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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte AMBARISH CHHATRE,
DAVID SCHAEFER, and KEITH GAFF

Appeal 2019-003788
Application 14/136,953
Technology Center 1700

Before MICHAEL P. COLAIANNI, GEORGE C. BEST, and
DEBRA L. DENNETT, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant¹ appeals under 35 U.S.C. § 134(a) the final rejection of claims 26–43, 50–56, and 58–62. Claims 1–25, 44–49, and 57 have been canceled. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We REVERSE.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as Lam Research Corp. (Appeal Br. 3).

STATEMENT OF THE CASE

Appellant's invention is directed to an edge ring for extending an elastomer seal's lifetime in a plasma processing chamber (Spec. Title). According to the Specification, semiconductor substrates are processed in a reaction chamber containing top and bottom electrodes by initially adding gas to the chamber (*id.* ¶ 1; *see also id.* at Fig. 1). The Specification describes that radio frequency power is then applied between the electrodes to excite the gas into a plasma, which is directed onto the substrate's surface to remove substrate material (*id.* ¶ 1). The described edge rings, which are positioned around the substrate support, are said to confine plasma to the volume above the substrate and/or to protect the substrate support from erosion by the plasma (*id.* ¶ 2).

Claims 26 and 51 are illustrative (emphasis added):

26. An edge ring configured to surround an outer periphery of a substrate support in a plasma processing chamber, wherein plasma is generated and used to process a substrate, wherein the substrate support comprises a base plate, a top plate, and an elastomer seal assembly between the base plate and the top plate, wherein the substrate support has an upper vertical sidewall extending between an outer periphery of an upper surface of the top plate and an outer periphery of a lower surface of the top plate, and wherein a lower vertical sidewall extends between an outer periphery of an upper surface of the base plate and an outwardly extending annular support surface of the base plate, the edge ring comprising:

a lower inner surface;

an edge step angled to define an interior portion of the edge ring and comprising

an upper inner surface, and

an inner angular surface extending from the lower inner surface to the upper inner surface and at an angle to narrow a

horizontal width of a gap between the elastomer seal assembly and the edge ring, such that the horizontal width decreases along the elastomer seal assembly between the inner angular surface and the elastomer seal assembly,

wherein the edge step is arranged to extend from a point outside of and opposing a periphery of the upper surface of the top plate down to a point outside and opposing the base plate, and

wherein the upper inner surface at least one of provides a constraint for an elastomer seal of the elastomer seal assembly or aids in preventing plasma erosion of the elastomer seal;

an outer surface;

a lower surface extending from the lower inner surface to the outer surface; and

a top surface extending from the outer surface to the upper inner surface.

51. The edge ring of claim 26, wherein *the inner angular surface extends upward and radially from the lower inner surface to the upper inner surface to narrow the gap between the elastomer seal assembly and the edge ring to at least one of provide the constraint for the elastomer seal or prevent plasma erosion of the elastomer seal.*

Appeal Br. 29–30, 35 (Claims App.) (emphasis added).

Appellant appeals the following rejections:²

1. Claims 51 and 60–62 are rejected under 35 U.S.C. § 112(a) as failing to comply with the written description requirement (Final Act. 3).

² In the Final Office Action, the Examiner rejected: (i) claim 59 under 35 U.S.C. § 112(a) as failing to comply with the written description requirement; and (ii) claims 26, 35, 51, 58, and 59 under 35 U.S.C. § 112(b) as indefinite (Final Act. 3–4). In the Advisory Action dated August 28, 2018, the Examiner indicated that an amendment, filed August 7, 2018,

2. Claims 26, 27, 29–35, 37, 39–43, 50–54, and 58–62 are rejected under 35 U.S.C. § 103 as unpatentable over Kadkhodayan et al. (US 2009/0200269 A1, published Aug. 13, 2009, “Kadkhodayan”) in view of Yudovsky et al. (US 2008/0072823 A1, published Mar. 27, 2008, “Yudovsky”) (Final Act. 4–5).
3. Claims 28 and 38 are rejected under 35 U.S.C. § 103 as unpatentable over Kadkhodayan in view of Yudovsky, and further in view of Augustino et al. (US 2010/0108261 A1, published May 6, 2010, “Augustino”) (Final Act. 5–6).
4. Claims 36, 55, and 56 are rejected under 35 U.S.C. § 103 as unpatentable over Kadkhodayan in view of Yudovsky, and further in view of Schaefer et al. (US 2013/0097840 A1, published Apr. 25, 2013, “Schaefer”) (Final Act. 6).

