UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ENTEGRIS, INC.,

Petitioner,

v.

GUDENG PRECISION INDUSTRIAL CO., LTD.,

Patent Owner

Case PGR2026-00037
Patent 12,347,711

DECLARATION OF DR. ALEXANDER GLEW REGARDING U.S. PATENT NO. 12,347,711

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d. 23[c]: a plurality of porous tubes, each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the porous tubes and enter an accommodating space of the shell.....71
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b. Claim 26: The wafer container according to claim 23, further comprising: a gas cartridge, having a bottom portion and a sidewall extending from the bottom portion, the bottom portion of the gas cartridge having the gas intake channels formed thereon. 74

c. Claim 27: The wafer container according to claim 26, wherein the gas cartridge is installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber. 77

d. Claim 28: The wafer container according to claim 26, wherein a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module. 78

e. Claim 30: The wafer container according to claim 23, further comprising: a base plate, connected below the shell to support the shell; wherein the buffering gas chamber is between the bottom portion and the base plate of the shell. 82

3. Independent Claim 13 83

a. 13[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising: 83

b. 13[a][1]: a gas cartridge, configured at a bottom portion of the wafer container to define a buffering gas chamber, ...84

c. 13[a][2]: the bottom portion provided with at least two coupling structures, each of the coupling structures defining a through channel having a center axis, ...85

d. 13[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and 86

e. 13[b]: at least two porous tubes, each of the porous tubes having a longitudinal space, the at least two porous tubes respectively installed to corresponding coupling structures of the wafer container, the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the at least two porous tubes and enter the accommodating space. 87

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a. Claim 18: The gas diffusion device according to claim 13, wherein the gas cartridge has a bottom portion and a sidewall extending from the bottom portion, and the gas intake channel is formed at the bottom portion of the gas cartridge. 87

b. Claim 19: The gas diffusion device according to claim 13, wherein the gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber. 87

c. Claim 20: The gas diffusion device according to claim 13, wherein a plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber. 87

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3. Claim 31: The wafer container according to claim 30, wherein the base plate is made of a material comprising a self-lubricating material. 96

4. Claim 22: The gas diffusion device according to claim 21, wherein the base plate is made of a material comprising a self-lubricating material. 97

C. Ground 4: Obviousness of Claims 1-9, 12, 13-21, 23-28, and 30 in view of Smith ’517 in further view of Smith ’154.....98

1. Motivation to Combine Smith ’517 (Ex1011) with Smith ’154 (Ex1008) 98

2. Independent Claim 1 114

a. 1[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising: 114

b. 1[a][1]: a buffering gas chamber, configured at a bottom portion of the wafer container, ...115

c. 1[a][2]: the bottom portion provided with at least one coupling structure, the coupling structure defining a through channel having a center axis, ...116

d. 1[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and 118

e. 1[b][1]: at least one porous tube, having a longitudinal space, the porous tube installed to the coupling structure of the wafer container, the longitudinal space of the porous tube communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the porous tube and enter the accommodating space, ...121

f. 1[b][2]: a gas intake center axis of the gas and a center axis of the coupling structure being coaxial. 124

3. Dependent Claims 2-9, and 12.....126

a. Claim 2: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial. 126

b. Claim 3: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial; the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis. 128

c. Claim 4: The gas diffusion device according to claim 1, wherein the longitudinal space of the porous tube has a closed end and an open end, and the open end receives the corresponding coupling structure, so that the gas enters the longitudinal space by passing through the buffering gas chamber and the open end. 133

d. Claim 5: The gas diffusion device according to claim 1, wherein a shape of a horizontal cross section of the porous tube is an ellipsoid or an elongated narrow shape having a long axis and a short axis, or a circle having a diameter. 136

e. Claim 6: The gas diffusion device according to claim 5, further comprising: a first collar, arranged in the open end, the first collar located between the open end and the coupling structure. 137

f. Claim 7: The gas diffusion device according to claim 6, further comprising: a second collar, located between the first collar and the coupling structure when the second collar is disposed on the coupling structure so as to reinforce airtightness. 139

g. Claim 8: The gas diffusion device according to claim 6, wherein a material of the first collar is softer than a material of the porous tube to prevent breaking of the open end. 141

h. Claim 9: The gas diffusion device according to claim 7, wherein the second collar and the porous tube are sintered or bonded into an integral structure to prevent breaking of the open end. 143

i. Claim 12: The gas diffusion device according to claim 1, further comprising: at least one gas intake module, communicatively coupled to the buffering gas chamber, the gas intake module having the gas intake center axis, supplying the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber. 144

1. Independent Claim 13 146

a. 13[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising: 146

b. 13[a][1]: a gas cartridge, configured at a bottom portion of the wafer container to define a buffering gas chamber, ...147

13[a][2]: the bottom portion provided with at least two coupling structures, each of the coupling structures defining a through channel having a center axis, ...147

13[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and 147

c. 13[b]: at least two porous tubes, each of the porous tubes having a longitudinal space, the at least two porous tubes respectively installed to corresponding coupling structures of the wafer container, the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the at least two porous tubes and enter the accommodating space. 150

