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D E C I S I O N
of 17 December 2002

Case Number: T 0598/99 - 3.4.3

Application Number: 92108288.9

Publication Number: 0513834

IPC: H01L 21/00

Language of the proceedings: EN

Title of invention:

Method and apparatus for cooling wafers

Patentee:

APPLIED MATERIALS, INC.

Opponent:

Institute of Technological Information, Inc.

Headword:

Method and apparatus for cooling wafers/APPLIED MATERIALS INC.

Relevant legal provisions:

EPC Art. 52(1), 54, 56, 84, 123(2), 123(3)

Keyword:

"Novelty (yes - after amendment)"

"Inventive step (yes - after amendment)"

"Amendment - an amendment made before grant and not objected to in the notice of opposition cannot in the absence of the patent proprietor's consent be examined by the Board (point 3.2.1)"

"*Reformatio in peius* - where the patentee is the sole appellant the principle of *reformatio in peius* cannot serve to protect the opponent respondent from being in a worse position than he was in before the appeal"

Decisions cited:

G 0001/91, G 0009/92, G 0004/93, T 0287/86, T 0433/96

Catchword:

-



Case Number: T 0598/99 - 3.4.3

D E C I S I O N
of the Technical Board of Appeal 3.4.3
of 17 December 2002

Appellant: APPLIED MATERIALS, INC.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 29 March 1999
revoking European patent No. 0 513 834 pursuant
to Article 102(1) EPC.

Composition of the Board:

Chairman: R. K. Shukla
Members: E. Wolff
M. J. Vogel

Summary of Facts and Submissions

I. This is an appeal from a decision of the opposition division, dispatched on 29 March 1999, to revoke European patent No. 0 513 834 pursuant to Article 102(1) EPC for lack of an inventive step over the prior art disclosed in documents

E1: US-A-4842683 and

E3: JP-A-52 069578 and its partial translation E3'.

II. The appellant (proprietor) filed a notice of appeal on 27 May 1999, and paid the appeal fee on the same day. The statement setting out the grounds of appeal along with new claims according to a main request was filed on 6 August 1999. Also, a set of new claims according to an auxiliary request was filed on 23 January 2001 under cover of a letter responding to the respondent's arguments.

III. In the opposition proceedings, in addition to documents E1 and E3, the following prior art documents were, *inter alia*, cited by the respondent opponent

E2: US-A-4 565 601

E4: US-A-4 955 590

In response to the statement of the grounds of appeal, the respondent opponent cited a new prior art document

E5: JP-A-59-72127 together with a partial translation thereof.

The appellant provided a full translation of document E5.

- IV. At the oral proceedings requested by both the parties, the appellant filed a new request replacing the main and auxiliary requests. The request contains 16 claims, of which claim 1 and claim 10 are independent claims with dependent claims 2 to 9 and 11 to 16, respectively.

Claim 1 reads as follows:

"1. A wafer cooling apparatus (10) comprising:

a chamber (16);

pedestal means (18) comprising a support body (36), made from a material having good thermal conductivity for removing heat from said wafer and having a substantially planar wafer support surface (60) exposed to said chamber (16), said wafer support surface (60) comprising a plurality of planar sections, separated by cooling fluid channelling means (62, 62') comprising groove means allowing fluids to be at least partially channeled away from beneath the wafer, thus adapted to prevent wafer skating,

means for lowering a wafer (88) disposed within said chamber (16) towards said wafer support surface (60) of said support body (36)."

Claim 10 reads as follows:

- "10. A method for cooling a wafer within a gaseous environment comprising:

lowering a wafer towards a substantially planar wafer support surface of a pedestal made from a material having good thermal conductivity, said surface comprising a plurality of planar sections separated by fluid channelling means comprising grooves,

to force at least a portion of said gas into said fluid channeling means in said surface and thereby prevent wafer skating, whereby said pedestal removes heat from said wafer."

- V. The appellant's argument in support of his request can be summarized as follows:

The invention relates to a cooling apparatus which forms an independent unit of a wafer processing plant. Its purpose is to provide cooling for wafers in between processing steps. In order to ensure adequate throughput, the cooling apparatus must allow wafers to be easily loaded, cooled and unloaded.

