filed an appeal and paid the fee on 5 January 1996 and filed a statement of grounds on 6 March 1996.

II. The following documents (arranged alphabetically) were referred to in the appeal proceedings:

D1: JP-A-59-90784 (with translation) (same as E9 and R14)

Declaration by Dale J. Missimer dated 16 February 1995

Declaration by Dale J. Missimer dated 16 July 1996

E1: see Polycold Form 8312

E2: DE-A-3 512 614

E5: Polycold Systems Inc. Price List for Polycold Cryocoolers dated November 1986

E6: see Polycold Form 8206

E7: JP-A-62-168 994 with a translation into English (the same as R22)

E9: same as D1 and R14

Exhibit A: see Polycold Form 8312

Exhibit B: see Polycold Form 8206

Exhibit C: see R13

Invoice No. 2743 of Polycold Systems Inc. dated 21 March 1983

Invoice No. 2725 of Polycold Systems Inc. dated 25 March 1983

Polycold Form 8312 (same as E1 and Exhibit A)

two printed pages from the company Polycold Systems Inc., one marked "Form 8312" and the other being the cover page entitled "Cryocoolers, Cryopumps and Vacuum Cold Trap Chillers". In particular Model P100-6CB is shown.

Polycold Form 8206 (same as Exhibit B)

two printed pages from Polycold Systems Inc. entitled "Polycold Cryorefrigerator and Baffle Systems Models P75-4CB & P100-6CB"

R1: US-A-4 176 526

R3: US-A-4 597 267

R4: US-A-4 535 597

R5: "A User's Guide to Vacuum Technology" by John F. O'Hanlon, 1980 by John Wiley & Sons. Inc.,

contents pages and pages 251 to 271

R7: "High vacuum pumping systems - an overview" by T. A. Heppell, Vacuum, volume 37, numbers 8/9, pages 593 to 601, 1987

R8: "Cryo Trends Fast-Cycle Pump Forecast: Cold & Dry" by Dale J. Missimer, Photonics Spectra, February 1984

R13: Polycold Systems, Inc., Specifications (of baffles), Form 588B, March 1990 (also called Exhibit C)

R14: see D1 and E9

R21: "Improved turbomolecular pump" by G. E. Osterstrom and A. H. Shapiro, The Journal of Vacuum Science and Technology, Vol. 9, No. 1, January/February 1972

R22: see E7

III. The statement of grounds of appeal listed a main request and four auxiliary requests with respective sets of claims and arguments for the patentability of the claimed subject-matter.

The respondent (opponent) argued in writing against these requests by discussing Polycold Forms 8312 and 8206, alleging that the subject-matter of some of the claims then on file was not new and of others not inventive. Moreover the step of claim 7 of the main request then on file of choosing the temperature of the

heat exchanger so that it only trapped water vapour was either physical nonsense or insufficiently disclosed. Concerning the auxiliary requests, the respondent argued that it was not clear which heat transfer elements of the heat exchanger were disposed parallel to the flow of gas molecules. It was obvious to regenerate while running the pump and closing the valve, as shown e.g. by E2.

A third party submitted a (further) Declaration by Dale J. Missimer dated 16 July 1996 and two Polycold Invoices aiming to prove that the Polycold documents (Forms 8312 and 8206) as well as the Polycold closed cycle cryorefrigerator Model P100-6CB were part of the state of the art.

By facsimile dated 2 March 1999 the appellant (patentee) replaced his requests by a new main request and five new auxiliary requests with respective new sets of claims.

IV. The opponent announced by facsimile received on 2 March 1999 that he would not attend the oral proceedings to which the parties had been summoned. In accordance with Rule 71(2) EPC the oral proceedings on 4 March 1999 took place without him.

