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File No.: T 0307/92 - 3.4.1

Application No.: 82 104 113.4

Publication No.: 0 070 982

Classification: H01J 37/34

Title of invention: Sputtering system

**D E C I S I O N**  
of 23 November 1993

Applicant: -

Proprietor of the patent: International Business Machines Corporation

Opponent: Leybold Aktiengesellschaft  
Balzers Aktiengesellschaft

Headword: -

**EPC:** Art. 102(3) and 84

Keyword: "Unclear definition of an essential feature of the invention"

**Catchwords**



**Case Number:** T 0307/92 - 3.4.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.1**  
**of 23 November 1993**

**Appellant:** Leybold Aktiengesellschaft  
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**Representative:**

**Appellant:** Balzers Aktiengesellschaft  
(Opponent) FL - 9496 Balzers (FL)

**Representative:** Troesch, Jacques J., Dipl.-Ing.  
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**Respondent:** International Business Machines  
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**Representative:** Klocke, Peter, Dipl.-Ing.  
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**Decision under appeal** Interlocutory decision of the Opposition Division of the  
European Patent Office dated 12 March 1992 concerning  
maintenance of European patent No. 0 070 982 in amended  
form.

**Composition of the Board:**

**Chairman:** G.D. Paterson

**Members:** H.J. Reich  
U.G.O.M. Himmler



## Summary of Facts and Submissions

- I. The Respondent is owner of European patent No. 0 070 982.
- II. The Appellants "Leybold AG" and "Balzers AG" separately filed notices of opposition against this patent on the grounds mentioned in Article 100(a) EPC and cited against the patent as granted and subsequently during the opposition procedure eight documents, referring in particular to the prior art which can be derived from documents:
- D1: DE-A-2 148 933,  
D2: IBM-Technical Disclosure Bulletin, Vol. 11, No. 9, February 1969, page 1102, and  
D3: DE-A-2 149 606.
- III. By an interlocutory decision within the meaning of Article 106(3) EPC the Opposition Division decided on the amended form in which the European patent could be maintained.

Claim 1 on which the decision was based, reads as follows:

- "1. Sputtering system comprising, within a chamber (20) adapted to be evacuated and to maintain a low pressure ionisable gas therein, an anode electrode (8) and a cathode electrode (7) having a surface facing said anode, a source target (2) mounted to said cathode surface facing the anode, with said

anode (8) adapted for mounting work-piece substrates (14) thereon in face-to-face sputtering relationship with the surface of said target (2), a spaced groundshield (22) surrounding said cathode electrode (7) and means for applying an operating voltage between said cathode and anode electrodes for sputtering of material from said target (2) on said substrates (14), characterized in that an electrically floating shield (86) **is located in the axial direction so as to** surround the target (2) in **such** a spaced relationship therewith, **that a plasma suppression gap is formed.**"

The wording of the amendment introduced during opposition proceedings into the granted version of Claim 1 is emphasised.

Claims 2 to 8 are dependent on Claim 1.

The Opposition Division took the view that amended Claim 1 implies an inventive step, in particular because document D1 describes a triode-sputtering system and not a quadrupole one having additionally a groundshield, and contains no information leading to the plasma suppression gap claimed. Furthermore, it cannot be deduced from document D2 that the cathode comprises a target plate, that the analogue to the claimed shield, a control cathode, is floating and surrounds a target plate, and that there is a plasma suppression gap between control cathode and target plate. The electrically floating shield interposed in

document D3 between cathode and groundshield reduces capacitive losses and thus solves a different problem. There is no incitement in document D3 leading to a floating shield which surrounds the target and is separated from it by a plasma suppression gap.

IV. The Appellants lodged an appeal against the interlocutory decision. In its Statement of Grounds the Appellant "Leybold AG" took the view that amended Claim 1 was obvious in view of document D1, a plasma suppression gap being automatically formed around a floating electrode and repulsing plasma electrons during sputtering as in the patent under appeal. The Appellant "Balzers AG" based its appeal mainly on the argument that the subject-matter of amended Claim 1 differs from the sputtering system disclosed in document D3 only in that the electrically floating shield "surrounds" the target. Such a position would be obvious in view of documents D1 and D2. Both Appellants requested that the patent under appeal be revoked, and auxiliarily, oral proceedings.

V. The Respondent, in a letter dated 13 August 1992, contested the Appellants' arguments. The inventive self-regulative arrangement is not derivable from the prior art. The shield disclosed in document D1 is not electrically floating, differently positioned and formed and not forming a plasma suppression gap. The cathode control mesh disclosed in document D2 is not floating but requires charge regulation means in order to produce the equipotential lines as indicated in Fig. B of document D2. The end parts of the capacity-



reducing shields disclosed in document D3 are positioned opposite a bent part of the ground shield which surrounds the target. Such a configuration excludes an influence of the shield on the plasma. Hence, a plasma stabilisation via a plasma suppression gap would be not obvious. For these reasons, the Respondent requested that the patent be maintained in the amended form as granted by the Opposition Division.