The invention fulfills these requirements by the claimed combination of a pedestal with high thermal conductivity to conduct the heat away from the wafer, and grooves in the pedestal which prevent skating of the wafer as it is lowered onto the pedestal. This latter function is important because during loading and unloading the chamber, it is open to the outside and hence at roughly ambient pressure. Moreover, the only force maintaining the contact between the wafer and the pedestal is gravity. In addition to conductive cooling through contact with the planar sections of the pedestal, there is also a very small amount of convective cooling by contact of the top of the wafer with a cooling medium. The invention provides very

effective cooling without adversely affecting throughput of wafers.

In contrast, the prior art cooling arrangements provide for wafer cooling during processing. The pressures at which the processing, such as etching, occurs are well below ambient pressure and the problem of wafer skating does not arise. Secondly, the wafers are either clamped to the surface of the pedestal (document E1) or forced towards the pedestal by electrostatic forces (document E2).

While the arrangement disclosed in document E3 provides for grooves in a wafer support surface which enable the gas to escape from underneath a wafer when it is lowered onto the surface and thereby preventing wafer skating, the wafer support consists merely of an array of ribs with edges too thin to provide adequate contact for conducting heat away from the wafer.

- VI. The arguments put forward by the respondent, in as much as they remain relevant to the claims of the request presented by the appellant at the oral proceedings, can be summarised as follows.

Admissibility of the appellant's request

During the opposition proceedings, the patentee had filed a main request and several auxiliary requests, all with independent claims which differed from and were narrower than the independent claims of the granted patent. The independent claims of the request now before the Board are broader than any of the requests rejected by the opposition division. Since the patent was revoked by the opposition division as

requested by the opponent respondent, he could not appeal against such a decision pursuant to Article 107 EPC. Nevertheless, the opponent is now in a worse position than before the appeal. This appears to contradict the principle of the prohibition of *reformatio in peius* and the request should therefore be rejected for this reason alone.

Furthermore, compared to the claims as granted, the order of the independent claims has been reversed. This amendment does not serve to overcome an objection raised against the patent, and should therefore not be allowed.

There is only one reference in the description to convective cooling, which is that the cooling medium flows past the pedestal. There is no basis for convective cooling by a cooling medium flowing under the wafer. The reference in the claims to cooling fluid channelling means in claim 1 therefore contravenes Article 123(2) EPC.

Clarity of and support for the claims

Claim 1 specifies that the wafer support surface comprises "a plurality of planar sections separated by cooling fluid channelling means ...". According to the description, however, the fluid can be ducted away not only by grooves but, instead by holes in the surface, for example. However, contrary to what is claimed, such holes cannot separate the surface into sections, and it is therefore unclear what is meant by the planar sections being separated.

The reference in the claim to a cooling medium is

inappropriate since according to the application as filed, cooling is achieved by contact with the pedestal, not through a cooling medium. The channels merely serve to allow the gas to escape to prevent skating.

Novelty and inventive step

The apparatus disclosed in document E1 is suitable for cooling wafers and has all the features claimed in claim 1, except for an explicit reference to the prevention of skating.

The apparatus disclosed in document E2 is an apparatus for controlling the temperature of a wafer, from which it follows apparatus can be used to cool wafers. Its radial and circumferential grooves allow gas to escape.

Both in respect of documents E1 and E2, for the skilled person it is a mere design measure to choose or modify the dimensions of the extant grooves so as to prevent wafer skating. Moreover, document E3 specifically addresses the problem and discloses the complete solution to the problem of wafer skating. Hence, by reading document E3 the skilled person not just could but would arrive at the solution to the problem of wafer skating. The same would apply in respect of document E5 if it were admitted into the proceedings.

Thus, even if the invention as claimed is considered to be novel, it is clearly obvious over the prior art.

Reasons for the Decision

1. The appeal is admissible.
2. *Preliminary considerations*

Opposition to the granted patent was filed on the grounds referred to in Article 100(a) EPC.

During the opposition proceedings, the appellant patent proprietor had requested the grant of a patent on the basis of several requests, all the requests containing independent claims which were restricted in their scope in relation to the scope of the corresponding independent claims of the patent as granted.

