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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MING HUEI LIEN, CHIA-HO CHEN, SHU-FEN WU,
CHIH-TSUNG LEE, and YOU-HUA CHOU

Appeal 2019-001957
Application 13/419,835
Technology Center 1700

Before ROMULO H. DELMENDO, BEVERLY A. FRANKLIN, and
SHELDON M. MCGEE, *Administrative Patent Judges*.

DELMENDO, *Administrative Patent Judge*.

DECISION ON APPEAL

The Appellant¹ appeals under 35 U.S.C. § 134(a) from the Primary Examiner's final decision to reject claims 10–16, 18, and 20–26.² We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

¹ We use the word “Appellant” to refer to “applicant” as defined in 37 C.F.R. § 1.42. The Appellant identifies “Taiwan Semiconductor Manufacturing Co., Ltd.” as the real party in interest (Appeal Brief filed October 12, 2018 (“Appeal Br.”) at 3).

² See Appeal Br. 13–26; Final Office Action entered April 13, 2018 (“Final Act.”) at 2–19; Examiner's Answer entered November 7, 2018 (“Ans.”) at 3–15.

I. BACKGROUND

The subject matter on appeal relates to a method for operating a semiconductor manufacturing apparatus provided with a valve assembly for loading and unloading substrates into and out of the apparatus and for carrying out a purge operation (Specification filed March 14, 2012 (“Spec.”) ¶ 1; Abstract). Figure 1 (annotated) is illustrative and is reproduced from the Drawings filed March 14, 2012, as follows:

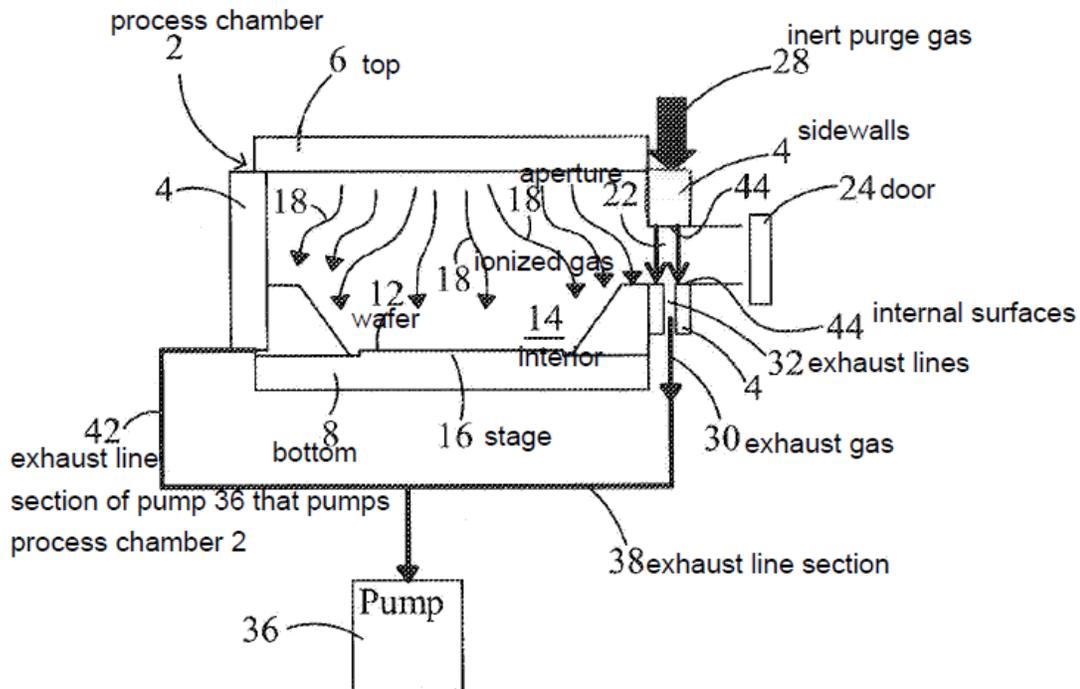


Figure 1 above illustrates a method of operating an apparatus in which a wafer **12** is loaded into a deposition process chamber **2** with side walls **4** through an aperture **22** provided by a valve assembly **50** (Fig. 2) including, *inter alia*, a door **24** in an open position, delivery lines **60** (Fig. 2) for supplying inert purge gas **28**, and exhaust lines **32** and then placed on a stage **16** for processing using ionized gas represented by arrows **18**, wherein a pump **36** including exhaust line **42** pumps process chamber **2** (Spec. ¶¶ 15–

17). The Specification states that when the processing operation is concluded, the purging of the valve assembly may continue at a lower rate than that used during processing (*id.* ¶ 22).