V. The oral proceedings commenced with a detailed discussion of the sets of claims of 2 March 1999. The board pointed out that addition of a new dependent claim 7 of the main request of 2 March 1999 (with corresponding claims in the first to fourth auxiliary requests) was an unnecessary, inappropriate and inadmissible amendment even under Rule 57a EPC since

the new dependent claim could not have any influence on the characteristics of the invention as set out in the independent claim 1 from which the new claim 7 depended (see e.g. decision T 829/93, sections 6.2 and 6.3). Moreover following the restriction of the independent method claim 8 of the main request, the way that claims were dependent on this new claim led to the claiming of previously undisclosed combinations of alternatives. There followed a discussion of whether the Polycold documents were publicly available. Then the claims and the prior art were discussed in detail.

VI. Following this discussion the appellant submitted a new single version of the claims 1 to 6 and a description adapted thereto, forming the basis of a sole request and containing the following independent claims:

"1. A turbomolecular pump having a rotor provided with a plurality of rotor blades and a spacer provided with a plurality of stator blades so that gas molecules are sucked in from a suction port, compressed and discharged from an exhaust port by the interaction between said rotor and stator blades, wherein the improvement comprises:

a heat exchanger provided inside said suction port, said heat exchanger being connected to a refrigerator through a refrigerant pipe; and

a gate valve provided on the upstream side of said suction port,

wherein said refrigerator has the capability of supplying a refrigerant cooled to from about -100°C to about -190°C, and

wherein all heat transfer elements of said heat exchanger are disposed parallel to the flow of gas

molecules sucked in from said suction port to minimize the flow resistance."

"6. A method of operating a turbomolecular pump comprising:

an exhaust step in which a gate valve provided at an upstream side of a suction port is opened and, in this state, water vapor is freeze-trapped by a heat exchanger provided inside said suction port and connected to a refrigerator through a refrigerant pipe,

wherein said refrigerator has the capability of supplying a refrigerant cooled to from about -100°C to about -190°C,

a regeneration step in which, with said gate valve closed, the freeze-trapped water vapor is thawed and released, and

wherein said regeneration step is conducted by just closing the gate valve and continuing the exhaust operation of said turbomolecular pump."

VII. The appellant requested that the decision under appeal be set aside and the case remitted to the first instance with the order to maintain the patent in the following version:

Claims: 1 to 6 filed during the oral proceedings of 4 March 1999

Description: columns 1 to 9 filed during the oral proceedings of 4 March 1999

Drawings: Figures 1, 2, 4A, 4B, 5A, 5B, 6 and 7 as granted.

The respondent requested (on page 1 of the letter of 22 November 1996) that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments*

2.1 The present claim 1 consists of all the features of the originally filed claims 1 and 2 (which are the same as the granted claims 1 and 2) plus the feature that all heat transfer elements of said heat exchanger are disposed parallel to the flow of gas molecules sucked in from said suction port to minimize the flow resistance.

This added feature is based on Figures 4A, 4B, 5A and 5B and the associated passages in the originally filed description, notably page 8, lines 22 to 36. While each of these embodiments is a particular arrangement of heat transfer coil 72', heat transfer member 74' and heat transfer plates 74", it can be immediately appreciated from the cited Figures and from the statement in page 8, lines 27 to 30 (column 6, lines 28 to 31 of the granted patent) of the various elements of the heat exchanger being "disposed parallel to the flow of gas molecules sucked in from said suction port, minimizing the flow resistance" that minimum resistance to gas flow is indeed achieved by arranging all the elements parallel to the incoming gas flow A. Accordingly the board finds it allowable in this

particular case to set out this feature of claim 1 in a more general way than a specific description of the cited Figures.

2.2 The present independent claim 6 comprises all the features of the original (and granted) independent claim 8 with additions from the original (and granted) claims 1, 2 and 11 with a clarification from the original page 10, lines 34 to 36 (the granted column 8, lines 5 to 7) that just, i.e. merely, closing the gate valve and continuing the exhaust operation of said turbomolecular pump constitutes the regeneration step.

2.3 Accordingly the board finds that the independent claims 1 and 6 do not contravene Article 123(2) EPC and, since each is more restricted in scope than the corresponding granted claim, they also do not contravene Article 123(3) EPC.

2.4 The present claims 2, 3 and 5 correspond to the original (and granted) claims 3, 4 and 7 respectively. The present claim 4 corresponds to the original (and granted) claim 6 omitting superfluous features resulting from the restriction of claim 1. Thus also the dependent claims do not contravene Article 123 EPC.