FINDINGS OF FACT & ANALYSIS

After review of the respective positions provided by Appellant and the Examiner, we REVERSE the Examiner’s rejections of claims 26–43, 50–56, and 58–62 for the reasons presented by Appellant. We add the following.

A. *Rejection of claims 51 and 60–62 under 35 U.S.C. § 112(a) as lacking written description support*

Appellant’s arguments for reversal of the Examiner’s § 112(a) rejection of claims 51 and 60–62 focus on limitations recited in each claim (*see* Appeal Br. 15; Reply Br. 2–5). We select claim 51 as representative of claims 60–62.

would be entered and that the amendment overcame the § 112(a) rejection of claim 59 and the § 112(b) rejection (Advisory Act. 2, 3).

The Examiner finds that the limitation “*the inner angular surface extends upward and radially from the lower inner surface to the upper inner surface . . . to at least one of provide the constraint for the elastomer seal or prevent plasma erosion of the elastomer seal,*” as recited in claim 51 (emphasis added), has inadequate support in the original disclosure (see Final Act. 3). The Examiner finds that the limitation contradicts the Specification as filed (*id.*). According to the Examiner, the Specification “attributes ‘constraint’ to the edge step (212) and the prevention of plasma erosion to the size of gap 384,” without any description that inner angular surface 222 provides either function (*id.* (citing Spec. ¶ 41)).

Figure 3, reproduced below, illustrates a cross-sectional view of a lower electrode assembly:

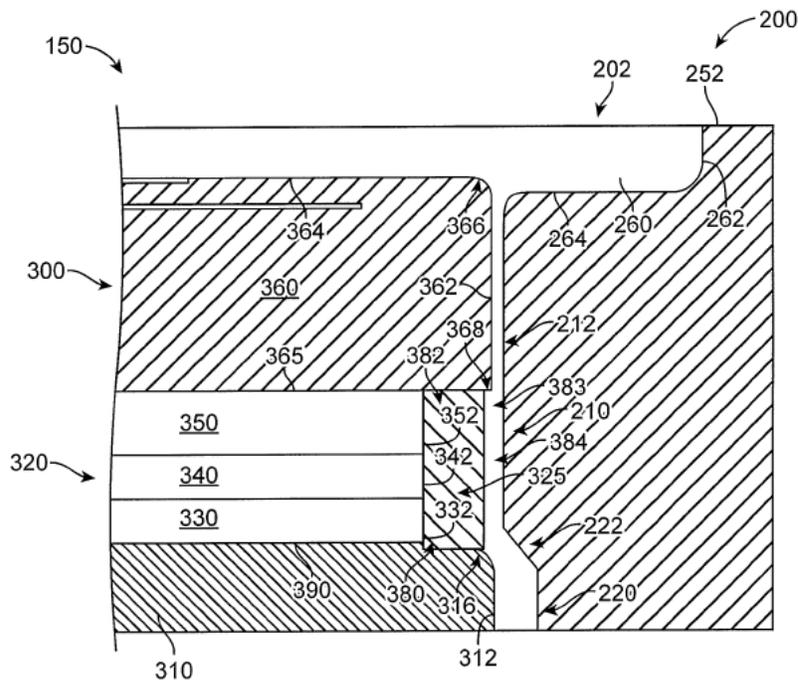


FIG. 3

The Specification’s Figure 3 illustrates edge ring 200 comprising edge step 212 of upper inner surface 210, which extends from an outer periphery

of substrate support surface 364 to an outer periphery 325 of elastomer seal assembly 320, with gap 384 therebetween (Spec. ¶¶ 26, 41). Figure 3 illustrates that edge ring 200 further comprises inner angular surface 222 and lower inner surface 220 (*id.* ¶ 26).