In its decision to revoke the patent, the opposition division concluded that the independent claims of the requests did not involve an inventive step. However, the amended independent claims were considered to comply with Article 123(2) EPC.

During the appeal proceedings, the respondent opponent raised objections pursuant to Article 100(b) EPC and Article 123(2) and (3) EPC against the independent claims of the appellant's requests filed during the course of the appeal proceedings. During the oral proceedings before the Board, the appellant filed a new request replacing all the previous requests with a view to overcoming the objections under Article 123(2) EPC, whereby independent claims 1 and 10 of the request are broader in scope than the corresponding independent claims of all the requests that were rejected by the opposition division.

The opponent respondent submitted that in the appeal proceedings, the appellant proprietor is restricted to

defending the narrow amended claims forming the basis of the decision of the opposition division, and that the appellant's new request containing broad independent claims is not admissible since it is contrary to the principle prohibiting *reformatio in peius*.

The Board cannot follow the respondent's submissions since the principle prohibiting *reformatio in peius* in inter partes appeal proceedings applies so as to prevent a sole appellant being put into a worse situation than he was in before he appealed. In the present case, the patentee is the sole appellant, so that the principle of *reformatio in peius* cannot serve to protect the opponent respondent from being in a worse situation than he was in before the appeal. (G 9/92 and G 4/93). Indeed, whenever a sole appellant patent proprietor is successful in his appeal against the revocation of his patent, the opponent will be in a worse position than before. The fact that the opponent was not entitled to appeal against the decision to revoke the patent is immaterial in this respect.

Moreover, subject to Article 123(3), there is no provision in the EPC which stipulates that where a patent is revoked in opposition proceedings, the scope of the independent claim of the proprietor's request on which the decision revoking the patent is based sets a limit that cannot be exceeded during the opposition appeal proceedings, that is, that the appellant patent proprietor is prohibited from filing during the appeal proceedings an independent claim with a scope which extends beyond that of the corresponding independent claim rejected by the first instance decision.

In the present case, the new claims of the appellant's request were amended with a view to complying with the requirements of Article 123(2) EPC. The amendments were thus appropriate and necessary and filing the new requests at the oral proceedings cannot be considered to constitute an abuse of procedure. The Board is therefore satisfied that filing the new request is completely justified.

3. *Admissibility of the amendments*

3.1 The claims of the request differ from the claims of the patent as granted *inter alia* in that the order of the independent claims is reversed, with claim 1 being the independent apparatus claim and claim 10 being the independent method claim of the request. Claim 1 of the request also differs from the corresponding claim 8 of the patent as granted in that the claim now contains no cross-reference to the method claimed in the independent method claim.

The respondent submitted that neither the reversal of the order of the claims nor the deletion in the apparatus claim of the cross-reference to the method were amendments that were made for the purpose of avoiding objections to the claims and should therefore not be allowed.

It is generally accepted that any indication of a purpose in a device claim has to be interpreted to the effect that the claimed device has to be suitable for the indicated purpose, but not that it is limited to this purpose. (T 287/86). Apparatus claim 1 recites the elements which are required to perform the method. The suitability of the apparatus for the intended purpose

is therefore, in the Board's view, not in doubt. The deletion of the explicit cross reference to the method thus neither adds nor subtracts anything from the subject matter of claim. The same applies to the reversal of the sequence in which the apparatus and the method are claimed.

In these circumstances, the Board sees no reason to object to these amendments which were made in the course of making other amendments in order to avoid material objections.

3.2 *Claim 1*

- 3.2.1 The respondent questioned the identification in claim 1 of the grooves through which the fluid or gas is allowed to escape from under the wafer as "cooling fluid channelling means". According to the invention, cooling was achieved by thermal conduction, not by convection via some cooling fluid or gas. Since there is no cooling fluid being used, there was no basis for the term "cooling fluid channelling means" in the application as filed. The use of the term therefore contravened the provisions of Article 123(2) EPC.

According to decision G 1/91, fresh grounds of opposition can be considered in appeal proceedings only with the approval of the patent proprietor. In decision T 433/96 it was held further that it follows directly and unambiguously from decision G 1/91 that the need stated there to examine amendments for compliance with the EPC extends only to amendments made during opposition or appeal proceedings, and that the Board therefore had no specific power to examine in the appeal proceedings amendments made before grant.