2. Dependent Claims 14-21.....150

a. Claim 14: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, the center axis of the longitudinal space of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial. 150

b. Claim 15: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial; the center axis of the longitudinal space of each of the porous tubes is offset from the center axis of the through channel, the center axis of the open end of the porous tube and the gas intake center axis. 151

c. Claim 16: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tube has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, and the center axis of the longitudinal space of each of the porous tubes are coaxial; a position of a gas intake center axis along which the gas passes is offset from the center axis of the through channel, the center axis of the open end and the center axis of the longitudinal space that are coaxial.....152

d. Claim 17: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels and the center axis of the open end of each of the porous tubes are coaxial; a gas intake center axis along which the gas passes and the center axis of the longitudinal space are both offset from the center axis of the through channel and the center axis of the open end that are coaxial.....156

e. Claim 18: The gas diffusion device according to claim 13, wherein the gas cartridge has a bottom portion and a sidewall extending from the bottom portion, and the gas intake channel is formed at the bottom portion of the gas cartridge. 157

f. Claim 19: The gas diffusion device according to claim 13, wherein the gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber. 158

g. Claim 20: The gas diffusion device according to claim 13, wherein a plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber. 159

h. Claim 21: The gas diffusion device according to claim 13, wherein the wafer container comprises a base plate installed at the bottom portion of the wafer container, and the buffer gas chamber is between the bottom portion and the base plate of the wafer container. 160

3. Independent Claim 23 161

a. 23[pre]: A wafer container, comprising: 161

b. 23[a]: a shell, comprising a bottom portion, the bottom portion configured with a plurality of coupling structures, the coupling structures defining a plurality of through channels;.....161

c. 23[b]: a buffering gas chamber, formed below the bottom portion, the buffering gas chamber having a plurality of gas intake channels, the gas intake channels communicating with the corresponding through channels; and 162

d. 23[c]: a plurality of porous tubes, each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the porous tubes and enter an accommodating space of the shell. 162

4. Dependent Claims 24-28, and 30 164

a. Claim 24: The wafer container according to claim 23, wherein the porous tube has a longitudinal space, the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber is capable of passing through the open end to enter the longitudinal space. 164

b. Claim 25: The wafer container according to claim 23, further comprising: a collar, arranged between the open end and the coupling structure, a material of the collar being softer than a material of the porous tube to prevent breaking of the open end. 165

c. Claim 26: The wafer container according to claim 23, further comprising: a gas cartridge, having a bottom portion and a sidewall extending from the bottom portion, the bottom portion of the gas cartridge having the gas intake channels formed thereon. 166

d. Claim 27: The wafer container according to claim 26, wherein the gas cartridge is installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber. 166

e. Claim 28: The wafer container according to claim 26, wherein a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module. 166

f. Claim 30: The wafer container according to claim 23, further comprising: a base plate, connected below the shell to support the shell; wherein the buffering gas chamber is between the bottom portion and the base plate of the shell. 166

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2. Claim 10: The gas diffusion device according to claim 8, wherein the coupling structure, the porous tube, the first collar and/or the second collar are/is made of a thermal resistant material which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP. 167

3. Claim 11: The gas diffusion device according to claim 1, further comprising: an airflow guiding member, arranged adjacent to one side of the porous tube, the airflow guiding member configured to adjust an airflow direction of the gas entering the accommodating space. 168

4. Claim 22: The gas diffusion device according to claim 21, wherein the base plate is made of a material comprising a self-lubricating material. 171

5. Claim 29: The wafer container according to claim 23, wherein the wafer container further comprises a door detachably combined with the shell, and a pair of support portions configured on an inner side of the shell, and the wafer container is made of a thermal resistance material, which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP. 171

6. Claim 31: The wafer container according to claim 30, wherein the base plate is made of a material comprising a self-lubricating material. 172

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1. Independent Claim 1 172
   a. 1[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising: 172
   b. 1[a][1]: a buffering gas chamber, configured at a bottom portion of the wafer container, ...174
   c. 1[a][2]: the bottom portion provided with at least one coupling structure, the coupling structure defining a through channel having a center axis, ...175
   d. 1[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and 176
   e. 1[b][1]: at least one porous tube, having a longitudinal space, the porous tube installed to the coupling structure of the wafer container, the longitudinal space of the porous tube communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the porous tube and enter the accommodating space, ...177
   f. 1[b][2]: a gas intake center axis of the gas and a center axis of the coupling structure being coaxial. 179
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   a. Claim 2: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial. 179

b. Claim 3: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial; the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis. 181

c. Claim 4: The gas diffusion device according to claim 1, wherein the longitudinal space of the porous tube has a closed end and an open end, and the open end receives the corresponding coupling structure, so that the gas enters the longitudinal space by passing through the buffering gas chamber and the open end. 184

d. Claim 5: The gas diffusion device according to claim 1, wherein a shape of a horizontal cross section of the porous tube is an ellipsoid or an elongated narrow shape having a long axis and a short axis, or a circle having a diameter. 185

e. Claim 6: The gas diffusion device according to claim 5, further comprising: a first collar, arranged in the open end, the first collar located between the open end and the coupling structure. 186

f. Claim 7: The gas diffusion device according to claim 6, further comprising: a second collar, located between the first collar and the coupling structure when the second collar is disposed on the coupling structure so as to reinforce airtightness. 186

g. Claim 8: The gas diffusion device according to claim 6, wherein a material of the first collar is softer than a material of the porous tube to prevent breaking of the open end. 186

