UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MASAHIRO KIMURA

Appeal 2008-3597
Application 10/150,966
Technology Center 1700

Decided: September 17, 2008

Before ADRIENE LEPIANE HANLON, THOMAS A. WALTZ, and CAROL A. SPIEGEL, *Administrative Patent Judges*.

HANLON, *Administrative Patent Judge*.

DECISION ON APPEAL

A. STATEMENT OF THE CASE

This is an appeal under 35 U.S.C. § 134 from an Examiner's final rejection of claims 1, 2, and 4-7, all of the claims pending in the application. We have jurisdiction under 35 U.S.C. § 6(b). We AFFIRM.

The Examiner finally rejected claims 1, 2, and 4-7 under 35 U.S.C. § 102(b) as anticipated by Muraoka,[1] Mohindra,[2] Schwenkler,[3] or Shimizu.[4] Final 2-3.[5]

B. ISSUE

Whether the Appellant has shown that the Examiner reversibly erred in rejecting claims 1, 2, and 4-7 under 35 U.S.C. § 102(b) as anticipated by Muraoka, Mohindra, Schwenkler, or Shimizu.

C. FINDINGS OF FACT

The following findings of fact (FF) are supported by a preponderance of the evidence. Additional findings of fact as necessary appear in the Analysis portion of the opinion.

1. Claimed subject matter

The claimed subject matter relates to a substrate drying apparatus.

Claims 1 and 2 are the only independent claims on appeal.

Claim 1 is representative of the issue on appeal, and it reads as follows:

> 1. A substrate processing apparatus drying a substrate after cleaning said substrate with a fluid, comprising:
> a processing bath storing a liquid for immersing said substrate in said liquid and cleaning said substrate;
> a holding device structured to hold said substrate in said processing bath;
> a discharge device discharging said liquid stored in said processing bath while said holding device holds said substrate

[1] US 5,826,601 issued to Muraoka et al. on October 27, 1998 ("Muraoka").
[2] US 5,571,337 issued to Mohindra et al. on November 5, 1996 ("Mohindra").
[3] US 5,752,532 issued to Schwenkler on May 19, 1998 ("Schwenkler").
[4] US 6,043,162 issued to Shimizu et al. on March 28, 2000 ("Shimizu").
[5] Final Office Action mailed August 25, 2006.

> in said processing bath and inert gas is introduced into said processing bath;
>
> a first introduction device structured and controlled to introduce inert gas into said processing bath while said discharge device discharges said liquid stored in said processing bath to expose at least part of a surface of said substrate, said liquid being replaced by said inert gas on an exposed surface of said substrate; and
>
> a second introduction device structured and controlled to, after introducing said inert gas by said first introduction device, introduce an organic solvent into said processing bath while said holding device holds said substrate in said processing bath from which said liquid has been discharged by said discharge device.

App. Br. 8,[6] Claims Appendix.

According to claim 5, the organic solvent is isopropyl alcohol vapor.

App. Br. 9, Claims Appendix.

2. Mohindra

1. Mohindra discloses a method and apparatus for rinsing and drying a substrate. Mohindra 1:12-21.

[6] Second Amended Appeal Brief dated July 23, 2007.

2. An embodiment of the rinse/dry chamber is illustrated in Figure 3. Mohindra 6:53-55. Mohindra Figure 3 is reproduced below:

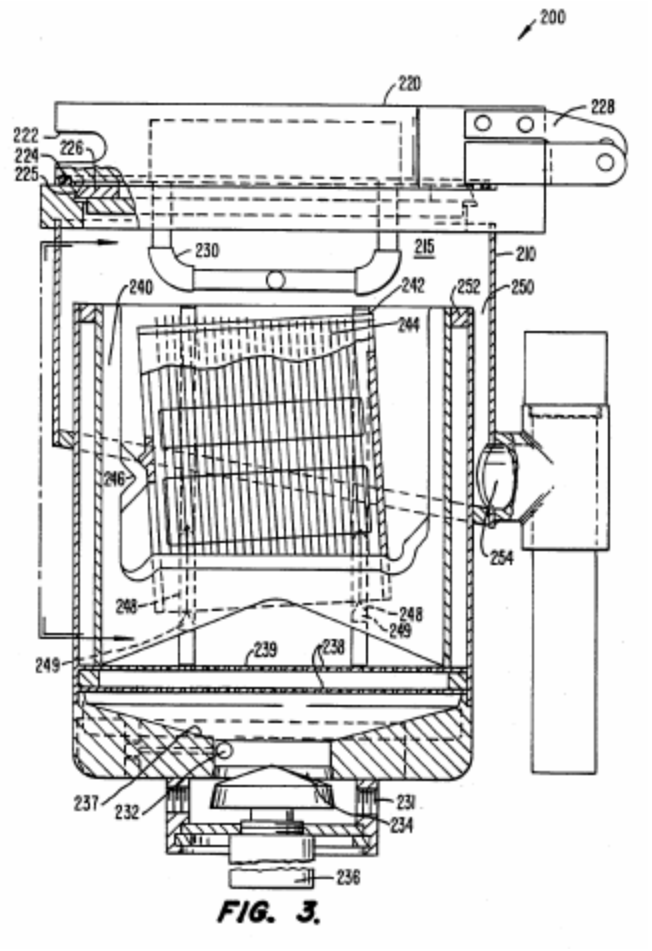

FIG. 3.

Figure 3 depicts a rinse/dry chamber.

3. Embodiment **200** includes a main chamber **210**, a process region **240**, a lower drain region **231**, and a cascade drain region **250**. Mohindra 6:55-59.
4. The process region **240** includes a wafer carrier **242**. Mohindra 7:6-7.
5. The main chamber **210** includes a gas inlet **230** having at least a carrier gas inlet and a solvent gas inlet. Mohindra 7:2-3.
6. The gas inlet may comprise two outside carrier gas inlets **302** and **306**, and a center solvent gas inlet **304**. Each of the gas inlets is a

distribution plenum with a plurality of holes for distributing gas evenly over the process region. Mohindra 8:54-59; Figure 4.

7. According to the method disclosed in Mohindra, an etched wafer is immersed in a bath of deionized water. Mohindra 9:10-12.
8. To remove acid, such as HF, from the surface of the wafer, the deionized water in the main chamber flows across the wafer and cascades over into a drain. The deionized water cascade carries excess acid into the drain and reduces the acid concentration in the vessel. Mohindra 9:22-26.
9. Optionally, the deionized water in the vessel may be removed by dumping it into a bottom drain dump. Preferably, the dumping step is a partial dump, and not a complete dump or removal of deionized water. During the removal of deionized water, a clean inert gas, e.g., filtered nitrogen, displaces the deionized water. Mohindra 9:27-32.
10. After displacing the deionized water with the inert gas, clean deionized water from the deionized water source flows into the main chamber to cover the surface area of the wafer. Mohindra 9:33-35.
11. When residual acid has been substantially removed from the wafer, a carrier gas including a polar organic compound displaces the deionized water. The carrier gas is preferably nitrogen with a trace of polar organic compound such as isopropyl alcohol. Mohindra 9:39-44.

3. Schwenkler

12. Schwenkler discloses a substrate cleaner and dryer as well as a method of drying a substrate using an isopropyl alcohol (IPA) vapor in the disclosed apparatus. Schwenkler 1:14-18.

13. An embodiment of the apparatus is illustrated in Figure 5. Schwenkler 5:44-45. Schwenkler Figure 5 is reproduced below:

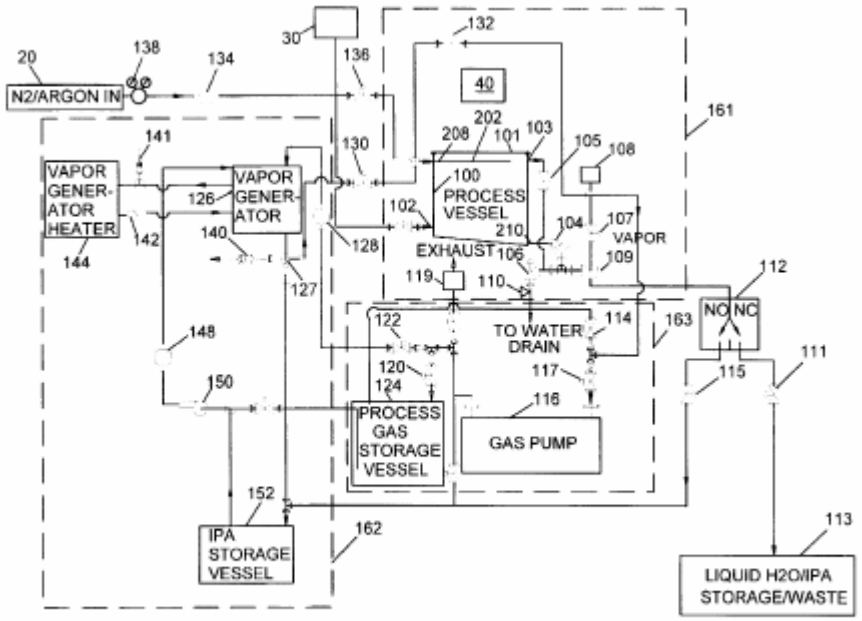

FIG. 5

Figure 5 depicts a clean/dry apparatus.

14. The apparatus includes a process vessel **100** that may function as a rinsing vessel, a cleaning vessel, and/or a drying vessel. Schwenkler 6:27-29.

15. According to the disclosed process, process vessel **100** is filled with deionized water introduced through valved portal **102**. Schwenkler 8:9-11.

16. The product to be rinsed and dried is placed into process vessel **100**. Schwenkler 8:12-13.

17. Overflow rinsing begins with water exiting through valved portal **103**. Schwenkler 8:14-16.

18. When the rinsing is complete, water is drained from process vessel **100** through portal **210** by opening main drain valve **104** and water drain valve **106**. Inert gas, typically N_2, is introduced through portal **202** by opening gas storage vessel valve **136** which allows pressurized inert gas from inert gas storage **20** to backfill process vessel **100** as the water drains. Schwenkler 8:30-37.
19. When the water level in process vessel **100** is empty, gas storage vessel valve **136** and water drain valve **106** are shut. Schwenkler 8:42-46.
20. Process gas recirculation is then initiated. Recirculation includes saturating the process gas with IPA vapor as it passes through vapor generator **126**. The IPA saturated process gas enters the process vessel **100** via portal **208**. Schwenkler 8:50-61.

4. Muraoka

21. Muraoka discloses a substrate treating apparatus and a method for treating a substrate in the disclosed apparatus. Muraoka 1:6-16.

22. One embodiment of the apparatus is illustrated in Figure 10. Muraoka 7:57-58. Muraoka Figure 10 is reproduced below:

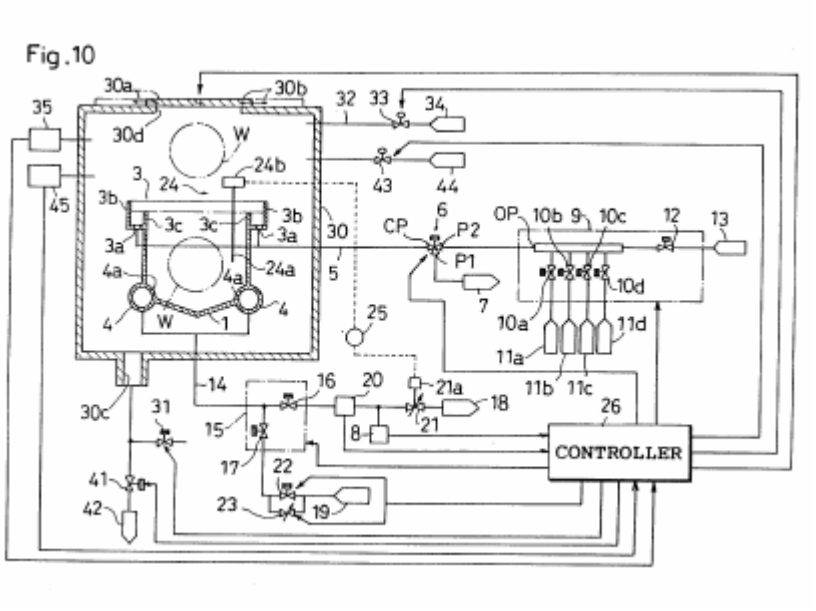

Figure 10 depicts a substrate treating apparatus.

23. A treating bath **1** is mounted in a closed chamber **30**. Muraoka 14:48-50.

24. A wafer W, supported by a wafer holder (not shown), is treated in the treating bath **1**. Muraoka 8:15-17.

25. The treating bath **1** includes an overflow passage **3** that allows treating liquids to flow into and out of the treating bath **1**. Muraoka 8:20-22.