In the present case, the notice of opposition was based on the grounds of opposition set out Article 100(a) EPC, but not on the grounds under Article 100(c) EPC.

The Board notes that the term "cooling fluid channelling means" was already used as such in the corresponding independent apparatus claim 8 of the patent as granted and whatever amendments were made to the claim after grant do not concern this specific term. Examining this amendment would amount to introducing a new ground of opposition under Article 100(c) EPC. In the absence of the appellant patent proprietor's consent, the objection to the term "cooling fluid channelling means" under Article 123(2) EPC cannot therefore be examined by the Board.

- 3.2.2 Independent apparatus claim 1 of the request refers to "a wafer support surface comprising a plurality of planar sections separated by fluid channelling means comprising grooves". The corresponding claim 8 of the patent as granted refers, instead, to "having fluid channeling means comprising grooves provided on said surface".

The respondent argued that lines 30 to 38 of column 6 of the patent as granted clearly envisage fluid channel arrangements other than grooves on the surface of the wafer support surface of the pedestal. Since there is also no mention of sections or planar sections anywhere in the description, the amended wording has no basis in the application as filed and therefore is contrary to the requirements of Article 123(2) EPC.

The Board cannot agree with the respondent's submission. Moreover, it is evident from the

description that the wafer support surface of the pedestal is "substantially planar" because the otherwise planar surface is interrupted by the grooves. It follows that the individual sections, having a much smaller surface area than the substantially planar wafer support surface as a whole, are necessarily planar. The amendment thus introduces no new subject matter and the chosen wording does not contravene Article 123(2) EPC.

3.3 *Claim 10*

The only difference between claim 1 as granted and claim 10 of the request refers to "surface comprising a plurality of planar sections separated by fluid channelling means comprising grooves" instead of to "having fluid channelling means comprising grooves provided on said surface".

This amendment merely brings the wording of claim 10 into line with the terminology adopted for claim 1 of the request, which now also refers to planar sections. For the reasons already discussed under point 3.2.2 above with reference to claim 1, the Board considers that no new subject matter is introduced by this amendment.

4. *Clarity*

The respondent objected to the wording "a wafer support surface comprising a plurality of planar sections separated by fluid channelling means comprising grooves" in claim 1 also on the ground that it fails to comply with the requirement of clarity as required by Article 84 EPC. At least one of the arrangements

envisaged contains holes in the wafer support surface instead of grooves. While as claimed such holes would allow gas to escape from under the wafer as it is lowered, the claimed plurality of planar sections would not be formed since individual holes cannot separate different planar sections.

However, the Board considers, as argued by the appellant, that the passage referred to does not indicate at all that the other channel arrangements referred are replacements for the grooves. Instead, as stated in column 6, lines 23 to 29, a pattern of grooves is always present, with the arrangements referred to in lines 30 to 38, such as holes in the wafer support surface, providing additional paths for channelling fluids away from the wafer support surface. The chosen wording is therefore clear in this respect.

5. *Novelty*

Claim 1

5.1 Although accepting that the claimed invention differed from the disclosures in each of documents E1 and E2 through its reference to the prevention of wafers skating, the respondent nevertheless remarked that the apparatus claimed in claim 1 may even lack novelty over the disclosure in either document E1 or document E2.

5.2 Document E1 discloses a magnetic field enhanced etch reactor having a chamber (68) and a pedestal (70), in which wafers are cooled during processing.

5.2.1 The respondent argued that the pedestal is implicitly of a material having good thermal conductivity and, in

view of the small deviation from a flat surface, is "substantially planar". The pedestal is also provided with cooling fluid channelling means comprising grooves 180 and with means for lowering the wafer (wafer fingers 79), and the pedestal removes the heat from the wafer.