Figure 4, reproduced below, illustrates a cross-sectional view of an edge ring:

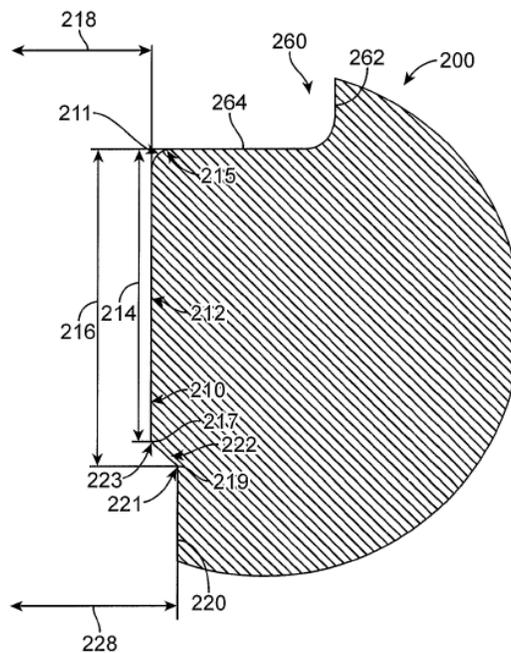


FIG. 4

The Specification's Figure 4 illustrates the height 216 of edge step 212 (Spec. ¶ 42).

Appellant argues that the Specification, as filed, "imputes the function of plasma constraint to the edge step 212, which includes both the upper inner surface 210 and the inner angular surface 222" (Appeal Br. 15 (emphasis added); see Spec. ¶ 41). In particular, Appellant notes that the Specification explicitly discloses that "edge step 212 has a height 216" and Figure 4 depicts height 216 as including inner angular surface 222 (Appeal Br. 15 (citing Spec. ¶ 42)). Appellant further notes the Specification

describes that “edge step 212 extends from the lower inner surface 220 of the edge ring 200 radially inward” to include inner angular surface 222 (Appeal Br. 15 (citing Spec. ¶ 43); *see also* Spec. Fig. 4).

Regarding the function of inner angular surface 222, Appellant directs our attention to the Specification’s description of edge step 212 (Appeal Br. 15). Specifically, the Specification describes that “the edge step 212 reduces the size of the gap 384” and “the reduction in the size of the critical gap 384 . . . can also help prevent plasma erosion of the elastomer seal 382” (*id.* (citing Spec. ¶ 41)). Appellant concludes, *inter alia*, that because edge step 212 is described as including inner angular surface 222, which contributes to reducing the size of gap 384, the Specification implicitly provides that inner angular surface 222 prevents plasma from eroding the elastomer seal 382 (Appeal Br. 17).

The preponderance of the evidence favors Appellant’s arguments of written descriptive support. For example, the Examiner responds to Appellant’s arguments by asserting that “the gas,” which enters from above lower electrode assembly 120 “will contact almost the entirety of the seal before it even reaches the inner angular surface” (Ans. 6; *see* Spec. Figs. 1–3). The Examiner’s assertion, however, is not supported by any evidence.

As Appellant argues, “approximately 13% of the elastomer seal 382 is directly opposite the inner angular surface 222” (Reply Br. 3 (citing Spec. Fig. 3)). Thus, we are persuaded by Appellant that “the inner angular seal [222] contributes at least partially to the narrowing of the gap [384] and the corresponding constraint on the elastomer seal 382” (Reply Br. 3; *see* Spec. Figs. 3, 4). In other words, the Specification demonstrates that Appellant possessed the subject matter recited in claim 51, i.e., “the inner angular

surface extends . . . to . . . provide the constraint for the elastomer seal or prevent plasma erosion of the elastomer seal,” at the time of filing. *See Lockwood v. Am. Airlines Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997) (holding that “[o]ne shows that one is ‘in possession’ of *the invention* by describing *the invention*, with all its claimed limitations, . . . by such descriptive means as words, structures, figures, diagrams, formulas, etc.”).

