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D E C I S I O N
of 12 October 2004

Case Number: T 0584/02 - 3.2.7

Application Number: 95117528.0

Publication Number: 0716160

IPC: C23C 14/32

Language of the proceedings: EN

Title of invention:

Geometries and configurations for magnetron sputtering apparatus

Patentee:

OPTICAL COATING LABORATORY, INC.

Opponent:

Deposition Sciences, Inc.

Headword:

-

Relevant legal provisions:

EPC Art. 56, 100(b)

Keyword:

"Enabling disclosure (yes)"

"Inventive step (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0584/02 - 3.2.7

D E C I S I O N
of the Technical Board of Appeal 3.2.7
of 12 October 2004

Appellant: Deposition Sciences, Inc.
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Respondent: OPTICAL COATING LABORATORY, INC.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 25 March 2002
rejecting the opposition filed against European
patent No. 0716160 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: A. Burkhart
Members: H. E. Felgenhauer
C. Holtz

Summary of Facts and Submissions

- I. The appellant (opponent) filed an appeal against the decision of the Opposition Division rejecting the opposition against European patent No. 0 716 160.

Opposition had been filed against the patent as a whole based on the grounds of opposition according to Article 100(a) EPC (lack of novelty and of inventive step) and Article 100(b) EPC (insufficiency of disclosure).

The Opposition Division held that the patent disclosed the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art and that the subject-matters of claims 1 and 19 involved an inventive step in view of documents

D3: EP-A-0 328 257 and

D4: US-A-3 814 983.

- II. Oral proceedings before the Board of Appeal were held on 12 October 2004.

The respondent although duly summoned to the oral proceedings did not appear. The proceedings were continued without him (Rule 71(2) EPC).

- (i) The appellant requested that the decision under appeal be set aside and that the patent be revoked.

(ii) The respondent (patent proprietor) had requested in writing that the appeal be dismissed.

III. Claim 1 reads as follows:

"A coating apparatus comprising: a vacuum chamber; carrier means mounted within said chamber and adapted for mounting substrates thereon; coating means comprising at least a first device in the form of a deposition device positioned adjacent the carrier means and adapted for depositing a selected material onto the substrates and at least one second device positioned adjacent the carrier means and adapted for providing a plasma of low energy ions for effecting a selected chemical reaction with the selected material; at least one of the carrier means and the coating means being adapted for movement relative to the other along a selected path; the combination of carrier means configuration, deposition device configuration and said relative movement along the selected path providing substantially equal deposition rates for said substrate surfaces; characterised in that the second device is a microwave ion source device".

Claim 19 defines a corresponding process for forming optical coatings on substrates using the device according to claim 1.

IV. The arguments presented by the appellant in writing and referred to during the oral proceedings can be summarised as follows:

(i) The invention according to the patent in suit can only be considered as being sufficiently

disclosed as far as the apparatus according to the general definition given by claim 1 is concerned. Thus relying on common general knowledge it is within the means of the person skilled in the art to devise a coating apparatus having as a second device a commercially-available microwave ion source device, which, due to inherent characteristics of such an ion source can create a plasma of low energy.

- (ii) This however does not apply for the embodiment incompletely disclosed in the patent in suit (page 17, lines 3 to 15; Figure 37), according to which the microwave device is positioned in a specific manner as a downstream microwave source and thus remote from the substrate. Concerning this arrangement of a microwave ion source device the patent in suit lacks the information required with respect to the manner in which the microwave energy is coupled to the reactive gas and with respect to the type of manifold to be used for proper guiding of the contents of the plasma of low energy to the deposited selected material, which are to react with this material.

- (iii) Considering that the person skilled in the art has to rely on common technical knowledge in order to be able to carry out the invention based on the general definition given by claim 1, the subject-matter of this claim needs to be considered as being obvious in view of the coating apparatus according to the closest prior art and the common technical knowledge of the person skilled in the art.