2.5 The amendments to the description and drawings presented by the appellant during the oral proceedings merely adapt the description to the new claims e.g. by deleting Figures 3A and 3B and references thereto.

2.6 Thus the board sees no objection under Articles 123(2) and 123(3) EPC to the above amendments.

While the respondent did not see the final version of the amended patent and therefore did not comment thereon, this was because he chose not to attend the oral proceedings (which moreover he had auxiliarily requested). Further, the new claims are a restricted version of the first auxiliary request filed with the statement of grounds and upon which the respondent commented in his letter of 22 November 1996. The amendments to the description and drawings follow logically the amendments to the claims. Therefore there is no reason for the board to give the respondent the chance to state observations on the amendments made (Rule 58(4) EPC).

3. *The Polycold documents*

3.1 The respondent argues that the closest prior art to the claimed subject-matter is the Polycold Portable Self-contained Cryosystem Model P100-6CB depicted in Polycold Forms 8312 and 8206.

The appellant argues that these documents were not publicly available prior art since no final proof of publication of the above documents or sale of the device has been supplied.

3.2 Mr Missimer states in each of his two declarations that

- Polycold Form 8312 "was published in December of 1983 by mailing it to a large number of actual and potential customers, as well as sales representatives and distributors. Also within the following year many copies of this document were distributed to potential customers at industry

trade shows."

- Polycold Form 8206 "was published in June of 1982 and was distributed in the same manner".

Cryosystem Model P100-6CB is depicted in each of these documents and specified on the second page of a Polycold price list E5 dated November 1986. Two Polycold invoices dated March 1983 document the sale and delivery to and payment by CALTECH of Pasadena, California, USA for a Polycold Model P100-6CB Cryo Baffle with a Serial No. 17769.

While the invoices and declarations were **filed** by a third party, the company from which the invoices originate and the person who made the declarations are well known. Indeed column 6, line 1 of the present patent refers to "United States Patent No. 4,176,526" (R1) whose inventor is Dale J. Missimer and the assignee Polycold Systems, Inc. He is also one of the inventors listed by R4 published in 1985 and entitled "Fast cycle water vapor cryopump", as well as being the author of the magazine article R8.

In view of the evidence presented and the length of time between, on the one hand, the inferred dates of publication of Polycold Forms 8312 and 8206 (1983 and 1982 respectively), the price list of 1986 and the invoices of 1983 and, on the other hand, the priority date of 7 March 1988 of the present patent, the board finds it proven beyond reasonable doubt that the Polycold Model P100-6CB as depicted in the Polycold Forms 8312 and 8206 indeed was publicly available before said priority date. Given the weight of evidence

and since the appellant presents no concrete reasons for doubting this evidence, his view that said information was not publicly available is not shared by the board.

4. *Closest prior art to the turbomolecular pump of claim 1*

4.1 The first candidate for being the closest prior art is a conventional turbomolecular pump stack such as that shown in the fourth column of Figure 2 (d: valved turbomolecular pump system) on page 595 of R7 or in Figure 10.5 on page 265 of R5. In the latter Figure the turbomolecular pump 1 is preceded by a liquid nitrogen trap 2 and a high vacuum valve 6. Lines 8 to 12 of page 266 explain that liquid nitrogen increases the system pumping speed for water vapour and this is placed directly over the throat of the pump.

While the cited trap 2 is a heat exchanger as required by claim 1, it is not provided inside said suction port and is a liquid nitrogen trap not a heat exchanger connected to a refrigerator through a refrigerant pipe. Moreover there is no information as to the orientation of the elements of the trap or of minimising gas flow resistance.

4.2 The second candidate is the turbomolecular pump shown in Figure 2 of E7 with a deflector 9 in its inlet. A cooling medium such as liquid nitrogen may be passed through holes 10 and 11 of the deflector (see the first paragraph of page 6 of the English translation).

