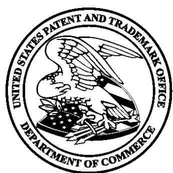

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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*Ex parte* BO-I LEE, HUANG SOON KANG,
CHI-MING YANG, and CHIN-HSIANG LIN

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Appeal 2019-002642
Application 13/240,856
Technology Center 1700

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Before LINDA M. GAUDETTE, GEORGE C. BEST, and
N. WHITNEY WILSON, *Administrative Patent Judges*.

WILSON, *Administrative Patent Judge.*

DECISION ON APPEAL

Appellant[1] appeals under 35 U.S.C. § 134(a) from the Examiner's April 12, 2018 decision finally rejecting claims 1–4, 9–15, 21–23, and 26–30 ("Final Act."). We have jurisdiction over the appeal under 35 U.S.C. § 6(b).

We affirm-in-part.

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[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies Taiwan Semiconductor Manufacturing Company, Ltd., as the real party in interest (Appeal Br. 3).

CLAIMED SUBJECT MATTER

Appellant's disclosure generally relates to an apparatus for fabricating a semiconductor device. The apparatus includes a polishing head that is operable to perform a polishing process to a wafer, and a retaining ring that is rotatably coupled to the polishing head (Abstract). The retaining ring is operable to secure the wafer to be polished, and includes a soft material component located within the retaining ring which is softer than silicon and which is operable to grind a bevel region of the wafer during the polishing process (*id.*). The apparatus further includes a spray nozzle that is rotatably coupled to the polishing head and is operable to dispense a cleaning solution to the bevel region of the wafer during the polishing process (*id.*). Details of the claimed apparatus are set forth in representative claims 1 and 10, which are reproduced below from the Claims Appendix to the Appeal Brief:

> 1. A semiconductor fabrication apparatus, comprising:
>
> a polishing head operable to be rotated, wherein the polishing head includes a membrane configured to polish a front surface or a back surface of a wafer;
>
> a retaining structure coupled to the polishing head through a first rotationally flexible mechanism and a vertically retractable rod, the first rotationally flexible mechanism being coupled between the vertically retractable rod and the retaining structure, wherein a side surface of the retaining structure is separated from the polishing head by an air gap, an upper surf ace of the retaining structure is separated from the polishing head by the first rotationally flexible mechanism and the vertically retractable rod, wherein a rotational movement of the retaining structure is independent from a rotation of the polishing head, wherein the retaining structure contains a recess that faces a bevel region of the wafer, and wherein the retaining structure allows the bevel region of the wafer to be inserted horizontally into the recess;

a component embedded in the recess of the retaining structure, wherein the component is softer than the wafer and circumferentially surrounds the wafer, and wherein the component is operable to make contact with the bevel region of the wafer once the bevel region is inserted into the recess;

a spray nozzle coupled to the polishing head, the spray nozzle being operable to dispense a cleaning solution; and

a second rotationally flexible mechanism coupled between the polishing head and the spray nozzle, wherein the second rotationally flexible mechanism is operable to rotate the spray nozzle in different directions to dispense the cleaning solution to different parts of the bevel region of the wafer.

10. A semiconductor fabrication tool, comprising:

a rotatable and movable polishing head that includes a membrane configured to polish a front surface or a back surface of a wafer;

a retaining ring that is rotatably coupled to the polishing head through a first trackball and a vertically retractable rod, the first trackball being coupled between the vertically retractable rod and the retaining ring, wherein the retaining ring is operable to secure a wafer to be polished, and wherein the retaining ring is operable to be rotated independently from the polishing head and is separated from the polishing head by an air gap, the first trackball, and the vertically retractable rod;

a soft material component located within a horizontally-facing recess of the retaining ring, wherein the soft material component includes an angular recess, wherein a bevel region of the wafer is configured to be horizontally inserted into, and make contact with, the soft material component through the angular recess, wherein the angular recess is formed by a side surface and sloped upper and lower surfaces, wherein the soft material component is softer than silicon, and wherein the soft material component is operable to grind the bevel region of the wafer that is in contact therewith during a polishing process; and

> a spray nozzle that is rotatably coupled to the polishing head through a second trackball, wherein the spray nozzle is operable to dispense a cleaning solution to the bevel region of the wafer during the polishing process.