- (iv) The closest prior art is the apparatus according to document D3. This apparatus comprises as a second device a linear magnetron ion source comprising electrodes. The second device thus acts in the manner of an ion gun.
- (v) Due to these electrodes this type of ion source undergoes wear while the apparatus is operated. The resulting decrease of operating lifetime of the second device leads to the objective technical problem to be solved aiming at an increase of the lifetime of this device and correspondingly the coating apparatus.
- (vi) Attempting to increase the lifetime for the second device of the apparatus according to document D3 it is the most likely solution to replace the source of the lifetime reduction, namely the linear magnetron ion source, by a microwave ion source. Use of such a device as second device in an apparatus of the kind concerned is well known in the common technical knowledge. Use of such a second device furthermore has the advantage of the generated plasma being of low energy. Application of such a plasma to the material deposited beforehand does not damage the crystal structure of the deposited material, as it can be the case for the linear magnetron ion source used as second device according to document D3.
- (vii) Document D4 directly leads to the use of a microwave ion source device as second device in

the apparatus according to document D3, since according to document D4 a microwave ion source device can be used as a second device of the kind concerned and since according to this document such a ion source device has the advantage of increased lifetime due to the absence of electrodes.

(viii) Consideration of features other than the ones comprised within claim 1 in the formulation of the technical problem to be solved by the coating apparatus according to claim 1 and in connection with the solution of this problem is, contrary to the opinion expressed in the decision under appeal and contrary to arguments of the respondent, not justified.

V. The arguments presented by the respondent in writing can be summarised as follows:

(i) The invention is disclosed in a sufficient manner in the patent in suit, taking into account that, as indicated in the description, a commercially-available microwave ion source device can be used. Furthermore a particular use of such a microwave ion source device as a downstream microwave ion source device is described in the patent in suit with reference to Figure 37.

(ii) Starting from document D3 as closest prior art the objective technical problem to be solved cannot be seen as being limited to an increase of the operating lifetime of the second device of the coating apparatus and of an increase of its

ionization efficiency. A technical problem should not be formulated such that it points to the solution. In addition to the technical problem being one seeking to improve the apparatus according to document D3 with respect to operation lifetime and efficiency, the person skilled in the art would have considered as further part of the problem to be solved to maintain the advantages of the apparatus according to document D3, namely high throughput and deposition rate, high controllability of the process and uniformity of the coating together with the ability to apply coatings to spherical and curved substrates.

- (iii) Starting from the apparatus according to document D3 the skilled person, in an attempt to solve this problem, would not have modified the apparatus according to document D3 by substituting for the second device the microwave device according to document D4, since microwave devices in general are known to be able to achieve only very limited uniformity. The pressure range disclosed in document D4 for the reactive gas is about a factor of 1000 higher than the pressure range according to document D3, which leads to the person skilled in the art having to expect severe problems in case it was attempted to use a second device according to document D4 in the apparatus according to document D3.

- (iv) Being aware of these disadvantages associated with the use of microwave ion source devices, the

person skilled in the art would have considered known specific uses of such devices only within the context of these uses.

- (v) Concerning document D4 the portion referring to an increase of the lifetime with respect to devices having electrodes does not relate to a substitution for an ion source device of the kind of the second device used in the apparatus according to D3, but to the substitution for arc lamps. Thus no indication is given for the replacement of the second device according to document D3.

Reasons for the Decision

1. *Subject-matter of claim 1*

Claim 1 is directed to a coating apparatus with coating means comprising at least a first device in the form of a deposition device for depositing a selected material onto the substrates and at least one second device adapted for providing ions for effecting a selected chemical reaction with the deposited material.

The second device is a microwave ion source device providing a plasma of low energy.

Concerning the structure of the second device and correspondingly the coating apparatus the use of a microwave ion source device results in a long operating lifetime, since the second device does not contain

sputtering elements (cf. patent in suit, page 17, lines 7, 8).

Concerning the function of the second device, the treatment of substrates with plasma of low energy, which directly results from the use of a microwave ion source device, leads to the crystal structure of the deposited selected material being less damaged by impinging ions (page 16, lines 53 to 55).

2. *Sufficiency of disclosure*

As indicated in section 1 above, claim 1 is directed to a coating apparatus with coating means comprising at least a first device in the form of a deposition device and at least one second device in the form of a microwave ion source device adapted for providing a plasma of low energy.

Claim 1 thus defines in rather general terms a coating apparatus with its essential elements for the deposition of material and for effecting a chemical reaction with respect to the deposited material.