The respondent argued further that in the apparatus of document E1, which is suitable for cooling wafers, the grooves would be capable of counteracting skating by allowing gas to escape, since they are suitable for supplying the flow of cooling gas into the space between the wafer and the pedestal. In particular, the wafer support surface is not limited to the area in contact with the wafer, because the patent itself includes embodiments in which the wafer is not in solid-to-solid contact with the pedestal. Moreover, the grooves that are provided in the pedestal must permit the cooling medium at least partially to be channelled away when the wafer is lowered; the wafer is clamped and hence unable to skate, only after it has reached its final position.

5.2.2 However, the Board accepts the appellant's argument that at least the following features distinguish the apparatus disclosed in document D1 from the invention as claimed in claim 1 of the request.

5.2.3 As shown, for example by Figures 13a and 13b of document E1, in order to cool the wafer, cooling gas passes between the underside of the wafer and the pedestal. To permit the required flow of cooling gas, the wafer needs to be clamped to the pedestal on account of the high cooling gas pressure. The function of the grooves in the pedestal of document E1 is to

supply gas under pressure into the gap between the back of the wafer and the top of the pedestal. The pressure in document E1 is sufficiently high for the wafer having to be clamped to the pedestal by a clamping ring. Grooves dimensioned to supply gas under pressure will be narrower than grooves which are designed to permit gas from under the wafer to escape under the very slight excess pressure which is generated under the wafer when it is lowered onto the pedestal. As described in the patent in suit (column 6, lines 2 to 29), in order to prevent wafer skating at about atmospheric pressure, the grooves need to be above a certain size, which can be determined empirically. There is thus no suggestion in document E1 that the grooves are "adapted to prevent wafer skating" as the claims of the patent in suit require.

- 5.2.4 Also, document E1 is concerned with uneven cooling as a result of a non-uniform gap between the wafer and a flat pedestal when the wafer is clamped to the periphery of the pedestal and bows under the pressure of the cooling gas. This problem is solved in document E1 by providing the pedestal with a bowed top surface. The curvature of the pedestal described in document E1 is therefore clearly deliberate (see, paragraph 5. Figure 13a to 13c and the corresponding description in column 13, lines 11 to 57) rather than an inadvertent deviation from intended planarity. In contrast, it is clear from the description of the patent in suit that the substantially planar surface is as planar as it can reasonably be made to match the underside of a wafer, since for cooling by heat conduction the contact between the wafer and the pedestal must be optimal, in particular since the wafer rests on the pedestal only under the influence of gravity. Thus, the surface of

the pedestal in document E1 cannot be said to be substantially planar in the sense of claim 1 of the request.

5.2.5 In view of the differences, the Board is satisfied that the invention as claimed is novel over the disclosure in document D1.

5.3 The apparatus disclosed in document E2 provides for wafers to be cooled during processing. The wafer is held in place by electrostatic forces which act on the whole wafer.

5.3.1 The respondent submitted that, as in the case of document E1, the only distinction between document E2 and the claimed apparatus was the reference in the claim to wafer skating. Additionally, the surface of the pedestal of document E2 was itself a planar surface provided with grooves. When the wafer is lowered, the radial grooves in the pedestal will at least partially channel away any gas present between the wafer and the surface of the pedestal. Moreover, because of the wording "at least partially channeled away", the claim covers both the described arrangements, of one which provides for the wafer to be fully lowered onto the pedestal, and the other in which the wafer is separated by a narrow gap from the pedestal.

5.3.2 Similar to the arrangement in document E1, the grooves in document E2 supply cooling gas ("heat transmission gas") under pressure to the underside of the wafer. The wafer needs to be held in place electrostatic forces hold the wafer in place against the pressure of the gas, thereby avoiding the pressure-induced deformation of the substrate (see for example, document E2,

column 6, lines 4 to 11).

5.3.3 Given the specific purpose of the grooves to supply gas under pressure to the underside of the wafer, the Board is persuaded by the appellant's argument that the grooves therefore differ from grooves adapted to prevent wafer skating. Such grooves would not serve even partially to displace gas from underneath the wafer when the wafer is lowered onto the surface and waferskating would be prevented by the electrostatic attraction acting on the wafer.

5.4 Document E3 describes a susceptor in which wafer skating is prevented by arc-shaped corrugations. These corrugations are separated by relatively sharp thin ridges. The Board accepts the appellant's contention that these ridges cannot remove heat from the wafer by conduction, a requirement of the invention as claimed, because heat conduction would require a much larger area of surface contact between the wafer and the pedestal.

