

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte NOBUO ISHII

Appeal 2007-2150
Application 10/343,201
Technology Center 1700

Decided: November 30, 2007

Before PETER F. KRATZ, JEFFREY T. SMITH, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

SMITH, *Administrative Patent Judge*.

DECISION ON APPEAL

Statement of the Case

This is an appeal under 35 U.S.C. § 134 from a final rejection of claims 1-10. We have jurisdiction under 35 U.S.C. § 6.¹

Appellant's invention relates to a radial antenna and a plasma processing apparatus comprising a radial antenna. Claims 1 and 10 are illustrative:

¹ An oral hearing was held on October 23, 2007.

1. A radial antenna characterized by comprising
 - a first conductive plate having a plurality of slots,
 - a second conductive plate having a microwave entrance and arranged to oppose said first conductive plate,
 - a ring member which connects peripheral portions of said first and second conductive plates, and
 - a guide member arranged in a radial waveguide formed of said first and second conductive plates to extend in a direction of propagation of a microwave from said microwave entrance to said ring member.

10. A plasma processing apparatus characterized by comprising
 - a susceptor which places a target object thereon,
 - a process chamber which accommodates said susceptor,
 - exhaust means for evacuating an interior of said process chamber,
 - gas supply means for supplying a gas into said process chamber, and
 - antenna means which is arranged to oppose a surface of said susceptor where the target object is to be placed and which supplies a microwave into said process chamber,
wherein said antenna means comprises the radial antenna according to claim 1.

The Examiner relies on the following references in rejecting the appealed subject matter:

| | | |
|----------------|-----------------|---------------|
| Kakehi | US 5,433,789 | Jul. 18, 1995 |
| Goto | 2001/0008122 A1 | Jul. 19, 2001 |
| Kawakami | US 6,470,824 B2 | Oct. 29, 2002 |

Claims 1-10 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Goto in view of Kakehi; and Kawakami in view of Goto and Kakehi.

We REVERSE.

The Examiner bears the initial burden of presenting a *prima facie* case of obviousness. *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). In order to establish a *prima facie* case of obviousness, the Examiner must show that each and every limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988)). “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (*quoted with approval in KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007)).

The Examiner has not established obviousness in this case.

The claimed invention is directed to a radial antenna, the guide member may comprise a plurality of conductive partitions arranged in the radial waveguide.

The Specification describes the radial antenna and guide member as follows:

[T]he radial antenna comprises a first conductive plate having a plurality of slots, a second conductive plate having a microwave entrance and arranged to oppose the first conductive plate, a ring member which connects peripheral portions of the first and second conductive plates, and a guide member arranged in a radial waveguide formed of the first and second conductive plates to extend in a direction of propagation of a microwave from the microwave entrance to the ring member.

The guide member can suppress generation of a standing wave at least in the circumferential direction of the radial

waveguide, and can prevent production of complex electromagnetic mode due to a microwave reflected from the peripheral portion of the radial waveguide. Hence, no electromagnetic absorbing member need be provided to the peripheral portion of the radial waveguide. The microwaves reflected from the peripheral portion of the radial waveguide are also radiated through the slots formed in the first conductive plate, so the microwaves contribute to production of a plasma. Since no electromagnetic absorbing member need be provided, excessive heat is not generated.

In this radial antenna, the guide member may comprise a plurality of conductive partitions arranged in the radial waveguide radially when viewed from the top and extending between the first and second conductive plates.
(Spec. 4-5).

The Specification discloses the guide member functions to distribute the microwave supplied to the radial antenna. Specifically the Specification states:

The microwave MW supplied to the radial antenna 30 spreads radially from the center in the radial waveguide 33 formed of the conductive plates 31 and 32. The partitions 37 arranged in that region of the radial waveguide 33 which is close to its peripheral portion serve as the guide members, so the microwaves MW propagate along the partitions 37. Since the gap between the adjacent partitions 37 is set to almost $L_1 \geq \lambda_g/2$, the microwave MW can easily propagate in the region partitioned by the partitions 37.

(Spec. 14).

Claim 1 describes a radial antenna comprising a guide member formed of first and second conductive plates that extend in the direction of propagation of a microwave from the microwave entrance to the ring member. The subject matter of claim 9 is directed to a radial antenna that comprises a guide member. Claim 9 does not describe the structure of the

radial antenna. However, as stated above, the Specification 4 discloses the radial antenna comprises a first conductive plate having a plurality of slots, a second conductive plate having a microwave entrance and arranged to oppose the first conductive plate, a ring member which connects peripheral portions of the first and second conductive plates. The Specification discloses that a guide member is arranged in a radial waveguide formed of the first and second conductive plates to extend in a direction of propagation of a microwave from the microwave entrance to the ring member.

The Examiner asserts that Goto describes a plasma processing apparatus comprising a radial antenna. The Examiner asserts that Goto does not disclose a guide member arranged in the radial waveguide. The Examiner asserts that Kakehi discloses a guide member arranged in a radial waveguide. The Examiner concludes that it would have been obvious to modify the apparatus of Goto to include the guide member of Kakehi (Answer 4).

In contrast to the assertion in the Answer, Kakehi describes a plasma generating apparatus comprising a waveguide for guiding microwaves in the propagation direction from a microwave generator to a plasma-forming region (col. 2, 7-11). Kakehi discloses the waveguides (mode restrictors) are used to subdivide the waveguide section that extends parallel to the microwave propagation direction (col. 2, 64-66). The Examiner has not established that Kakehi (alone or in combination with Kawakami and/or Goto) teaches or suggests a radial waveguide with a guide member arranged in the radial waveguide so as to suppress standing wave formation and/or formed from first and second conductive plates to extend

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in a direction of propagation of a microwave as required by the claims on appeal. The Examiner has failed to establish how the cited references teach or suggest a waveguide having the structure required by the appealed claims.²

The Examiner has not adequately addressed the suitability of modifying the cited prior art to achieve the claimed invention.

ORDER

The Examiner's decision rejecting claims 1-10 is reversed.

REVERSED

tf/ls

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² The Kawakami reference was not cited for describing the waveguide component.