REJECTIONS

1. Claims 10–13, 15, and 21–23 are rejected under 35 U.S.C. § 103(a) as unpatentable over Koike[2] in view of Basol,[3] Kimura '868,[4] and Mayer.[5]

2. Claims 27, 28, and 30 are rejected under 35 U.S.C. § 103(a) as unpatentable over Koike in view of Basol, Kimura '868, Mayer, and further in view of Moinpour.[6]

3. Claims 1–4, 9, and 14 are rejected under 35 U.S.C. § 103(a) as unpatentable over Koike in view of Basol, Kimura '150,[7] Kimura '868, and Mayer.

4. Claims 26 and 29 are rejected under 35 U.S.C. § 103(a) as unpatentable over Koike in view of Basol, Kimura '150, Kimura '868, Mayer, and further in view of Moinpour.

Two separate rejections under 35 U.S.C. § 112 which were made in the Final Action have been withdrawn (Ans. 14, 15).

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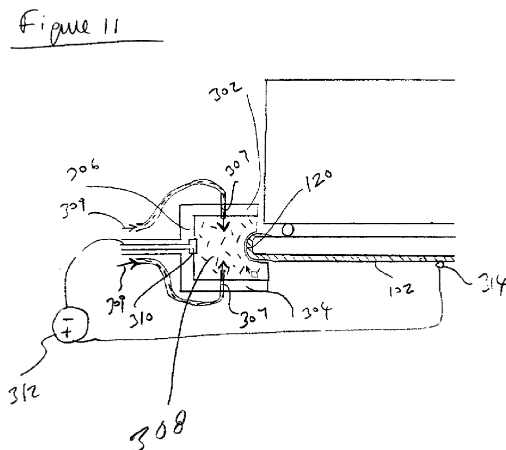
[2] Koike, US 6,113,467, issued September 5, 2000.
[3] Basol, US 2003/0116444 A1, published June 26, 2003.
[4] Kimura et al., US 6,019,868, issued February 1, 2000.
[5] Mayer et al., US 6,309,981 B1, issued October 30, 2001.
[6] Moinpour et al., US 5,861,066, issued January 19, 1999.
[7] Kimura et al., US 2001/0029150 A1, published October 11, 2001.

DISCUSSION

***Rejections 1 and 2***. Appellant's arguments focus on the following section of claim 10:

> a soft material component located within a horizontally-facing recess of the retaining ring, wherein the soft material component includes an angular recess, wherein a bevel region of the wafer is configured to be horizontally inserted into, and make contact with, the soft material component through the angular recess, wherein the angular recess is formed by a side surface and sloped upper and lower surfaces

The Examiner finds that Koike does not teach the "soft material component" of claim 10 (Final Act. 12). The Examiner further finds that element 308 in FIG. 11 of Basol, as shown below corresponds to the claimed soft material component, and shows the claimed angular recess (*id.*):




Basol's Figure 11 shows in detail edge removal according to another embodiment of its invention

Appellant argues that the recess shown in Basol's Fig. 11 is caused by the insertion of the wafer into element 308 (Appeal Br. 15). In other words, according to Appellant, Basol's element 308 doesn't have an angular recess

therein, much less an angular recess formed by a side surface and sloped upper and lower surfaces (Appeal Br. 14–15).

The Examiner's position, however, is that the claim language is properly construed as not being limited in how the angular recess is formed and, therefore, that whether the angular recess shown by Basol is preformed or formed by the edge of the wafer is irrelevant to the patentability issue (Ans. 16).

