

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 31

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte AKINORI EBE, SATOSHI NISHIYAMA,
KIYOSHI OGATA, and YASUO SUZUKI

Appeal No. 1998-1628
Application No. 08/384,597

ON BRIEF

Before HAIRSTON, GROSS, and BLANKENSHIP, Administrative Patent Judges.

GROSS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 5 through 7, which are all of the claims pending in this application.

Appellants' invention relates to an apparatus for forming a film on a substrate. The apparatus includes an ion source and an evaporation source, which together operate to produce on the substrate a mixed layer with a ratio M/N ranging from 10 to 1000, where M is the number of evaporation material

atoms reaching the substrate surface per unit time and per unit area and N is the number of ions reaching the substrate surface per unit time and per unit area. The apparatus further includes means for forming a film of the evaporation material on top of the mixed layer. Due to the mixed layer, the film adheres well to the substrate. Claim 5 is illustrative of the claimed invention, and it reads as follows:

5. A film forming apparatus comprising:

means for continuously moving an objective substrate through a vacuum chamber;

an evaporation source disposed at a first location for vacuum evaporation of a material onto a substrate surface as the objective substrate is moved through the vacuum chamber in a first direction;

an ion source disposed at a second location for radiating ions having ion energy in a range of 500eV to 8KeV toward the substrate surface as the objective substrate is moved through the vacuum chamber in the first direction, said ion source being disposed so that the radiating ions form a mixed layer with the ratio (M/N) of the number M of evaporation material atoms reaching the substrate surface per unit time and per unit area to the number N of ions reaching the substrate surface per unit time and per unit area being in a range from 10 to 1000;

the ion and evaporation sources operating to produce a mixed layer on the substrate surface as the substrate is moved through the vacuum chamber in the first direction; and

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the evaporation source operating to produce a film on the mixed layer on the substrate surface as the objective substrate is again moved through the vacuum chamber in the first direction or a second direction opposite to the first direction.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Suzuki et al. (Suzuki) 1987	4,683,149	Jul. 28,
Ando et al. (Ando) 1989	4,828,870	May 09,
Ogata et al. (Ogata) 1993	5,250,327	Oct. 05,
Fukui et al. ¹ 1990 (Nisshin Steel)	JP 02-247371	Oct. 03,

Claim 5 stands rejected under 35 U.S.C. § 103 as being unpatentable over Suzuki in view of Ogata and Ando.

Claims 5 through 7 stand rejected under 35 U.S.C. § 103 as being unpatentable over Nisshin Steel in view of Suzuki, Ogata, and Ando.

Reference is made to the Final Rejection (Paper No. 22, mailed July 24, 1996) and the Examiner's Answer (Paper No. 28,

¹ Since both the examiner and appellant refer to this reference as Nisshin Steel, we too shall use the name Nisshin Steel for this reference. In addition, our understanding of this reference is based upon a translation provided by the Translations Branch of the Patent and Trademark Office, a copy of which is attached to this decision.

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mailed April 11, 1997) for the examiner's complete reasoning in support of the rejections, and to appellants' Brief (Paper No. 27, filed January 16, 1997) and Reply Brief (Paper No. 29, filed June 4, 1997) for appellants' arguments thereagainst.

OPINION

We have carefully considered the claims, the applied prior art references, and the respective positions articulated by appellants and the examiner. As a consequence of our review, we will reverse the obviousness rejections of claims 5 through 7.

The examiner first rejects claim 5 over Suzuki, Ando, and Ogata. Suzuki discloses an apparatus for forming a film on a substrate which includes an evaporation source and an ion source. Suzuki states (column 3, lines 37-41) that ions from the ion source mix with the deposition layer at the interface between the substrate and the deposition layer, forming a continuously varying composition or mixed layer. Suzuki discloses (column 1, lines 52-53, column 2, lines 13-14, and column 3, lines 32-34) that the ion beam energy ranges from 10KeV to 100KeV, with specific examples of 30KeV and 40KeV (see column 4, lines 57-58, column 5, lines 16-18 and 55-56,

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and column 6, lines 43-44), which fall outside the claimed range of 500eV to 8KeV. Further, Suzuki makes no mention of the ratio of evaporation atoms to ions reaching the substrate.