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h. Claim 9: The gas diffusion device according to claim 7, wherein the second collar and the porous tube are sintered or bonded into an integral structure to prevent breaking of the open end. 186

i. Claim 12: The gas diffusion device according to claim 1, further comprising: at least one gas intake module, communicatively coupled to the buffering gas chamber, the gas intake module having the gas intake center axis, supplying the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber. 186

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2. Claim 10: The gas diffusion device according to claim 8, wherein the coupling structure, the porous tube, the first collar and/or the second collar are/is made of a thermal resistant material which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP. 188

3. Claim 11: The gas diffusion device according to claim 1, further comprising: an airflow guiding member, arranged adjacent to one side of the porous tube, the airflow guiding member configured to adjust an airflow direction of the gas entering the accommodating space. 189

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A. Claim 1 190

B. Claims 2, 3, 12 193

EXHIBIT LIST 195

CLAIM LISTING 197

I. INTRODUCTION

1. I have been retained by counsel for Entegris, Inc. ("Entegris") in the above-captioned proceeding. I have been asked to provide my opinion about the state of the art of the technology described in U.S. Patent No. 12,347,711 ("'711 Patent") (Ex1001) and on the patentability of claims 1-31 of this patent (the "Challenged Claims"). The following is my written declaration on these topics.

2. I am being compensated at a rate of $750.00 per hour for my study and testimony in this matter. My compensation is not contingent on the outcome of this matter or the specifics of my testimony. My CV, attached as Exhibit 1007, lists all other cases in which I have testified as an expert at trial or by deposition.

A. Background and Qualifications

3. My professional qualifications, experience, publications and presentations, and a listing of previous cases in which I have provided expert testimony are set forth in my CV, attached as Exhibit 1007.

4. I have significant experience in flow control and gas distribution in semiconductor manufacturing equipment.

5. I began my career at Applied Materials, Inc., where I specialized in high-purity processing, gas, and chemical delivery technology. Throughout my career at Applied Materials, I led teams and projects focusing on this technology. For example, I was responsible for flow suppliers, including valves, filters,

purifiers and similar products, for multiple divisions of the company. I also established and managed the customer engineering special group for the chemical vapor deposition (CVD) division, which engineered all equipment modifications including for process chambers, vacuum systems, and gas delivery. I also managed a team developing liquid source chemical delivery systems for dielectric deposition, as well as a team that tested and recommended gas, vacuum, and chemical components for the CVD division. My responsibilities included sitting on the corporate engineering/technology council responsible for corporate direction in high-purity processing, gas, and chemical delivery for all divisions.

6. Since 1997, I have led my own engineering consulting firm, where our clients include companies with projects or products related to semiconductor equipment, plasma generation, vacuum systems, fluid delivery systems, and flow and pressure components. I have a B.S. and M.S. in Mechanical Engineering from University of California, Berkeley and an M.S. and Ph.D. from Stanford University in Materials Science and Engineering. I am a licensed mechanical engineer in the state of California, and have several issued patents, as set forth in my CV.

Information Considered

7. My opinions are based on my years of education, research and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this report and those

listed in the Exhibit List at the end of this declaration.

8. I may rely upon these materials and/or additional materials to respond to arguments raised by the Patent Owner. I may also consider additional documents and information in forming any necessary opinions — including documents that may not yet have been provided to me.

9. My analysis of the materials produced in this matter is ongoing and I will continue to review any new materials as it is provided. This declaration represents only those opinions I have formed to date.

B. Summary of Opinions

10. Based on my background and review and analysis of the materials considered, I have reached certain opinions in this matter, listed below:

- Claims 23, 24, 26-27, 30 & 13, 18-19, 21 are anticipated under 35 U.S.C. §102 by Smith ’154
- Claims 23, 24, 26-28, 30 & 13, 18-21 are rendered obvious under 35 U.S.C. §103 in view of Smith ’154
- Claims 23, 24, 26-31 & 13, 18-22 are rendered obvious under 35 U.S.C. §103 in view of Smith ’154 in further view of Ogawa
- Claims 1-9, 12-21, 23-28, 30 are rendered obvious under 35 U.S.C. §103 in view of Smith ’517 in further view of Smith ’154

- Claims 1-31 are rendered obvious under 35 U.S.C. §103 in view of Smith ’154 and Smith ’517 in further view of Ogawa
- Claims 1-9, 12 are rendered obvious under 35 U.S.C. §103 in view of Smith ’517, under Patent Owner’s potential construction of “buffering gas chamber”
- Claims 1-12 are rendered obvious under 35 U.S.C. §103 in view of Smith ’517 in further view of Ogawa, under Patent Owner’s potential construction of “buffering gas chamber”
- Claims 1-12 are invalid under 35 U.S.C. §112.

II. LEGAL STANDARDS FOR PATENTABILITY

11. In expressing my opinions and considering the subject matter of the claims of the ’711 Patent, I am relying upon certain legal principles that have been explained to me.