VI. In a communication dated 14 May 1993 and annexed to a summons to oral proceedings, the Board informed the parties *inter alia* of its provisional view that the present wording of Claim 1 might be regarded as not satisfying Article 84 EPC for the following reasons:

- (a) A clear definition of the position of the floating shield - i.e. that it extends **radially** in front of the groundshield surface facing the anode - would be an essential feature of the solution of the problem to increase the stability of the plasma.
- (b) Moreover, the present wording of Claim 1: "in that the floating shield is located in **axial** direction ..." may be interpreted to define a technical means of the system according to document D3, wherein also a "plasma suppression gap" between shield and target might be present in view of the statement in document D3, column 2, lines 63 to 66.
- (c) Furthermore, it would be necessary to clarify that the shield surrounds "the periphery" of the target

in order to exclude its undesired extension into the volume between anode and cathode.

VII. In letters dated 30 June 1993 and 9 July 1993 respectively, both Appellants declared that they would not be represented at the appointed oral proceedings. Thereupon, in a letter dated 13 July 1993 the Board informed the parties that the appointed oral proceedings were cancelled and the pending appeal proceedings were to be continued in writing.

VIII. In the Board's letter dated 13 July 1993 the parties were invited to present their comments to the Board's communication dated 14 May 1993 in writing within a two-month period. However, none of the parties replied to this letter within the given period.

**Reasons for the Decision**

1. As disclosed in the patent under appeal, column 2, lines 25 to 37, the object of the invention is to provide a sputtering system with reduced arcing, increased stability and reduced flaking contamination. The arcs can melt metal surface parts of the chamber, which melted particles will spray all over in the chamber, causing potential product reduction in particular in the deposition of insulating layers. For this reason, the gist of the invention consists in a very low susceptibility to arcing due to the mechanical configuration of the invention, which reduces the RF field gradient across the source target and at the edge

of said target; see the patent under appeal, column 2, lines 42 to 53. Such gradient reduction is disclosed to be realised by the electrically floating shield which according to the patent under appeal, column 3, lines 34 to 40 "**circumscribes** the target in spaced relationship therewith forming a plasma suppression gap", or which according to the disclosure in Figures 2 to 4 of the patent under appeal "extends **radially** in front of the groundshield surface facing the anode so as to surround the periphery of the target in such a spaced relationship therewith, that a plasma suppression gap is formed. A plasma suppression gap is defined - for instance in document D3, column 2, lines 8 to 16 - as a gap with a width which is too small to allow electrons to ionise gas molecules and form a plasma within this gap. Hence, in order to secure arc suppression, form and position of the floating shield have to guarantee a reduction of the field gradient around the target. They are thus essential features of the solution of the technical problem and have to be comprised in the subject-matter of the independent claim; see also T 32/82, OJ EPO 1984, 354, paragraph 15.

2. However, the amended wording of present Claim 1 reads that the floating shield "is located in the **axial** direction so as to surround the target". The claimed "axial" direction being nowhere explicitly defined in the text of the patent under appeal, a skilled person would look for an axis in the embodiments of the figures and find that the only recognisable axis is the central axis of symmetry which is directed normal to

the main surface of the target. For this reason, in the Board's view, the claim wording can be interpreted linguistically in that the minimum local distance between shield and target shall lie in a direction normal to the main target surface. However, such distance is contrary to all embodiments disclosed in the patent under appeal, wherein the minimum distance between shield and target lies in a direction parallel to the main target surface as a result of a shield location not in axial but in **radial** direction so as to surround the **periphery** of the target. In the Board's view exclusively such a location of the shield suppresses ionisation in the vicinity of the edges of the target and produces the desired gradient reduction near the target surface. Hence, the amendment introduced into granted Claim 1 during the opposition procedure leads to a severe contradiction with regard to the technically consistent disclosure of the essential element for the solution of the technical problem, which is derivable from the description and drawings of the patent under appeal.

3. Moreover, as explained in paragraph 2 above, the claimed "axial" direction allows an interpretation as a direction normal to the target surface. Therefore, the present wording of Claim 1 cannot be excluded to describe the mechanical configuration of floating shields 21 and 22 in document D3, so that a clear definition of the differences between the local positions of the floating shield in the closest prior art and that in the invention according to the patent under appeal is missing in Claim 1. Hence, in the

Board's view, Claim 1 lacks a clear definition of the essential technical means which converts the capacitance-reducers 21 and 22 of document D3 into the desired arc-suppressor of the patent under appeal.

4. For the reasons set out in detail in paragraphs 1 to 3 above, in the Board's judgment, Claim 1 is not clear in the sense of Article 84 EPC. Therefore, the patent under appeal cannot be maintained on the basis of Claim 1 with regard to Article 102(3) EPC.

**Order**

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

1. The decision of the Opposition Division is set aside.
2. European patent No. 0 070 982 is revoked.

The Registrar:

The Chairman:

M. Beer

G.D. Paterson