On this record, we reverse the Examiner’s rejection of claims 51 and 60–62 under 35 U.S.C. § 112(a) as lacking written description.

B. Rejection of claims 26, 27, 29–35, 37, 39–43, 50–54, and 58–62 as unpatentable over the combination of Kadkhodayan and Yudovsky.

Appellant’s arguments for reversal of the Examiner’s rejection of claims 26, 27, 29–35, 37, 39–43, 50–54, and 58–62 focus on limitations recited in independent claim 26 (*see* Appeal Br. 17–27; Reply Br. 5–12). We select claim 26 as representative of claims 27, 29–35, 37, 39–43, 50–54, and 58–62.

The Examiner’s findings and conclusions regarding Kadkhodayan and Yudovsky are located on pages 4–5 of the Final Office Action and pages 3–6 and 7–8 of the Answer.³

Kadkhodayan’s Figure 6, reproduced below, illustrates a cross-sectional view of a substrate edge portion of a plasma processing chamber:

³ The Examiner has provided new grounds for the § 103 rejection of claim 26 as unpatentable over Kadkhodayan in view of Yudovsky (Ans. 3–6). The Examiner notes that these new grounds provide an “enhanced form of explanation,” which do not “contravene the outstanding [obviousness] rejections” (*id.* at 3).

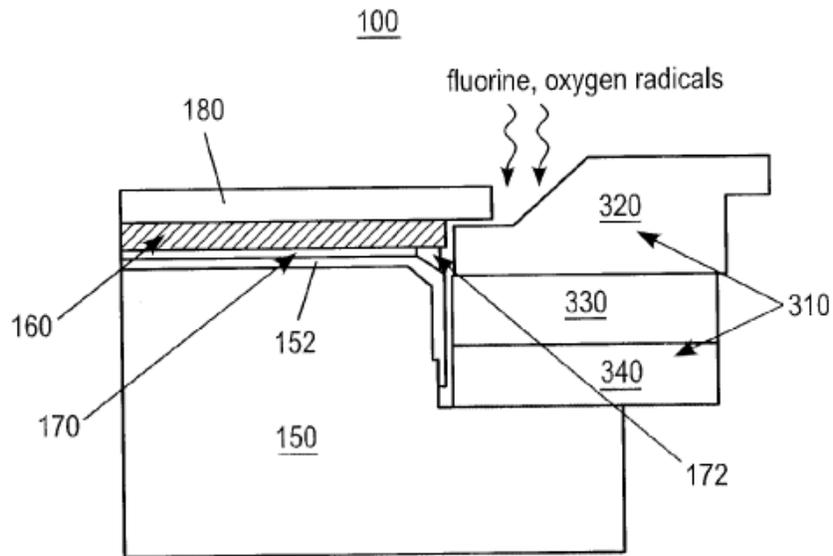


FIG. 6

Kadkhodayan's Figure 6 shows a cross section of a substrate 180 edge region of plasma apparatus 100 having an elastomer bond 170, which joins a chuck 160 to a lower electrode assembly 150 (Kadkhodayan ¶¶ 47, 48). Figure 6 further illustrates silicone base material 172 having improved plasma erosion resistance, which is separated by a gap from edge ring assembly 310 comprising upper ring 320 (*id.* ¶¶ 48, 49).

The Examiner finds that Kadkhodayan's upper ring 320 teaches each limitation of the edge ring recited in claim 26, with the exception that Kadkhodayan does not teach that upper ring 320's vertical sidewall profile includes "an 'inner angular surface[,] which angles so as to narrow a 'horizontal width of a gap between the elastomer seal assembly and the edge ring'" (Ans. 4; *see* Kadkhodayan Fig. 6).