Representative claim 10 is reproduced from the Claims Appendix to the Appeal Brief, as follows:

10. A method for operating a semiconductor manufacturing apparatus, said method comprising:

providing a process chamber [2] having an interior [14] and a sidewall [4] with an aperture [22] therethrough;

providing a valve assembly [50] including a door [24] that forms a detachable seal with said sidewall [4] to close said aperture [22], wherein said door [24] contacts an outer surface of said sidewall [4] to form the detachable seal with said sidewall [4];

operating said apparatus by carrying out a substrate processing operation within said process chamber [2];

exhausting a process gas from said process chamber by a first exhaust line [42] directly connected to said interior [14] of the process chamber [2];

cleaning said apparatus by carrying out a cleaning operation of a stage within said process chamber [2], while no wafer [12] is on the stage [16];

delivering an inert purge gas [28] to said valve assembly [50] during said substrate processing operation and said cleaning operation; and

exhausting said inert purge gas [28] from said valve assembly [50] at a same time as said substrate processing operation is performed and a same time said cleaning operation is performed, via a second exhaust line [32] directly connected to said valve assembly [50], wherein the exhausting is performed using a single pump [36] directly connected to the first and second exhaust lines [42, 32], *wherein the inert purge gas [28] is provided at a first flow rate when the door [24] of the valve assembly [50] is closed and a second flow rate when the door [24] of the valve assembly [50] is open, wherein the second flow rate is less than the first flow rate;*

unloading a processed substrate from said process chamber [2] while exhausting said inert purge gas [28] at said second flow rate.

(Claims Appendix (emphasis and bracketed reference numerals added)).

II. REJECTIONS ON APPEAL

The claims stand rejected under pre-AIA 35 U.S.C. § 103(a), as follows:

- A. Claims 10–16, 18, and 20–26 as unpatentable over Shigeoka et al.³ (“Shigeoka”), Lorimer,⁴ Kawasaki,⁵ Ramm,⁶ and Garnache;⁷ and, alternatively,
- B. Claims 10–16, 18, and 20–26 as unpatentable over Shigeoka, Komino,⁸ Kawasaki, Ramm, and Garnache.

(Ans. 3–15; Final Act. 2–19).

III. DISCUSSION

1. *Grouping of Claims*

With respect to Rejection A, the Appellant’s arguments focus on claim 10 (Appeal Br. 13–23). With respect to Rejection B, the Appellant’s arguments refer to the same reasons offered against Rejection A, adding only that Komino does not cure the alleged deficiencies in the Examiner’s

³ JP 2004-288982, published October 14, 2004. We cite to the machine-generated English language translation of record.

⁴ US 5,363,872, issued November 15, 1994.

⁵ US 2009/0190009 A1, published July 30, 2009.

⁶ US 2003/0021895 A1, published Jan. 30, 2003.

⁷ US 3,603,284, issued Sept. 7, 1971.

⁸ JP 7-147247, published June 6, 1995.

reasoning provided for Rejection A (*id.* at 23–25). Therefore, consistent with 37 C.F.R. § 41.37(c)(1)(iv), we confine our discussion to claim 10. That discussion controls the outcome for both rejections and all claims on appeal.

2. *The Examiner’s Position*

The Examiner finds that Shigeoka describes a method for processing a semiconductor wafer including many of the limitations recited in claim 10 but acknowledges several differences between the claimed method and Shigeoka’s method (Ans. 3–5; Final Act. 2–7). In resolving these differences, the Examiner relies on the teachings found in Lorimer, Kawasaki, Ramm, and Garnache and provides reasons in support of a conclusion that a person having ordinary skill in the art would have combined the references in the manner claimed by the Appellant (Ans. 5–7; Final Act. 7–11). Regarding the disputed claim limitations highlighted in reproduced claim 10 above, the Examiner relies primarily on the combined teachings found in Shigeoka and Garnache (Ans. 7; Final Act. 10–11). In this regard, the Examiner points out that “the critical issue is . . . whether the secondary reference [Garnache]’s teaching of nominal flow of inert gas during substrate loading means a very small flow rate” (Ans. 11)—i.e., whether “a person of ordinary skill in the art would have understood that ‘nominal’ [as disclosed in Garnache] refers to a very small flow rate during loading (chamber is open) relative to the flow rate during purging (chamber is closed)” (*id.* at 12). In support, the Examiner relies on a dictionary definition of the term “nominal” (*id.* at 7).