A. Anticipation and Obviousness

12. I understand that for an invention claimed in a patent to be found patentable under 35 U.S.C. §§ 102 and 103, it must be, among other things, new and not obvious from what was known before the invention was made.

13. I understand the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art” and includes patents and printed publications (e.g., books, journal publications, articles on

websites, product manuals, etc.).

14. I understand that in this proceeding the Petitioner has the burden of proving that the claims of the ’711 Patent are anticipated by or obvious from the prior art by a preponderance of the evidence. I understand that “a preponderance of the evidence” is evidence sufficient to show that a fact is more likely true than it is not.

15. I understand that in this proceeding, the claims should be given their ordinary and accustomed meaning as understood by one of ordinary skill in the art in view of the patent and its file history. The claims after being construed in this manner are then to be compared to the information in the prior art. My analysis below compares the claims to patents and printed publications that are prior art to the claims.

16. I understand that there are two ways in which prior art may render a patent claim unpatentable. First, the prior art can be shown to “anticipate” the claim. It is my understanding that the claims of a patent are anticipated by a prior art reference if each and every element of the claim is found either explicitly or inherently in a single prior art reference. I understand that inherency requires a showing that the missing descriptive matter in the claim is necessarily or implicitly present in the allegedly anticipating reference, and that it would have been so recognized by a POSITA. In addition, I understand that an enabling disclosure is a

disclosure that allows a POSITA to make the invention without undue experimentation. Although anticipation typically involves the analysis of a single prior art reference, I understand that additional references may be used to show that the primary reference has enabling disclosure, to explain the meaning of a term used in the primary reference, and/or to show that a characteristic is inherent in the primary reference.

17. Second, the prior art can be shown to have made the claim "obvious" to a person of ordinary skill in the art. I understand that a claimed invention is not patentable if it would have been obvious to a person of ordinary skill in the field of the invention at the time the invention was made. I understand that the obviousness standard is defined in the patent statute (35 U.S.C. § 103(a)) as follows:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. I understand that the following standards govern the determination of whether a claim in a patent is obvious. I have applied these standards in my evaluation of whether the claims of the '711 Patent would have been considered obvious as of the priority date of the patent.

19. I understand that to find a claim in a patent obvious, one must make

certain findings regarding the claimed invention and the prior art. Specifically, I understand that the obviousness question requires consideration of four factors (although not necessarily in the following order):

- The scope and content of the prior art;
- The differences between the prior art and the claims at issue;
- The knowledge of a person of ordinary skill in the pertinent art; and
- Whatever objective factors indicating obviousness or non-obviousness may be present in any particular case.

20. In addition, I understand that the obviousness inquiry should not be done in hindsight, but must be done using the perspective of a person of ordinary skill in the relevant art as of the effective filing date of the patent claim.

21. I understand the objective factors indicating obviousness or non-obviousness may include: commercial success of products covered by the patent claims; a long-felt need for the invention; failed attempts by others to make the invention; copying of the invention by others in the field; unexpected results achieved by the invention; praise of the invention by those in the field; the taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at the making of the invention; and the patentee proceeded contrary to the accepted wisdom of the prior art. I also understand that any of this evidence must be specifically connected to the invention rather than being associated with the prior art or with marketing or other efforts to promote an

invention. I am not presently aware of any evidence of "objective factors" suggesting the claims of the '711 Patent are not obvious, and reserve my right to address any such evidence if it is identified in the future.

22. I understand the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I also understand that an example of a solution in one field of endeavor may make that solution obvious in another related field. I also understand that market demands or design considerations may prompt variations of a prior art system or process, either in the same field or a different one, and that these variations will ordinarily be considered obvious variations of what has been described in the prior art.

23. I also understand that if a person of ordinary skill can implement a predictable variation, that variation would have been considered obvious. I understand that for similar reasons, if a technique has been used to improve one device, and a skilled artisan would recognize that it would improve similar devices in the same way, using that technique to improve the other device would have been obvious unless its actual application yields unexpected results or challenges in implementation.

24. I understand that the obviousness analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, but

instead can take account of the "ordinary innovation" and experimentation that does no more than yield predictable results, which are inferences and creative steps that a skilled artisan would employ.

25. I understand that sometimes it will be necessary to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art. I understand that all these issues may be considered to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

26. I understand that the obviousness analysis cannot be confined by a formalistic conception of the words "teaching, suggestion, and motivation." I understand that in 2007, the Supreme Court issued its decision in *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), where the Court rejected the previous requirement of a "teaching, suggestion, or motivation to combine" known elements of prior art for purposes of an obviousness analysis as a precondition for finding obviousness. It is my understanding that *KSR* confirms that any motivation that would have been known to a person of skill in the art, including common sense, or derived from the nature of the problem to be solved, is sufficient to explain why references would have been combined.

27. I understand that a person of ordinary skill attempting to solve a

problem will not be led only to those elements of prior art designed to solve the same problem. I understand that under the *KSR* standard, steps suggested by common sense are important and should be considered. Common sense teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle. As such, the prior art considered can be directed to any need or problem known in the field of endeavor as of the priority date of the patent and can provide a reason for combining the elements of the prior art in the manner claimed. In other words, the prior art does not need to be directed towards solving the same problem that is addressed in the patent. Further, the individual prior art references themselves need not all be directed towards solving the same problem.