This pump is similar to that of R5 in that both use liquid nitrogen instead of a refrigerator. Moreover the

deflector of E7 is wedge shaped, see three lines from the bottom of page 6 of the English translation, instead of having elements disposed parallel to the gas flow, thus the flow resistance is not minimised.

4.3 The third candidate is an assembly of a turbomolecular pump with the cryobaffle Polycold Model P100-6CB, see the above section 3.

The only documents on file that can be used to determine the construction of such an assembly are Polycold Forms 8312 and 8206 and the price list E5. R13 (Exhibit C) cannot be used since it is dated after the priority date.

Form 8206 states that "A low height chevron baffle is connected directly to a 'Polycold' closed cycle Cryorefrigerator. The baffle operates at -130°C or colder and provides high speed water vapor pumping to the low 10^{-7} torr vacuum range. It is optically opaque and effectively stops backstreaming. It eliminates liquid nitrogen ... Steady cold temperature holds trapped vapors without regurgitation. Usable with both diffusion and turbomolecular pumps to increase water speeds. Baffle fits easily between high vacuum valve and pump inlet."

Form 8312 adds that the baffle "is mounted between the existing flanges of the high vacuum valve and the diffusion or turbomolecular pump, and is held in place by the flange bolts."

Thus there is disclosed an assembly which comprises a turbomolecular pump and which has the features set out

in the first lines of claim 1. A heat exchanger is provided, not inside the suction port as set out in claim 1 but adjacent thereto (since the baffle is held in place by the flange bolts, also see the diagram on the second side of Form 8206 but noting that the pump depicted seems to be a diffusion pump).

It can be deduced from the photograph on both Forms and the above-mentioned diagram that the baffle i.e. heat exchanger is connected to the refrigerator through a refrigerant pipe. A high vacuum valve is provided on the upstream side of said suction port (since the baffle is stated to be mounted between the valve and the pump).

The "baffle is cooled to -130°C" or "operates at -130°C or colder", from which it may be deduced that the refrigerator has the capability of supplying a refrigerant cooled to somewhere around -130°C, i.e. a single temperature falling within the range of about -100°C to about -190°C specified in the claim.

Since the heat exchanger comprises an "optically opaque, chevron baffle" the heat transfer elements of said heat exchanger are not disposed parallel to the gas flow and so do not minimize the flow resistance. On the contrary, the chevron baffle should effectively stop backstreaming.

4.4 The board considers the assembly of a turbomolecular pump with the cryobaffle Polycold Model P100-6CB as disclosed by the Polycold Forms 8312 and 8206 and the price list E5 to be the closest prior art to the turbomolecular pump of claim 1.

5. *Novelty - claim 1*

After examination of the three candidates set out in the above section 4 and of the other prior art documents on file, the board is satisfied that none of them discloses a turbomolecular pump with all the features of claim 1.

The subject-matter of claim 1 of the main request is thus considered novel within the meaning of Article 54 EPC.

6. *Problem and solution - claim 1*

6.1 Starting from the turbomolecular pump and baffle assembly disclosed by the Polycold documents, the problem to be solved by the invention set out in claim 1 is to improve the gas exhausting performance of the turbomolecular pump when the gas to be exhausted contains water vapour, see column 2, lines 4 to 7 of the granted patent.

6.2 This problem is solved as follows.

6.2.1 The temperature at which water vapour will be trapped by the heat exchanger will depend on the pressure that it is at, see Figure 6 of the patent as granted. The refrigerator's capability of supplying a refrigerant

cooled to from about -100°C to about -190°C, which is a range which is not disclosed for the Polycold refrigerator, enables the heat exchanger temperature to be set at the optimum temperature for trapping water vapour at the particular pressure prevailing at the heat exchanger.

6.2.2 Arranging all the heat transfer elements of the heat exchanger parallel to the flow of gas molecules sucked in from said suction port plainly minimizes the flow resistance compared with the optically opaque construction of the Polycold baffle.