The examiner maintains (Final Rejection, pages 2-3, and Answer, pages 4-6) that both the claimed ion energy of 500eV to 8KeV and the claimed ratio of 10 to 1000 for evaporation atoms to ions are merely statements of intended use of the apparatus, and, therefore, are not given patentable weight. Appellants, on the other hand, assert (Brief, page 8) that the claimed voltage range is not an intended use, but rather "quantifies a structural characteristic of an element of the apparatus, i.e., the ion source." Similarly, appellants assert (Brief, page 10) that the claimed ratio of evaporation atoms to ions is not an intended use, but rather, "constitutes structural definition of the ion and evaporation sources as elements of the apparatus."

We agree with appellants. Both the voltage range and the ratio are positively recited limitations in the claims and at least partially define the positioning and amounts of the ion and evaporation sources. Thus, the two ranges amount to structural limitations which cannot be ignored.

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Regarding the claimed energy range, as indicated above, Suzuki discloses an energy range greater than that claimed by appellants. The examiner never acknowledges this difference, but rather states (Final Rejection, page 2) that the apparatus of Suzuki "has the inherent capability of operation." Thus, Suzuki fails to suggest the claimed energy range.

Ogata discloses (column 6, lines 15-23) that the energy for ions should be no higher than 40KeV for reducing defects in a ceramic material being formed on a metal substrate. However, there is no suggestion in Ogata to use an energy as low as 0.5 to 8KeV, as claimed. Ando discloses that energy for irradiating the surface of a substrate with ions should range from 0.1KeV to 1KeV, which overlaps the claimed range, to improve the crystalline properties of aluminum vapor deposited thereon. However, Ando radiates the ions to strengthen the vapor deposited aluminum layer, not to form an intermediate layer between the substrate and the vapor deposited layer. Therefore, we find no motivation for applying the recited energy range to Suzuki's formation of an intermediate mixing layer.

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The examiner further asserts (Final Rejection, page 3) that the ratio M/N would have been obvious because "it is a variable of art recognized importance which is subject to routine experimentation and optimization and discovery of an optimum value for a known apparatus is obvious." However, optimization is only obvious for result effective variables, and the examiner has provided no evidence that the ratio of M/N is such a result effective variable. See In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

The examiner contends (Final Rejection, page 3) that Ogata suggests adjusting the ratio according to the materials deposited. However, Ogata provides no guidance as to how one would select a ratio of evaporation atoms to ions. Further, the examiner (Final Rejection, page 3-4) points to the range of 3 to 200 in Ando, which overlaps the claimed range, for the ratio of evaporation atoms to ions and asserts that it would have been obvious to set the ratio in Suzuki to within such a range "because better quality film is produced." However, as with the energy range, since Ando is directed to strengthening a deposited aluminum layer, we find no motivation for applying Ando's disclosed range to Suzuki's formation of an

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intermediate mixing layer. Consequently, we cannot sustain the rejection of claim 5 over Suzuki, Ogata, and Ando.

The examiner additionally applies Nisshin Steel, Suzuki, Ogata, and Ando in combination against claims 5 through 7. Nisshin Steel uses an ion beam energy of 10eV, which is significantly lower than the claimed energy range (see translation, page 7). Further, like Suzuki, Nisshin Steel fails to disclose the ratio of evaporation atoms to ions. The examiner employs the same reasoning for modifying Nisshin Steel that we above found deficient with regard to modifying Suzuki. We find the reasoning equally lacking for modifying Nisshin Steel. Accordingly, we cannot sustain the rejection of claims 5 through 7 over Nisshin Steel, Suzuki, Ogata, and Ando.

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CONCLUSION

The decision of the examiner rejecting claims 5 through 7 under 35 U.S.C. § 103 is reversed.

REVERSED

KENNETH W. HAIRSTON)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
ANITA PELLMAN GROSS)	APPEALS
Administrative Patent Judge)	AND
)	INTERFERENCES
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HOWARD B. BLANKENSHIP)	
Administrative Patent Judge)	

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