The second means, being the one of importance with respect to the examination of whether or not the European patent discloses the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art, is defined with respect to its structure, namely as a microwave ion source device, and with respect to its function, namely as adapted for providing a plasma of low energy. As indicated by the appellant this function is inherent to the use of a microwave ion source device and thus does

not need to be further considered in context with the examination of the sufficiency of the disclosure.

According to the specific embodiment referred to in the patent in suit (description, page 17, lines 2 to 15; Figure 37) the second device can be a commercially-available microwave ion source arranged in a specific manner, namely as a downstream microwave source. As indicated this specific arrangement requires a manifold being provided to extend the microwave discharge from the remote location of the microwave ion source device to the substrate.

Unlike the disclosed embodiment, the coating apparatus according to claim 1 merely defines that the second device is in the form of a microwave ion source device, irrespective of the manner in which this device may be positioned with respect to the substrate.

The arguments by the appellant with respect to insufficiency of disclosure with respect to the specific embodiment with a downstream microwave ion source device thus do not apply with respect to the coating apparatus according to claim 1.

Since it is evident that the microwave ion source device can be a commercially-available one as indicated in the description, irrespective of the manner in which it is applied, and since a specific microwave ion source device can be selected, depending on the specific requirements with respect to the plasma of low energy ions to be generated by a second device, the European patent discloses the invention according to claim 1 in a manner sufficiently clear and complete for

it to be carried out by a person skilled in the art (Article 100(b) EPC).

3. *Inventive step*

3.1 Closest prior art

It is undisputed that document D3 constitutes the closest prior art. The coating apparatus according to this document comprises a first device in the form of a magnetron sputter device and a second device formed by a similar device in the form of a linear magnetron ion source operating in a reactive plasma mode (page 3, lines 34 to 44; page 6, lines 37 to 48). The plasma generated by this second device is, due to the second device being of the ion gun type (page 5, lines 45 to 49), of relatively high energy. It is known that such devices have, due to wear resulting from the use of electrodes, a reduced lifetime (cf. document D4, column 16, lines 10 to 22).

3.2 Problem

The coating apparatus according to claim 1 of the patent in suit differs from the one according to document D3 with respect to the structure and the function of the second device, which according to claim 1 is a microwave ion source device providing a plasma of low energy.

Provision of a second device of this type has the effect on the structure of the second device and thus the entire coating apparatus that the lifetime is

increased (cf. patent in suit, page 17, lines 7,8; document D4, column 16, lines 18 to 22).

Use of a microwave ion source device as a second device automatically leads to the additional, functional effect, that the plasma generated is one of low energy ions. This effect results in that the damage of the crystal structure of the deposited material due to impinging kinetic ions is lessened (patent in suit, page 16, lines 53 to 55), since these ions do not have the high kinetic energy of the ions generated by the linear magnetron ion source according to document D3. Since this additional effect comes automatically with the use of a microwave ion source device as second device the corresponding distinguishing feature and the effect obtained by it need not be further considered with respect to the formulation of the objective technical problem to be solved by the subject-matter of claim 1.

Based on the structural feature distinguishing the coating apparatus according to claim 1 from the one according to document D3 and structural effect this feature has, the objective technical problem underlying the patent in suit can be formulated as aiming at an increase of the operating lifetime of the second device and correspondingly of the coating apparatus.

Contrary to the decision under appeal (reasons, No. 5.3) and the opinion of the respondent, features not comprised within claim 1, and correspondingly effects resulting from such features, cannot be considered in the formulation of the problem.

Although in this respect the opinion of the respondent can be followed that in addition to the technical problem seeking to improve the apparatus according to document D3 with respect to an increase of the lifetime of the second device, the person skilled in the art would likewise have considered the advantages of the apparatus according to document D3, namely high throughput and deposition rate, high controllability of the process and uniformity of the coating together with the ability to apply coatings to spherical and curved substrate to be maintained, such considerations can, due to the lack of corresponding features in claim 1 of the patent in suit, neither be considered in the formulation of the objective technical problem to be solved nor in the examination of the solution to this problem with respect to inventive step.