5.5 For the foregoing reasons the Board is satisfied that none of the cited documents disclose the apparatus claimed in claim 1 of the request, and that the subject matter of claim 1 is new, as required by Article 54(1) and (2) EPC.

5.6 Claim 10

The novelty of the independent method claim 10 was not in dispute.

6. *Inventive step*

Claim 1

- 6.1 Document E1, already referred to with reference to the issue of novelty in paragraphs 5.2 ff above, was regarded by the respondent opponent to be the closest prior art. Starting from document E1, the respondent identified the problem to be solved by the invention as being the provision of a grooved pedestal with a surface that prevents wafer skating.
- 6.2 The respondent submitted that in seeking a solution to the stated problem, the skilled person would, merely by relying on the first principles governing gas flow, arrive at the conclusion that the grooves need to be made larger than the mean free path of the gas molecules in order to allow gas to escape when the wafer is lowered, and thereby to prevent skating. The invention as claimed in claim 1 was thus obvious from document E1 in the light of the general knowledge of the skilled person.
- 6.3 In the magnetic etch reactor of document E1, gas is supplied to the underside of the wafer under sufficient pressure to cause bowing of the wafer. The wafer is secured in place with the aid of a clamping ring. As already discussed in relation to the issue of novelty (paragraph 5.2.3 above), the grooves which supply gas under such pressure will be too narrow to fulfil the requirement of the claim that gas must be able to be "at least partially channeled away" through these grooves when the wafer is lowered onto the surface. Document E1 further requires that the pedestal has a bowed top surface, thus failing to provide the required thermal contact (see paragraph 5.2.4 above). Moreover, because the pedestal surface is bowed, gas underneath

the wafer would be able to escape outwardly without requiring grooves to duct the gas away. Wafer skating would not be a problem that needs to be addressed, and there would be no incentive to widen the grooves in the manner suggested by the respondent opponent. The Board therefore concludes that as argued by the appellant, the invention as claimed is not obvious from reading document E1 with the common general knowledge possessed by the person skilled in the art.

6.4 Document E3 describes a susceptor designed to prevent wafer skating by using arc-shaped corrugations in the top surface, even if those ridges do not fulfil the requirement of the invention that heat be removed from the wafer by conduction since this would require better surface contact. The respondent opponent argued that, once the skilled person was aware that wafer skating may occur and that it may be prevented by providing the surface with grooves through which the gas can escape, the claimed invention would be obvious in the light of the combined teaching of documents E1 and E3.

6.5 In the Board's view, however, for the reasons given by the appellant, the combination of documents E1 and E3 not only fails to make the claimed invention obvious, but in view of their technical contents, documents E1 and E3 cannot reasonably be combined.

6.5.1 The narrow ridges on the surface of the susceptor described in document E3 clearly do not fulfil one of the requirements of the invention which is that heat be removed from the wafer by conduction, because efficient heat conduction would require much more surface contact between the wafer and the pedestal. The ridge structure of document D3 could not therefore be transposed

without modification to the apparatus of document D1. Also, in document E1 the wafer is clamped to the electrode a clamping ring rather than just resting on the surface. Without knowledge of the invention, it would therefore not be clear which features of documents E1 and E3 would have to be retained, and which discarded in order to arrive at the apparatus claimed in claim 1 of the patent in suit. A further indicator that the teaching of documents E1 and E3 cannot be combined in an obvious manner arises from the fact that the surface of the electrode in document E1 is bowed rather than flat.

6.6 The respondent also submitted that the invention as claimed in claim 1 was obvious over document E2, either if viewed in the light of the common general knowledge of the person skilled in the art, or if combined with document E3. As in the case of document E1, the only distinction between document E2 and the claimed apparatus was the reference in the claim to wafer skating. The problem to be solved was again to provide a surface which would prevent wafer skating.