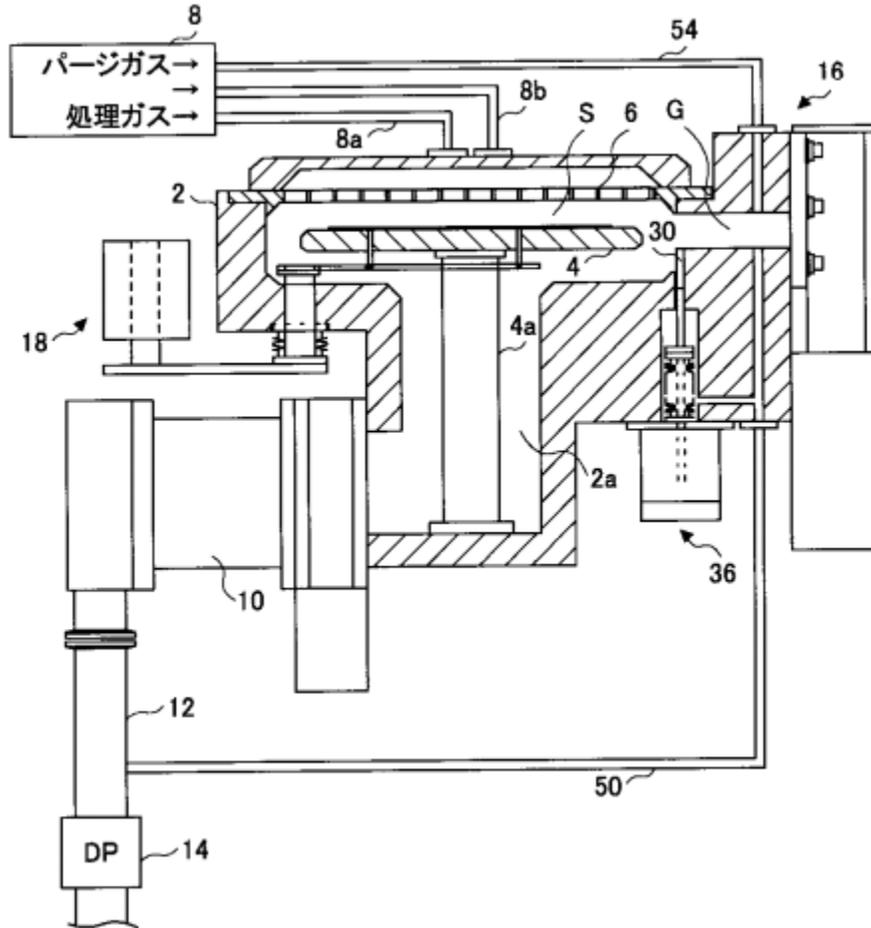
3. *The Appellant's Contentions*

The Appellant does not specifically dispute the Examiner's factual findings regarding the scope and content of Shigeoka, Lorimer, Kawasaki, or Ramm (Appeal Br. 13–23). Rather, the Appellant's principal argument is that "the Examiner has misinterpreted the teachings of Garnache" because "contrary to the Examiner's assertion, a person having ordinary skill in the art would not have understood the term 'nominal' [as disclosed in Garnache] to mean 'very small' as used in the context of Garnache" and that "Garnache fails to differentiate the 'nominal' flow rate from any other flow rate such that a person having ordinary skill in the art would have understood the nominal flow rate to be less than a first flow rate provided when the door of a valve assembly is closed" (*id.* at 14). According to the Appellant, the definition "very small" for "nominal" is only applicable in the context of a price or charge and, therefore, is not relevant in interpreting Garnache (*id.* at 15). The Appellant urges that, instead, the term "nominal" is being used in Garnache to indicate that the "flow rate did not 'necessarily correspond exactly to the real value' of the desirable flow rate" (*id.* (relying on an alternative definition)).

4. *Opinion*

For the reasons given by the Examiner and below, the Appellant's arguments fail to identify reversible error in the Examiner's rejection. *In re Jung*, 637 F.3d 1356, 1365 (Fed. Cir. 2011).

Shigeoka describes an atomic layer deposition (ALD) method using a processing unit in which raw gas is supplied to a heated substrate under decompression (Shigeoka ¶ 2). Specifically, Shigeoka's Figure 1 is reproduced, as follows:



Shigeoka's Figure 1 above depicts a processing unit in which a gate valve **16** is attached to a side wall of a treatment container **2**, wherein the gate valve **16** may be opened to allow insertion/removal of a wafer **W** (not shown in Fig. 1) or closed (Shigeoka ¶¶ 23, 26). According to Shigeoka, raw gas and purge gas may be supplied from gas supply device **8** to the internal space **S** in which the wafer is placed, and a turbo-molecular pump **10** and dry pump **14** are used for exhaust (*id.* ¶¶ 23–25). Shigeoka also discloses a local ventilation mechanism by which gate space **G** is exhausted using dry pump **14** without passing the exhaust gas through treatment space **S** (*id.* ¶ 45). As

the Examiner finds (Ans. 5), Shigeoka does not disclose, *inter alia*, the disputed limitations highlighted in reproduced claim 10 above.