6.2.3 It can be seen from the formulae in column 1, lines 39 to 51 of the granted patent that the gas exhausting performance is inversely proportional to the absolute temperature of the gas. It is therefore better to avoid a rise in temperature between the heat exchanger and the rotor and stator blades by locating the heat exchanger directly inside the pump's suction port instead of upstream thereof e.g. in the vacuum chamber (the work space), see column 3, lines 33 to 35 of R3 or column 1, lines 45 to 47 of R4. In the case of the Polycold system however the difference may be more theoretical than actual because the baffle is in any case mounted next to the pump's suction port (i.e. work space).

7. *Inventive step - claim 1*

7.1 Starting from the closest prior art, the turbomolecular pump and baffle assembly disclosed by the Polycold documents, the skilled person would need to make various changes if he were to arrive at the

turbomolecular pump specified in claim 1.

7.1.1 In the Polycold arrangement the cryobaffle is attached to the flanges of the pump's suction port but the board considers that it would be obvious for the skilled person instead to mount the Polycold cryobaffle actually in the suction port, a feature of claim 1. This is because the adjacent Figures 3 and 2 of E7 show the cooled deflector 9 being mounted respectively in a pipe 12 attached to the pump's suction port and actually in the suction port.

7.1.2 The Polycold refrigerator seems to offer only a single fixed temperature for the refrigerant and therefore for the cryobaffle. As can be seen from the above section 6.2.1, this is disadvantageous because if this single value is too warm for the prevailing pressure then water vapour will not be trapped whereas if it is unnecessarily cold then energy will be wasted and the regeneration time will be unnecessarily long. It is noted that the Polycold Form 8206 shows in the graph a lower pressure limit of 10^{-8} Torr and specifies in the text a lower limit of "the low 10^{-7} torr vacuum range". It can be seen from Figure 6 of the granted patent that for such pressures a cryobaffle temperature of -130°C suffices, however this temperature would be too high for 10^{-10} Torr. The board sees no hint in the Polycold documents or the other prior art documents available to it that would lead the skilled person to construct the refrigerator such that its refrigerant temperature can be adjusted. Most of the prior art water vapour traps operate with liquid nitrogen and so plainly do not provide this capability.

7.1.3 The Polycold baffle is described as a chevron baffle which is optically opaque. As such it obviously presents a flow resistance but, as this construction is stressed in the Polycold documents, the board cannot see, in the absence of a disclosure of a more streamlined arrangement elsewhere in the prior art, that the skilled person would be led to arrange all the heat transfer elements of the heat exchanger parallel to the flow of gas molecules sucked in from said suction port in order to minimise the flow resistance, particularly since one effect of the Polycold chevron baffle is stopping backstreaming.

7.2 Thus for the reasons set out in the above sections 7.1.2 and 7.1.3 the board does not find that it would have been obvious for the skilled person starting from the turbomolecular pump and baffle assembly disclosed by the Polycold documents to arrive at the subject-matter of claim 1.

7.3 The conclusion in the above section 7.2 would not be changed if the skilled person were to choose another starting point.

7.3.1 Each of the conventional turbomolecular pump stacks discussed in the above section 4.1 uses a liquid nitrogen trap. This also applies to the deflector of the turbomolecular pump of E7 (discussed in section 4.2 above) where the only cooling medium disclosed is liquid nitrogen. A liquid nitrogen trap is also used in R14, see the middle of page 2 of the translation, and in R21, see page 407, the last two lines of the left hand column and the first eight lines of the right hand column. In no case is there is a hint to replace the

liquid nitrogen trap with a refrigerator whose refrigerant temperature can be adjusted.

7.3.2 Moreover there is no information as to the disposition of the trap elements of the conventional turbomolecular pump stacks discussed in the above section 4.1 and no hint to arrange them parallel to the flow of gas molecules sucked in from said suction port to minimize the flow resistance. In the case of the turbomolecular pump of E7 (see section 4.2 above) the deflector is there "for imparting a momentum in a specific direction to gas molecules", see page 4, lines 17 and 18 of the translation into English, and so it could not be obvious to arrange the elements of this deflector so that they had no deflecting effect on the gas. Neither can a hint be found in the Polycold baffle since it prevents backstreaming.