6.6.1 Unlike in document E1, the surface of the pedestal of document E2 was itself a planar surface provided with grooves which, when the wafer is lowered, will at least partially channel away any gas present between the wafer and the surface of the pedestal as required by claim 1. In particular, the pedestal shown in document E2 has radial grooves. It is an inherent physical feature of the radial grooves that gas is allowed to flow out from under the wafer when it is lowered onto the pedestal. Moreover, because of the wording "at least partially channeled away", the claim covers both the described arrangements, of one which

provides for the wafer to be fully lowered onto the pedestal, and the other in which the wafer is separated by a narrow gap from the pedestal. Choosing grooves of the appropriate dimensions to ensure that wafer skating would be prevented was either a matter of applying the common knowledge of the skilled person, or of applying the teaching of document E3, which explicitly refers to the prevention of wafer skating.

6.6.2 In respect of document E2, the appellant argued that the apparatus disclosed there is not the kind of apparatus for cooling wafers to which the invention relates, since in the apparatus of the invention cooling is performed during not processing but, as explained in the description of the patent in suit, in between processing stages. Also, document E2 disclosed neither the problem of wafer skating, nor the feature of claim 1 of the request of "fluid channelling means comprising groove means ... adapted to prevent wafer skating". Also, the wafer is attracted and secured to the pedestal by electrostatic forces in an environment which, like the environment of document E1, is a low-pressure environment. This is in contrast to the invention in suit, where the wafer is resting on or just above the pedestal in an environment of ambient pressure and merely under the influence of gravity. As in the case of document E1, in the absence of any mention of the problem of wafer skating in document E2, the modifications required to the apparatus disclosed in document E2 were obvious neither in the light of common knowledge nor as a result of combining

document E2 and E3. In particular, as in the case of document E1, the teachings of documents E2 and E3 cannot be combined because the respective concepts cannot be combined.

6.6.3 The Board's view on the relevance of document E2 is similar to that expressed already in relation to document E1. As argued by the appellant, there is no mention of the problem of wafer skating in document E2. Moreover, in document E2, too, the grooves are provided for the purpose of supplying cooling gas ("heat transmission gas") to the underside of the wafer. The wafer is held in place against the pressure of the gas by an electrostatic force which acts across the whole wafer and therefore not only prevents deformation of the wafer but also prevents wafer skating. Given the specific purpose of the grooves to supply gas under pressure to the underside of the wafer, and the fact that the wafer is held in place by electrostatic forces. The Board is persuaded by the appellant's argument that, without the knowledge of the invention claimed in the patent in suit, document E2 provides no incentive for the skilled person contemplating the document in the light of his common general knowledge to consider widening the grooves to prevent wafer skating.

6.6.4 Concerning the combination of document E2 and document E3, the Board shares the view of the appellant that, as in the case of document E1, it would not be immediately clear which features of documents E1 and E3 would have to be retained, and which discarded in order to arrive at the apparatus claimed in claim 1 of the patent in suit. The narrow ridges on the surface of the susceptor described in document E3 clearly do not

fulfil one of the requirements of the invention which is that heat be removed from the wafer by conduction which would require much greater surface contact between the wafer and the pedestal. Thus, the ridge structure of document E3 could not without modification be applied to modify the apparatus of document E2 and therefore by reading these two documents together the skilled person would not, in the absence of any inventive activity, arrive at the apparatus claimed in claim 1 of the patent in suit.

- 6.7 The respondent also referred to a further document, document E5, which he wished to introduce into the proceedings as being another document that relates to the prevention of wafer skating. Following the Board's preliminary comment that the new document did not appear to teach anything more relevant to the determination of inventive step than document E3 since the modification required to the apparatus of document E1 would be similarly incompatible with the latter's declared purpose, the respondent did not pursue the matter any further. The question of the admissibility of the new document therefore does not need to be considered.
- 6.8 The respondent did not advance any separate arguments about lack of inventive step in respect of independent method claim 10.
7. In the Board's judgement, for the reasons set out above, the invention as claimed in claim 1 and claim 10 of the request involves an inventive step and complies with the other requirements of the EPC. The description in the patent in suit, however, needs to be adapted to be consistent with the amended claims.

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 with the claims as amended according to the only request, filed during the oral proceedings, drawings figures 1 to 8 as granted, and the description as to be adapted.

The Registrar:

The Chairman:

P. Martorana

R. K. Shukla