28. I understand that obviousness does not require that the features of a secondary reference be bodily incorporated into the structure of the primary reference. Rather, the test is what the combined teachings of those references would have suggested to a skilled artisan. The disclosures of the prior art references need not be physically combinable. Combining the teachings of references should be the focus of the analysis.

29. I understand that an invention that might be considered an obvious variation or modification of the prior art may be considered non-obvious if one or

more prior art references discourages or lead away from the line of inquiry disclosed in the reference(s). A reference does not "teach away" from an invention simply because the reference suggests that another embodiment of the invention is better or preferred. My understanding of the doctrine of teaching away requires a clear indication that the combination should not be attempted (*e.g.*, because it would not work or explicit statements saying the combination should not be made).

30. I understand that a person of ordinary skill is also a person of ordinary creativity.

31. I further understand that in many fields, it may be that there is little discussion of obvious techniques or combination, and it often may be the case that market demand, rather than scientific literature or knowledge, will drive design trends. When there is such a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In that instance the fact that a combination was obvious to try might show that it was obvious. The fact that a particular combination of prior art elements was "obvious to try" may indicate that the combination was obvious even if no one attempted the combination. If the combination was obvious to try (regardless of whether it was actually tried) or

leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than innovation.

B. Invalidity under Section 112

32. I understand that for an invention claimed in a patent to be found patentable under 35 U.S.C. § 112, it must have, among other things, a written description of the invention, and shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

33. I understand that the hallmark of written description is disclosure, and the test for satisfaction of the written description requirement requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. The written description must clearly allow a person of ordinary skill in the art to recognize that the inventor invented what is claimed, and reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter (commensurate with the full scope of the claims) as of the filing date. Stated another way, one skilled in the art, reading the original disclosure, must immediately discern the limitation at issue in the claims. I understand that a claim which lacks sufficient written description is invalid under 35 U.S.C. § 112.

34. I further understand that distinctly claiming the subject matter of the invention requires that the claim must be sufficiently "definite" to a person of ordinary skill in the art. I understand that a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention. For example, I understand that a claim which is indefinite, and thus invalid under 35 U.S.C. § 112, when it is impossible for a person of ordinary skill in the art to discern the scope of a limitation.

III. PERSON OF ORDINARY SKILL IN THE ART

35. The '711 Patent claims priority, at least in part, to three provisional applications filed respectively on August 17, 2021, November 30, 2021, and March 3, 2022. Ex1003; Ex1004; Ex1005. The '711 Patent identifies the relevant field of art as follows: "The present invention relates to a gas diffusion device, and more particularly, to a gas diffusion device for filling a specific gas and installed in a wafer container, and even more particularly, to a gas tower installed in a wafer container." Ex1001, 1:18-22.

36. Based on the alleged priority and that description of the field of art, my experience, and the prior art I discuss herein, I believe a person of ordinary skill in the art in the field of the '711 Patent in 2021-2022 ("Skilled Artisan" or "POSITA") would have had an advanced degree in mechanical engineering,

microcontamination, materials science, or a related degree and four years of experience in semiconductor wafer manufacturing. I believe that additional training can substitute for educational or research experience, and vice versa.

IV. STATE OF THE ART

37. Wafer containers have long been "used to transport and store" wafers in manufacturing facilities. Ex1017, 1. For example, a patent filed by Petitioner in 2009 explains that by then it was well known that "[w]afer containers and reticle pods generally are sealed containers known as FOUPs (front opening unified pods), FOSBs (front opening shipping boxes), or SMIF (standard mechanical interface) pod" and that "[t]hese containers provide a microenvironment to isolate and control the environment surrounding a wafers and substrates used in manufacturing integrated circuits, during storage, transport and processing of the materials." Ex1021, 1:15-22.

38. Specifications for these containers have long been established, since at least the early 2000s, to "ensur[e] modularity and interchangeability." Ex1017, 1. Further, a POSITA would have known that it was common to periodically purge these containers with gas during the manufacturing process. *Id.*, 16.

39. By 2021, a POSITA would have had significant familiarity with different designs and implementations of gas diffusion devices to purge a wafer container. As even admitted by the '711 Patent, prior art "diffuser assemblies are

usually arranged in a wafer container (10) with respective gas intake modules (11) and porous tubes (12), wherein each gas intake modules (11) has a check valve 10 (13)" that can be connected to "[a] gas filling disk surface (14) . . . at the bottom of the wafer container (10) and supply a gas." Ex1001, 2:5-12. In fact, the prior art had extensive disclosures of each of the elements of the Challenged Claims. In this section I set forth certain known designs, systems, and design considerations.

A. Alignments and shapes of elements in gas distribution systems

40. By 2021, a POSITA would have approached the design of a gas distribution system for a wafer container—either a new wafer container or an existing container retrofitted with new gas distribution components—with the knowledge that the choice of arrangement, such as alignment and shape, for the gas distribution components would be dictated by the shape, structure, and size of the container at issue. The wafers occupy a substantial portion of the container, creating design constraints. For example, a POSITA would have understood that the volume of the exclusion zone inside the container—the area in which the wafers are stored that cannot be encroached upon–would limit how the gas distribution elements could be arranged. *See* Ex1017, 1, 3, 9, 16; Ex1021, 3:3-12. Further, the desired location of the purge flow could be considered in choosing the alignment of the mechanical components.