26. The overflow passage **3** guides a treating liquid overflowing the treating bath **1** into a pipe **5** through bores **3*a***. The overflow passage **3** also receives a treating liquid from the pipe **5** through bores **3*a***, and allows this treating liquid to flow into the treating bath **1**. Muraoka 8:25-29.

27. The treating bath **1** further includes a drain/supply pipe **4**. Muraoka 8:22-24.
28. The drain/supply pipe **4** connected to the bottom of the treating bath **1** receives a treating liquid drawn from the treating bath **1** through a plurality of bores **4*a***, and allows the treating liquid to flow into a pipe **14**. The drain/supply pipe **4** also allows a treating liquid to be supplied from the pipe **14** into the treating bath **1** through bores **4*a***. Muraoka 8:62-67.
29. The apparatus includes an inert gas source **34**. A pipe **32** extends into the closed chamber **30** for supplying the inert gas. The pipe **32** has a switch valve **33** operable to supply the inert gas from the inert gas source **34** to the closed chamber **30**. Muraoka 14:61-64.
30. The apparatus also includes an IPA (isopropyl alcohol) supply line having a switch valve **43** operable to supply IPA from an IPA source **44** to the closed chamber **30**. Muraoka 17:40-43.
31. According to the treating process disclosed in Muraoka, chamber **30** is filled with an inert gas, e.g., nitrogen gas. Muraoka 15:19-23.
32. After the chamber **30** is purged with the inert gas, wafer treatment is performed using a recipe of different chemicals. Muraoka 15:24-27, 17:46-48.
33. Wafer treatment includes supplying a chemical or deionized water continuously to the top of the treating bath **1** while deionized water or the chemical, respectively, is discharged from the bottom thereof. Muraoka 11:24-12:40, 15:28-30.
34. When wafer treatment is complete, the switch valve **33** is closed to stop the inert gas supply. Muraoka 16:4-6.

35. The process continues with opening the switch valve **43** to supply IPA into the closed chamber **30**. Muraoka 17:55-56; Figure 11.

36. The wafer W is raised from the deionized water in the treating bath **1** and stopped in a position to be dried. Muraoka 17:56-60.

5. Shimizu

37. Shimizu discloses a method for processing a substrate. Shimizu 1:7-9.

38. Figure 1 illustrates an apparatus that embodies the disclosed method. Shimizu 2:53-54. Shimizu Figure 1 is reproduced below:

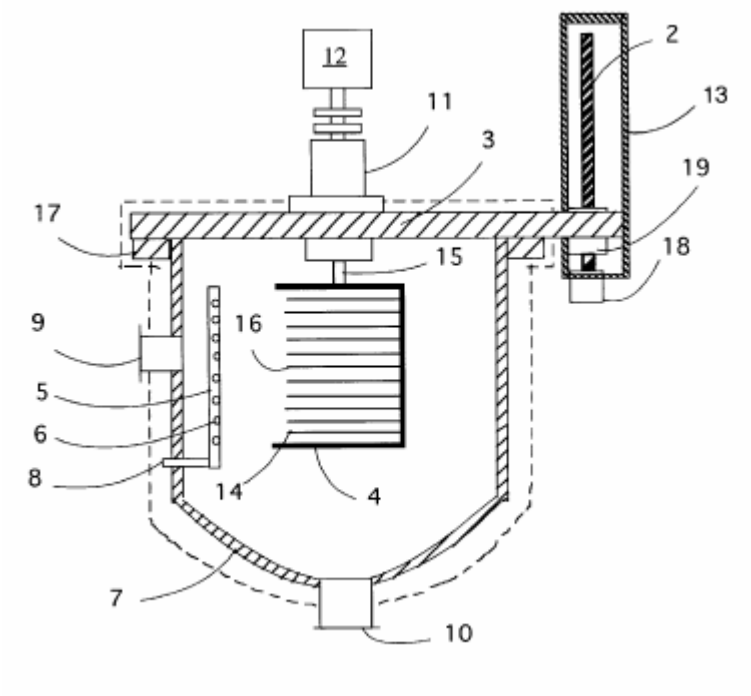

Figure 1 depicts a vapor etching apparatus.

39. The disclosed apparatus comprises a reaction chamber **7**, a support boat **4** on which a plurality of semiconductor wafers **14** are vertically stacked, an injector means **5**, a drainage port **10** for discharging pure water used for cleaning, and an exhaust port **9** for discharging etching gases and a drying gas. Shimizu 2:60-3:12.