7.4 There are other documents on file which were cited during the opposition proceedings by the opponent and/or by the third party but which were not mentioned anymore during the appeal proceedings. Some of the documents filed by the third party have not been proven to have been publicly available before the priority date. Others are no longer relevant after restriction of the claims or merely repeat points made by other documents and commented on in this decision.

7.5 Thus the subject-matter of claim 1 involves an inventive step as required by Article 56 EPC.

8. *Independent method claim 6*

8.1 As set out above in section 4.1, the conventional

turbomolecular pump stack of R5 includes a liquid nitrogen trap and the only coolant described for the deflector of the turbomolecular pump of E7 (see section 4.2 above) is also liquid nitrogen. These documents therefore do not destroy the novelty of the subject-matter of claim 6 which specifies freeze-trapping of water vapour with a heat exchanger which is able to be supplied with a refrigerant cooled to from about -100°C to about -190°C.

Because of the use of a refrigerant from a refrigerator instead of the use of liquid nitrogen, the board considers the closest prior art to the method of claim 6 to be the method of operation of the Polycold Model P100-6CB assembly as disclosed by the Polycold Forms 8312 and 8206 and the price list E5. Since claim 6 specifies that the refrigerant is cooled to from about -100°C to about -190°C, instead of being provided with a single temperature value which appears to be the case for the Polycold refrigerator, the subject-matter of claim 6 is also novel over the disclosure of the Polycold documents.

After considering also the other prior art documents available to it, for example R21 involving liquid nitrogen and heating, the board concludes that the subject-matter of claim 6 is to be considered novel within the meaning of Article 54 EPC.

8.2 The Polycold documents give little information as to how the regeneration of this assembly is carried out. However the front page of Form 8312, under the heading "Fast Cycle Water Vapor Cryopumps" states that "Total regeneration time is just 4 minutes including warm-up

and re-cooling to cryogenic temperature." Warming up the heat exchanger is obviously a common way of regenerating it e.g. in R4 hot defrost vapours are supplied to a tube 10 bonded thermally to the cryosurface, see the Figure and column 3, line 64 to column 4, line 14.

8.3 The problem to be solved by the present invention is to simplify the regeneration step. This is achieved in accordance with claim 6 not by the use of a heater but merely by closing the gate valve and continuing the exhaust operation of the turbomolecular pump. As explained in column 4, lines 37 to 43, of the granted patent, the valve is periodically shut during normal operation of the pump in, for example, a semiconductor manufacturing process, and this makes it possible to run the turbomolecular pump on a continuous basis without requiring a specific time for regeneration. It is explained in column 8, lines 5 to 24 of the patent as granted with reference to Figures 6 that shutting the valve and continuing the pump operation lowers the vapour pressure at the trap and causes freeze trapped water vapour to be sublimated and discharged by the pump.

8.4 The prior art gives no hint as to regeneration of a refrigerator-cooled cryotrap or a liquid nitrogen cooled cryotrap in this manner. Regeneration in R4, R21 and E2 involves heat (and while page 11 of E2 describes regeneration with a closed valve, the pump in this document is a cryopump not a turbomolecular pump). Lines 16 to 21 on page 256 of R5 also specify "warming the cryogenic trap" and in R14 (see the last paragraph of page 5 of the translation) there is a heater 6.

Concerning the other documents on file, the comments made concerning claim 1 in the above section 7.4 also apply to the independent claim 6.

Thus the subject-matter of the independent claim 6 involves an inventive step as required by Article 56 EPC.

9. The patent may therefore be maintained amended, based on independent claim 1, claims 2 to 5 dependent thereon, independent claim 6, the amended description and drawings.

10. Concerning the respondent not seeing the final version of the amended patent, comments have been made in the above section 2.6.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in the following version:

Claims: 1 to 6 filed during the oral proceedings of 4 March 1999

Description: columns 1 to 9 filed during the oral proceedings of 4 March 1999

Drawings: Figures 1, 2, 4A, 4B, 5A, 5B, 6 and 7 as

granted.

The Registrar: The Chairman:

N. Maslin C. Andries