41. A finite number of possible and predictable alignments and shapes for

the components of a gas distribution system were known in the art by 2021 to address these constraints.

42. **Alignments:** For example, the prior art teaches that components of a gas distribution system (such as gas inlets, porous tubes, and connectors between the same) may be concentric about a central axis, or that those components may be radially offset relative to a central axis, or that some components may be concentric and others may be radially offset. *See, e.g.*, Ex1011, 14:46-57. For example, as shown in Figure 16B, Smith '517 teaches configurations that include at least three radially offset axes between a porous tube, connector, and gas inlet. As another example, as shown in Figure 19, the porous tube, connector, and gas inlet components are all centered on a single axis.

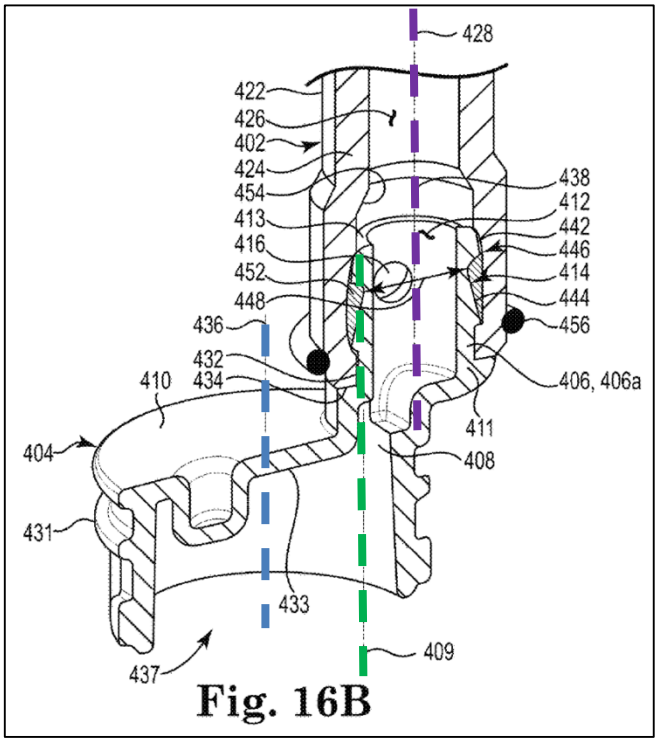


Fig. 16B

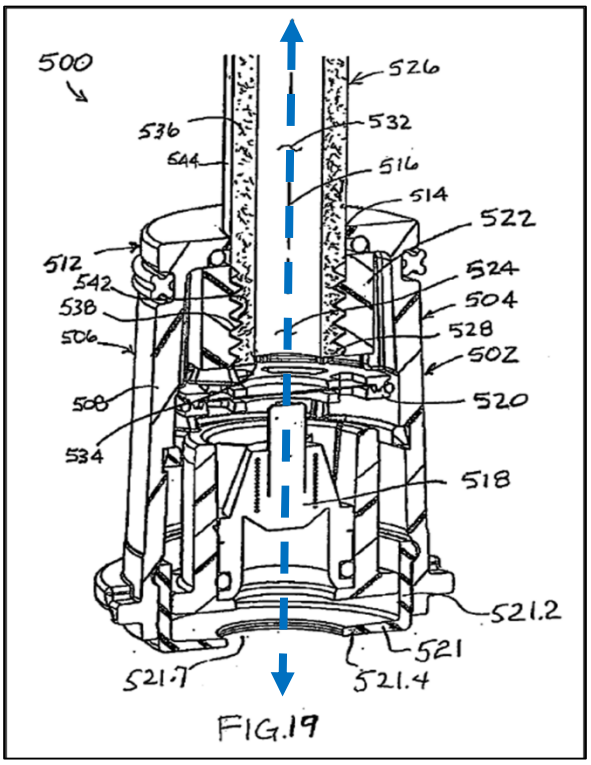


FIG.19

Ex1011, Figs. 16B (annotated) and 19 (annotated).

43. As another example, Eggum discloses another optional design with an outlet having an opening, where the center of the opening is offset from a center of the inner diameter of the connector into a substrate container. Ex1013, 12:64-67, Fig. 8A; *see also id.*, 12:10-13:61.

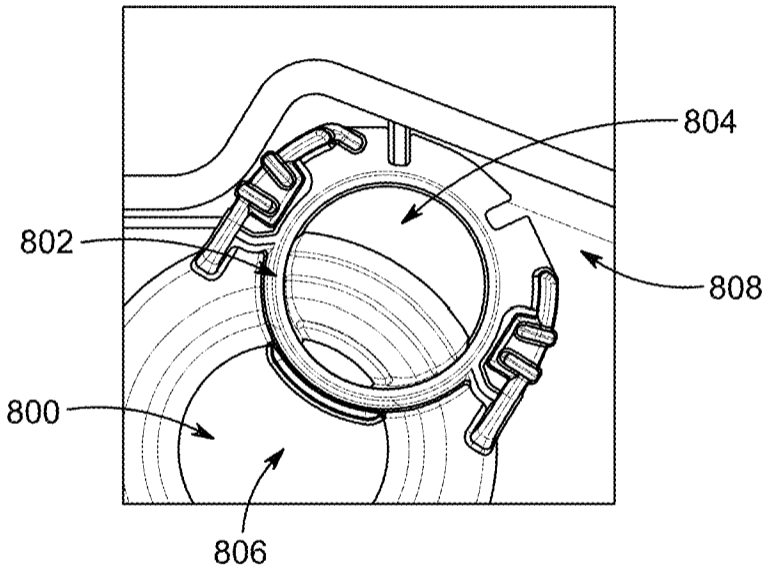


Figure 8A

Ex1013, Fig. 8A.