The Examiner, however, finds that Yudovsky's ring process kit teaches or suggests the limitations missing from Kadkhodayan (Ans. 4). Yudovsky's Figure 3, reproduced below, illustrates a side view of an edge ring positioned above a substrate support:

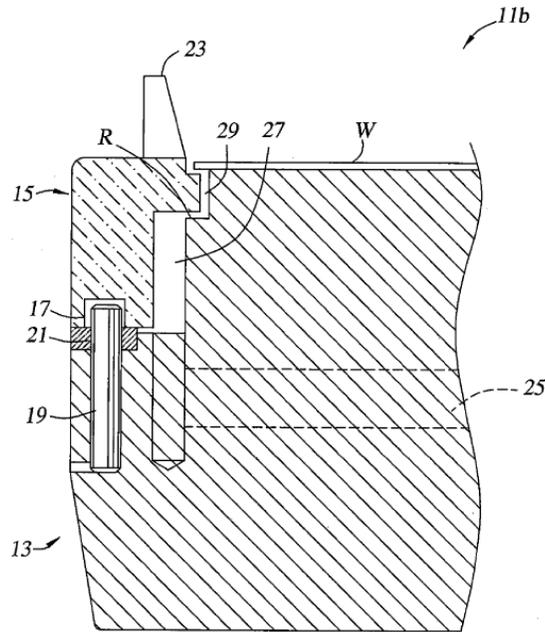
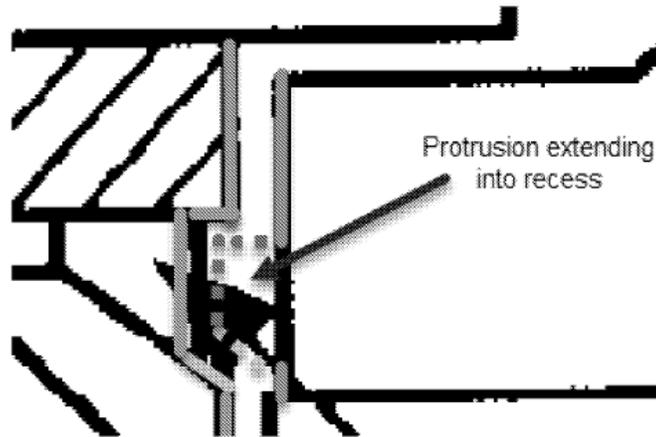


Fig. 3

Yudovsky's Figure 3 illustrates restrictor gap R formed by a horizontal notch in substrate support 13 and a corresponding horizontal protrusion in purge ring 15 (Yudovsky ¶ 35).

The Examiner finds Yudovsky teaches a principle of contour matching, i.e., "the principle of the edge ring's surfaces mirroring the orientation of the corresponding substrate support surfaces" (Ans. 4; *see also id.* at 5 (citing Yudovsky ¶ 35)). The Examiner determines that it would have been obvious to one of ordinary skill in the art at the time of the invention to contour match "Kadkhodayan's edge ring so that its interior surfaces are oriented parallel to the corresponding surfaces of the substrate support" (Ans. 5). According to the Examiner, such a modification would have extended Kadkhodayan's upper ring 320's vertical sidewall profile into the recessed region created by the recessed position of silicone base material 172 (*id.*; *see* Kadkhodayan Fig. 6).

The Examiner's annotation of Kadkhodayan's Figure 6, reproduced below, illustrates the upper ring's sidewall profile reconfigured as proposed to protrude into the recessed region:



Kadkhodayan's Figure 6 illustrates an enlarged view of the Examiner's proposed modification of upper ring 320's sidewall, which is depicted as a dotted line extending into the recessed region created by the recessed position of silicone base material 172 (Ans. 6; *see also* Kadkhodayan Fig. 6). The Examiner determines that Kadkhodayan, in view of Yudovsky's contour matching principle, would have taught or suggested reconfiguring the sidewall profile of Kadkhodayan's upper ring 320 to follow the "dotted line, [which] extends upwardly at approximately 45 degrees," thereby rendering obvious the claimed "inner angular surface" recited in claim 26 (Ans. 5).

Appellant argues that the Examiner has failed to demonstrate that modifying Kadkhodayan's upper ring 320's sidewall profile in view of Yudovsky's contour matching principle would have narrowed a horizontal width of a gap between the elastomer seal assembly and the edge ring (Appeal Br. 23). In particular, Appellant argues that "[m]imicking the shape

of a portion of a substrate support simply suggests at best maintaining a gap size, not reducing a gap size” (*id.*).