It is well established that "the PTO must give claims their broadest reasonable construction consistent with the specification. Therefore, we look to the specification to see if it provides a definition for claim terms, but otherwise apply a broad interpretation." *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1379 (Fed. Cir. 2007) (citation omitted). In this instance, as noted by the Examiner, the Specification does not explicitly state that the angular recess in the soft material component is "preformed" (i.e. not created by the pressure imparted on it by the beveled edge of the wafer). However, the disclosures in the Specification are clear that the broadest reasonable construction of the phrase "angular recess" which is consistent with the Specification requires "preforming" the angular recess.

Specifically, the Specification explicitly states that the soft material component has an angular recess "which is configured to house the bevel region" of the wafer (Spec. ¶ 31). Because the angular recess is "configured to house" the bevel, this suggests that the angular recess is created in advance and, as noted by Appellant (Reply Br. 6), is not the byproduct of the soft material component being pressed in by the edge of wafer. Moreover, the Specification also makes clear that the relative dimensions of the angular recess and the bevel region of the wafer are set so that the bevel region can

be “adequately and efficiently accommodated” by the angular recess (Spec. ¶ 32).

The Examiner finds that the relative dimensions described by Paragraph 32 of the Specification are not necessarily because the angular recess is “preformed,” but rather because of debris on the surface of the bevel region which must be accommodated into the angular recess (Ans. 15). This finding is not supported by the preponderance of the evidence of record. Instead, we conclude that the broadest reasonable interpretation of the phrase “angular recess” is one which is preformed such that it can accommodate the bevel edge of the wafer.

Claim 21 recites the presence of a “recess” in the component. In view of the foregoing analysis, we also construe “recess” in claim 21 as a preformed recess (i.e. not created by pressure from the wafer).

The Examiner does not dispute Appellant’s argument that Basol does not discloses the claimed angular recess or recess, as construed above (*see*, Ans. 16). Accordingly, we reverse Rejection 1, including the rejection of each of the claims which depend from claims 10 and 21.

***Rejections 3 and 4***. Appellant focuses its argument regarding the patentability of claim 1 on the following claim limitation: “a component embedded in the recess of the retaining structure, wherein the component is softer than the wafer and circumferentially surrounds the wafer” (Appeal Br. 18). The Examiner finds that Kimura ‘150 discloses a polishing cloth 84

which circumferentially surrounds a wafer W, as shown in Kimura '150's FIG. 3:

*F I G. 3*

Kimura 150's's FIG. 3 shows an enlarged cross-sectional view showing a top ring and an outer periphery polishing unit for polishing an outer peripheral portion of a substrate

Appellant argues that the Examiner has not adequately established that polishing cloth 84 circumferentially surrounds the wafer because FIG. 3 only shows it contacting the left and right sides of the wafer (Appeal Br. 18–19, Reply Br. 11). This argument is not persuasive. FIG. 3 is explicitly described as a cross-sectional view. A person of skill in the would expect that, in the absence of a clear description to the contrary, the arrangement shown in FIG. 3 would mean that the polishing cloth would extend around the entire periphery of the wafer (i.e. circumferentially surround the wafer).

Appellant also argues that the Examiner has not established that Koike teaches the presence of the claimed air gap: "wherein a side surface of the retaining structure is separated from the polishing head by an air gap, an upper surface of the retaining structure is separated from the polishing head by the first rotationally flexible mechanism and the vertically retractable

rod" (Appeal Br. 19). The Examiner finds that Koike teaches the recited air gap as shown in FIG. 1 (Ans. 19; see also Final Act. 6). However, as noted by Appellant (Reply Br. 12), the Examiner has not adequately explained how Koike's FIG. 1 teaches the claimed air gap. Nevertheless, the Examiner has explained how the claimed air gap is disclosed in FIG. 6 of Kimura '868, and this finding is not specifically challenged by Appellant (see, Reply Br. 11–12).[8]

Accordingly, we conclude that Appellant has not demonstrated error in the rejection of claim 1 as set forth in Rejection 3.