Furthermore the technical problem stated above is formulated based on one effect, namely the structural effect provided for by the features distinguishing the coating apparatus according to claim 1 from the one according to document D3 and thus does, contrary to the opinion expressed by the respondent, not comprise elements of the solution. Connecting the problem of lifetime to be increased directly to an element, namely the second device of a coating apparatus, can in the present case not be understood as pointing to the solution. The source of reduced lifetime is readily identifiable as being the second device, the electrodes of which are subject to wear (cf. document D4, column 16, lines 10 to 22), such that it is justified to focus the technical problem aiming at this disadvantage to be avoided, and subsequently also the solution to this problem, on the second device.

As pointed out by the appellant it is, contrary to the view expressed in the decision under appeal (reasons, No. 5.6.2), of no concern for the formulation of the problem that in document D3 the lifetime of the coating apparatus or of its second device is not referred to. The technical problem indicated above is formulated based on the structural feature distinguishing the subject-matter of claim 1 from the coating apparatus according to document D3. Due to the second device according to document D3 comprising electrodes which are subject to wear, it is a problem which becomes apparent during the operating lifetime of the known coating apparatus and also one which is known from common technical knowledge, since, contrary to the decision under appeal (reasons, 5.6.1), it is clearly stated in document D4 that, for a second device of the kind concerned (column 1, lines 40 to 44; column 10, lines 53 to 62), the presence of electrodes reduces the operating lifetime (column 16, lines 10 to 18). Although document D4 mentions "arc lamps, such as high pressure xenon arcs" as an example for devices with "early failure (which) resides in the presence of electrodes" it is clear that this disadvantage applies likewise for any device referred to in this document and thus also for those being of the type of second devices as long as they comprise electrodes.

3.3 Solution

The problem stated above in section 3.2 is according to the subject-matter of claim 1 solved in that the second device is a microwave ion source device. Providing a second device of this type not only the structural

effect, according to which the operating lifetime is increased, is achieved but automatically also the additional functional effect, according to which damage to the crystal structure of the deposited material is lessened (cf. section 1 above).

3.4 Obviousness

Starting from the coating apparatus according to document D3 in order to solve the problem, namely to increase the operating lifetime of the second device it is according to the appellant the first choice for the person skilled in the art to replace the second device by one with increased operating life. The Board follows this opinion, which also results directly from document D4.

This document relates to devices having the function of second devices as referred to in claim 1 (cf. column 1, lines 34 to 44; column 10, lines 49 to 62), mentions the problem of reduced operating lifetime of corresponding devices due to the presence of electrodes (column 16, lines 10 to 18) and proposes a solution for this problem, namely the provision of a microwave ion source device (claim 1; column 16, lines 18 to 22).

Starting from the coating apparatus according to document D3 having a second device comprising electrodes it is obvious for the person skilled in the art, in an attempt to increase the operating lifetime of this second device, which is, as can be experienced and as it is known from document D4, reduced due to the presence of electrodes, to replace this second device

by the microwave ion source device proposed among others for this very reason by document D4.

According to the decision under appeal (reason 5.6.5) and the respondent the person skilled in the art, starting from the apparatus according to document D3, in an attempt to solve the problem of increasing the operating lifetime of the second device, would not have modified the apparatus according to document D3 by substituting the microwave device for the second device as proposed by document D4, since it is not derivable from this document that microwave devices are able to provide a plasma of the required rate and uniformity over large areas as required and since the pressure range disclosed within document D4 for the reactive gas is about a factor of 1000 higher than the pressure range according to document D3, leading to severe problems to be expected due to this pressure difference. These arguments cannot be considered in the examination of inventive step with respect to the subject-matter of claim 1 since these considerations apparently neither have been materialised as features of this claim nor as part of the description or of the drawing of the patent in suit.

For completeness sake it should be indicated that features relating to uniformity of the plasma and pressure differences between areas occupied by first devices and by second devices, which are not comprised in claim 1 and not disclosed in the patent in suit, and which, due to the general definition of a coating apparatus of claim 1, have not been considered with respect to the examination of sufficiency of the

disclosure, can likewise not be considered in the examination with respect to inventive step.

Therefore, the coating apparatus according to claim 1 of the patent in suit does not involve an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

G. Nachtigall

A. Burkhart