Garnache discloses a method for operating a vapor deposition reactor in which substrates **30** are loaded onto a graphite susceptor **28** while a bottom plate **16** is in a lowered position such as to allow a “*nominal* flow of inert gas . . . in order to maintain chamber **18** in a relatively clean condition” and “[b]ottom plate **16** is raised in order to close reactor **10** for the deposition process” (Garnache col. 4, ll. 37–43 (emphasis added); Abstract; Fig. 1). Garnache further teaches that “[c]hamber **18** is *then* purged for about one minute by an inert gas, preferably argon, which is maintained at *any desirable flow rate* which will [e]nsure adequate purging” and “[d]ue to the high cost of argon, it is acceptable to utilize a purge rate of about one-tenth that of the reactant gases to be referred to later” (*id.* at col. 4, ll. 44–48 (emphases added)).

Given the collective teachings found in Shigeoka and Garnache, we share the Examiner’s conclusion that a person having ordinary skill in the art would have been prompted to combine these references in the manner claimed by the Appellant—i.e., to provide a “nominal” purge rate that is at a relatively low rate when Shigeoka’s gate valve **16** is open (for loading the wafers) than that compared to when the gate valve **16** is closed to “[e]nsure adequate purging”—in order to effect a clean deposition chamber efficiently without wasting costly inert purge gas such as argon, as suggested by Garnache. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (“[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the

same way, using the technique is obvious unless its actual application is beyond his or her skill.”).

We find no persuasive merit in the Appellant’s argument that the Examiner’s proffered definition of the term “nominal” in Garnache as “very small” is erroneous because that definition applies only in the context of a price or charge (Appeal Br. 14–15). Consistent with the Examiner’s position, the term “nominal” may mean “TRIFLING, INSIGNIFICANT” such as in “his involvement was *nominal*” (See <https://www.merriam-webster.com/dictionary/nominal>). Thus, the Appellant is incorrect that “nominal” cannot mean a “very small” (or insignificant) amount in a context other than price or charge.

In any event, Garnache would have suggested a lower purge rate while the chamber **18** is open (to accommodate loading of the wafers) because, as the Examiner explains (Ans. 13–14), Garnache teaches that the purge rate after the chamber is closed may be “*any desirable flow rate which will [e]nsure adequate purging*” (Garnache at col. 4, ll. 42–46 (emphasis added)). Such “any desirable flow rate” would include at least the “nominal” flow rate or a flow rate slightly higher than the “nominal” flow rate, the latter of which would meet claim 10’s relationship between the “first flow rate” and the “second flow rate.” *In re Aller*, 220 F.2d 454, 456 (CCPA 1955) (“[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”).

The Appellant also argues that “[n]one of the additionally cited references are cited for disclosing ‘unloading a processed substrate from said process chamber while exhausting said inert purge gas at said second flow

rate[]’” (Appeal Br. 19). But, as the Examiner explains (Ans. 13), “[a] person of ordinary skill [in the art] would not have wasted argon when the chamber is opened.” Therefore, a person having ordinary skill in the art would have unloaded Shigeoka’s treated wafers at a relatively lower purge—i.e., at a “nominal” flow rate—to minimize argon waste. *In re Preda*, 401 F.2d 825, 826 (CCPA 1968) (“[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.”).

The Appellant argues that the Examiner’s rejection lacks an articulated reason with some rational underpinning to support a conclusion that a person having ordinary skill in the art would have combined Shigeoka with Garnache in the manner claimed by the Appellant (Appeal Br. 20). That is incorrect (*see* Ans. 7, 12–14).

For the reasons well-stated by the Examiner and above, we uphold the Examiner’s rejections.

IV. CONCLUSION

In summary:

Claims Rejected	35 U.S.C. §	Reference(s)/ Basis	Affirmed	Reversed
10–16, 18, 20–26	103(a)	Shigeoka, Lorimer, Kawasaki, Ramm, Garnache	10–16, 18, 20–26	
10–16, 18, 20–26	103(a)	Shigeoka, Komino, Kawasaki, Ramm, Garnache	10–16, 18, 20–26	
Overall Outcome			10–16, 18, 20–26	

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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