44. **Shapes:** Regarding the porous tubes or other components for distributing purge gas inside a container, it was also well known in the art by 2021 that a variety of shapes and configurations could be used. For example, the tubes could be cylindrical, as shown in Figure 7 of Smith ’517, or could have diameters

that vary across the length of the tube, as shown in Figures 14A-C of Smith ’517.

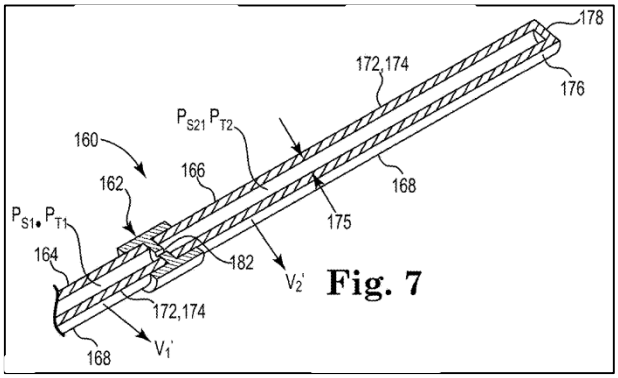


Fig. 7

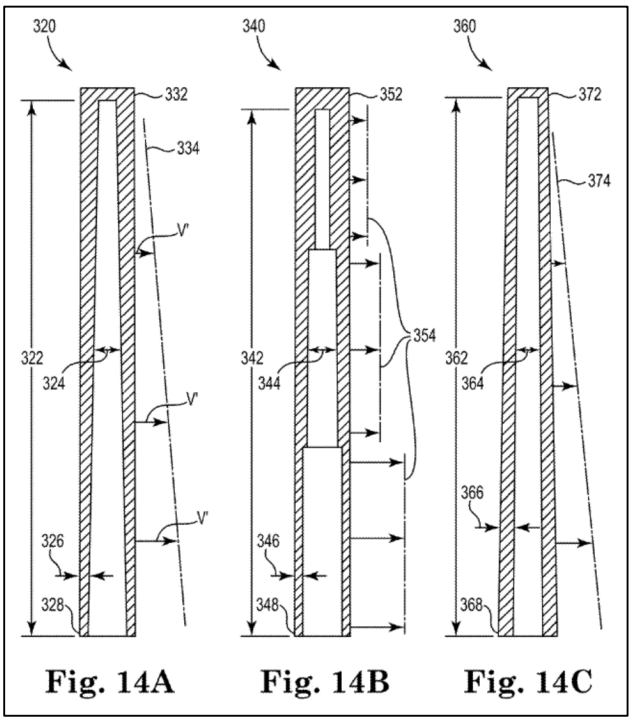
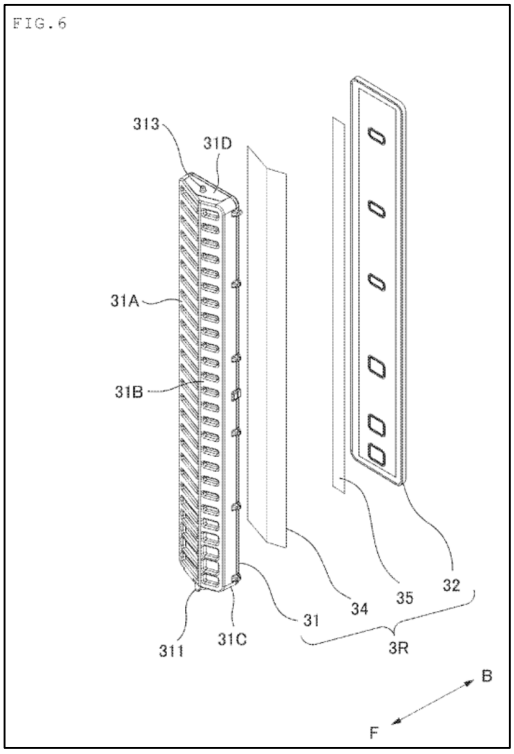


Fig. 14A Fig. 14B Fig. 14C

Ex1011, Figs. 7, 14A-C.

45. Further, non-circular tubes and baffles to direct the gas flow inside the container, as shown in Ogawa Figure 6, were also well known in the art. For example, Ogawa’s housing member 31 and cover member 32 direct the gas exiting the non-circular internal space of the diffusion device 34/35.



Ex1012, Fig. 6.