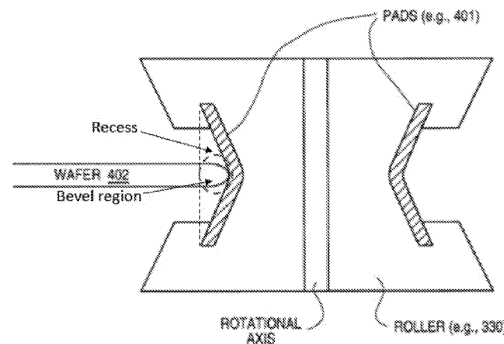
Appellant separately argues some of the dependent claims:

Claim 2 recites "[t]he semiconductor fabrication apparatus of claim 1, wherein the retaining structure is operable to be rotated 360 degrees around the wafer." The Examiner finds that this limitation is taught by Koike because Koike's rotating motor 52 can rotate wafer W 360 degrees separately and independently from motor 62" (Final Act. 22). Appellant argues that Koike's rotating motor 52 rotates the wafer W, not the retaining structure, and therefore does not satisfy this limitation (Appeal Br. 19–20). In response, the Examiner, in the Answer, turns to Kimura '868, in particular presser ring 3A as suggesting this limitation (Ans. 19–20). However, Appellant persuasively argues, inter alia, that Kimura '868 does not disclose that presser ring 3A rotates 360 degrees around the wafer (Reply Br. 14). The only evidence pointed to by the Examiner—Kimura '868, 9:29–31—does not state that the presser ring 3A is rotated, or rotatable around the

[8] Nor has Appellant challenged the Examiner's rationales for why a person of skill in the art would have combined the teachings of the references as set forth in the rejections.

wafer. Accordingly, we conclude that Appellant has shown reversible error in the rejection of claim 2, and the claims which depend from it (claims 3, 4, 9, and 14).

Appellant's arguments regarding errors in the rejections of claims 26 and 29 are not persuasive. In particular, in connection with claim 26, FIG. 4 of Moinpour does not show a portion of the bevel region of the wafer not being inserted into the recess, as shown in the annotated version of FIG. 4 provided by Appellant:




An annotated version of Moinpour's FIG. 4 shows the bevel region of the wafer is entirely inserted into the recess.

With respect to claims 26 and 29, Appellant argues that Moinpour does not show that "the retaining structure is larger than the wafer in a manner such that a segment of the bevel region of the wafer is separated from the retaining structure by a gap in a top view" (Appeal Br. 21). In response, the Examiner made findings regarding FIG. 3 from Appellant's drawings, and suggests that because the wafer is not part of the claimed apparatus, the claim is really reciting an intended use of the apparatus. However, the claim clearly states that the retaining structure (which is part

of the claimed apparatus) is large enough so that it cannot completely cover the bevel portion of the wafer from a top view perspective (as shown in Appellant's FIG. 3). Although Moinpour's structure is such that the bevel of a wafer in its apparatus would be visible from a top view (because each individual roller only covers a small portion of the overall circumference of the wafer), the Examiner has not made findings or determinations as to how or why that feature would have been combined with other cited art to arrive at the claimed limitation. Accordingly, we reverse the rejection of claims 26 and 29.

## CONCLUSION

In summary:

| **Claims Rejected** | **35 U.S.C. §** | **Reference(s)/Basis** | **Affirmed** | **Reversed** |
|---|---|---|---|---|
| 10–13, 15, 21–23 | 103(a) | Koike, Basol, Kimura '868, Mayer | | 10–13, 15, 21–23 |
| 27, 28, 30 | 103(a) | Koike, Basol, Kimura '868, Mayer, Moinpour | | 27, 28, 30 |
| 1–4, 9, 14 | 103(a) | Koike, Basol, Kimura '868, Kimura '150, Mayer | 1, 9 | 2–4, 14 |
| 26, 29 | 103(a) | Koike, Basol, Kimura '868, Kimura '150, Mayer, Moinpour | | 26, 29 |
| **Overall Outcome** | | | 1, 9 | 2–4, 10–15, 21–23, 26–30 |

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED-IN-PART