In response, the Examiner finds that “by applying Yudovsky’s precept of contour matching to [Kadkhodayan’s] edge ring . . . , the claimed feature of an inner angular surface is generated as a concomitant” (Ans. 8).

According to the Examiner, the proposed “dotted line clearly narrows the gap width within the vertical extent of the elastomer seal, per the requirements of the claim” (*id.*; *see also id.* at 6 (showing the Examiner’s annotation of Kadkhodayan’s Figure 6)).

Appellant, however, asserts that the Examiner’s response does not explain how modifying “Kadkhodayan’s edge ring in view of Yudovsky narrows a gap between an elastomer seal and an edge ring” (Reply Br. 8). Appellant, moreover, argues that “[i]t is unclear how the claimed narrowing of a gap between an elastomer seal and an edge ring is concomitant” and “the Examiner has not provided any evidence or logical reasoning to show that this is true” (*id.* at 9). With regard to the Examiner’s depicted modification, Appellant argues that “this dotted line does not accurately contour match and run parallel to the contour of the member 152 and the silicone base material 172” (*id.* at 10).

Appellant’s arguments are persuasive.

It is well understood that “[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.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). 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).

In this instance, the Examiner has not shown that Kadkhodayan in view of Yudovsky's contour matching principle teaches or suggests "*an inner angular surface extending . . . at an angle to narrow a horizontal width of a gap between the elastomer seal assembly and the edge ring, such that the horizontal width decreases along the elastomer seal assembly between the inner angular surface and the elastomer seal assembly*" (claim 26) (emphasis added). We agree with Appellant that the Examiner's depicted dotted line modification fails to accurately contour match the contours of member 152 and silicone base material 172 (Reply Br. 10; *see* Ans. 6). Given these inaccuracies, the Examiner's conclusion that the disputed gap narrowing limitation is met by the applied prior art is reversibly erroneous (*see* Ans. 8).

The Examiner, furthermore, has not provided findings or reasoning supported by adequate facts to explain why this claimed feature of an inner angular surface "is generated as a concomitant" (Ans. 4). Thus, the Examiner has not established a *prima facie* case of obviousness based upon articulated reasoning with rational underpinnings.

On this record, we reverse the Examiner's § 103 rejection.

C. Rejection of claims 28 and 38 as unpatentable over the combination of Kadkhodayan, Yudovsky, and Augustino.

The Examiner's findings and conclusions regarding Kadkhodayan, Yudovsky, and Augustino are located on pages 5–6 of the Final Office Action.

The Examiner's § 103 rejection of dependent claims 28 and 38 over Kadkhodayan, Yudovsky, and Augustino does not cure the deficiencies discussed above with respect to the § 103 rejection over Kadkhodayan and Yudovsky alone. Therefore, we reverse the Examiner's § 103 rejection.

D. Rejection of claims 36, 55, and 56 as unpatentable over the combination of Kadkhodayan, Yudovsky, and Schaefer.

The Examiner's findings and conclusions regarding Kadkhodayan, Yudovsky, and Schaefer are located on page 6 of the Final Office Action.

The Examiner's § 103 rejection of dependent claims 36, 55, and 56 over Kadkhodayan, Yudovsky, and Schaefer does not cure the deficiencies discussed above with respect to the § 103 rejection over Kadkhodayan and Yudovsky alone. Therefore, we reverse the Examiner's § 103 rejection.

CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
51, 60–62	112(a)	Written Description		51, 60–62
26, 27, 29–35, 37, 39–43, 50–54, 58–62	103	Kadkhodayan, Yudovsky		26, 27, 29–35, 37, 39–43, 50–54, 58–62

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Application 14/136,953

Claims Rejected	35 U.S.C. §	Reference(s)/Basis	Affirmed	Reversed
28, 38	103	Kadkhodayan, Yudovsky, Augustino		28, 38
36, 55, 56	103	Kadkhodayan, Yudovsky, Schaefer		36, 55, 56
Overall Outcome				26-43, 50- 56, 58-62

REVERSED