40. The injector means **5** is connected to an external pure water tank, a reactive gas tank, an alcoholic gas tank, and an inert gas tank through a port **8**. Shimizu 3:22-24.

41. Shimizu discloses that a plurality of injector means may be provided in the reaction chamber. Shimizu 3:28-30.

42. The disclosed method comprises the steps of loading semiconductor wafers into the reaction chamber, evacuating the reaction chamber to about 1 Pa, etching the wafers by introducing an etching gas, restoring the pressure in the reaction chamber to atmospheric pressure while introducing an inert gas to purge the reactive gas, cleaning the wafers while rotating the same, drying the wafers by rotating the same in a flow of inert gas, drying the inner wall surface of the reaction chamber by introducing an alcoholic gas therein, and removing the wafers from the reaction chamber. Shimizu 4:10-22.

D. ANALYSIS

Claim 1 recites an apparatus comprising first and second introduction devices "structured and controlled" to perform particular functions.

The Examiner found that Muraoka, Mohindra, Schwenkler, and Shimizu disclose introduction devices that are physically capable of operating in many controlled/programmed scenarios, including the scenario recited in claim 1. Thus, the Examiner found that Muraoka, Mohindra, Schwenkler, and Shimizu each disclose an apparatus within the scope of the claims on appeal. Ans. 5-6.[7]

[7] Examiner's Answer mailed October 4, 2007.

The Appellant argues that the Examiner incorrectly interpreted claim 1 as reciting first and second introduction devices having some "controllable" structure. App. Br. 4-5. In contrast, the Appellant argues:

> [T]he recitation that the first introduction device is structured and controlled to introduce inert gas into a processing [bath] while the discharge device discharges a liquid stored in the processing bath, is clearly a recitation of the physical attributes of the structure itself, and is recognizable structure as such to one of ordinary skill in the art. Similarly, the second introduction device that is structured and controlled to introduce an organic solvent into the processing bed after introduction of the inert gas by the first introduction device is also a description of the physical properties of the device to one of ordinary skill in the art.

App. Br. 5.

To the extent that the first and second introduction devices recited in claim 1 require more than some "controllable" structure to perform the recited functions, we find that the prior art describes first and second introduction devices within the scope of claim 1. For example, Mohindra describes "a first introduction device structured and controlled to introduce inert gas into said processing bath while said discharge device discharges said liquid stored in said processing bath" and "a second introduction device structured and controlled to, after introducing said inert gas by said first introduction device, introduce an organic solvent into said processing bath." *See, e.g.,* FF 9-11.

The Appellant also argues that the claimed apparatus is patentably distinct from the apparatuses of the prior art because the structure of the prior art does not provide the liquid/inert gas/organic solvent sequence of the claimed apparatus. App. Br. 5-6. In particular, the Appellant argues that the

"second introduction device" recited in the claims on appeal executes the process of *replacing* an inert gas with an organic solvent on a substrate surface. App. Br. 6.

According to claim 1, the second introduction device is structured and controlled to introduce an organic solvent into the processing bath *after* the inert gas has been introduced by the first introduction device. Claim 1 does not exclude the introduction of other liquids, such as deionized water, into the processing bath after the inert gas has been introduced but before an organic solvent is introduced. That is, claim 1 does not require an organic solvent to *replace* the inert gas. *In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989) (during patent examination pending claims must be interpreted as broadly as their terms reasonably allow).

Finally, the Appellant argues that each of the cited references only discloses one "control element" whereas the claims on appeal require two "control elements." App. Br. 6.

Although both of the introduction devices must be "controlled" to perform a particular function, the claims on appeal do not require the first and second introduction devices to be controlled by separate controllers. *See* Ans. 7 (the claims are silent with respect to the limitation of "two control elements").

For the reasons set forth above, the Appellant has failed to show that claims 1, 2, and 4-7 were improperly rejected under 35 U.S.C. § 102(b) as anticipated by Muraoka, Mohindra, Schwenkler, or Shimizu.

E. DECISION

The rejection of claims 1, 2, and 4-7 under 35 U.S.C. § 102(b) as anticipated by Muraoka, Mohindra, Schwenkler, or Shimizu is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 35 U.S.C. § 1.136(a) (2008).

AFFIRMED

rvb

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