46. It was also well known in the art that, instead of simple tubes, "gas distributing surfaces . . . can be any of the structures for distributing the purge gas into the interior of the substrate container[], including, but not limited to, top/bottom/side manifold(s), top/bottom/side diffusers, top/bottom/side membranes, top/bottom/side portions having slits or nozzles or made of porous material." An example of such a gas distribution device that is bent at one end and runs along the top of the container is shown in Smith '154 Figure 4B. These diffuser configurations were all well known options for a POSITA for distributing gas as needed in a particular wafer container with particular purge flow specifications.

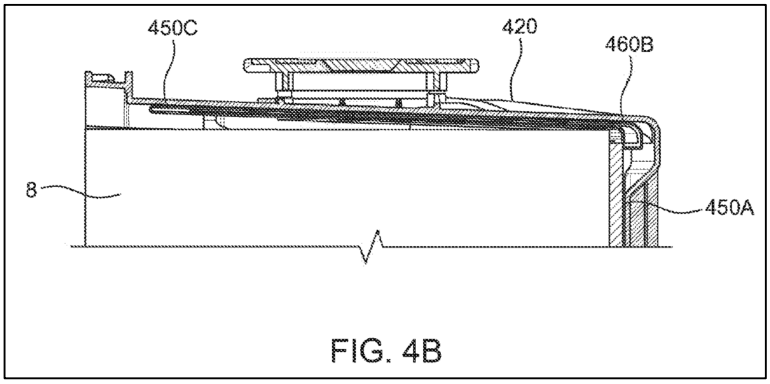


FIG. 4B

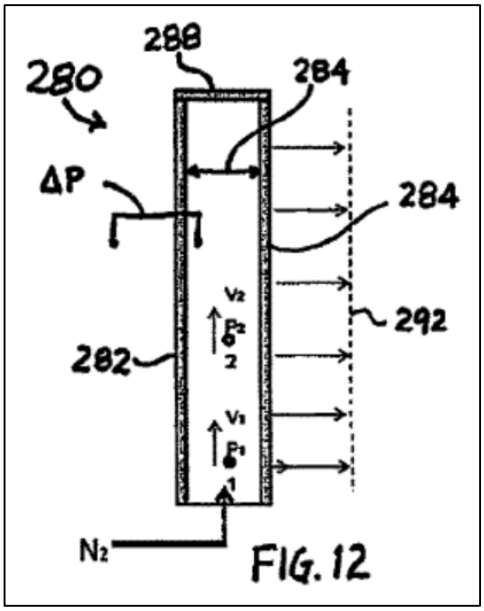
Ex1008, Fig. 4B.

B. Buffering gas chambers for balancing pressure

47. Balancing the pressure, and thus flow, between multiple flow outlets by using a large reservoir of pressurized gas is a well-understood concept. An everyday example that one may observe is the use of plenums and large volumes for heating and air conditioning, to balance the flow to different diffusers or outlet ducts. Another example from the semiconductor industry is the use of a plenum behind the gas delivery plate ("showerhead") in a process chamber, to keep the flow substantially similar for each orifice in the showerhead. In this case, the pressure drop is greater than the ratio of two to one, thus creating choked flow. The outlet flow from each orifice depends only on the inlet pressure, which is substantially constant in a plenum.

48. Various techniques for balancing gas pressure of the purge gas to be distributed in a wafer container were also known in the art by 2021. For example, in purge gas distribution systems, the use of "plenum-type diffuser bod[ies]" that

"can be tailored to provide a desired flow profile" such as substantially consistent pressure across the diffusers devices, were well known in the art. Ex1011, 11:23-31. One such example is shown in Smith '517's Figure 12:



Ex1011, Fig. 12.

49. Smith explicitly describes the desirable pressure balancing and plenum effect created though use of these diffusers. Ex1011, 11:31-12:4; *see also id.* 12:5-13:45, Figs. 13, 14A, 14B, and 14C.

50. Smith '154 further discloses a purge flow distribution system that connects diffusers for distribution of the purge gas flow into the interior of a substrate container. The purge flow distribution system tightly regulate the amount of purge gas distributed to each diffuser in the system:

> It is appreciated that the amount of purge gas can also be set using an orifice, spring loaded diverter, or having one of the first or

> second flow paths have piping/pipes that have smaller or larger cross-sectional areas, as needed, to divide the supply of purge gas to the appropriate/predetermined amount to supply the gas distributing device(s), e.g., the dividing/supplying of the purge gas is based on differential pressure of the network. It is also appreciated that amount of purge gas can be set to each separate gas distributing surface 351A, 351B, 351 C. In other words, the supply of purge gas from a single inlet port is divided and set so that the predetermined amount of purge gas is supplied to the plurality of discrete input purge ports for supplying the gas distributing devices and/or gas distributing surfaces, respectively.

Ex1008 ¶ 37.

51. For example, Figure 5B depicts a purge flow distribution system 540 with a manifold base 560 and a network of separate gas distributing devices 550. Ex1008 ¶ 50. The manifold base includes, as seen in Fig. 5B, "a first flow path 560A connected to inlet purge port(s) for supplying purge gas to a first gas distributing device and a second flow path 560B connected to inlet purge port(s) for supplying purge gas to a second gas distributing device." *Id.* "The first gas distributing device can be a rear gas distributing device 550A that can include rear

left and right diffusers 550A and 550B and the second gas distributing device can be a front gas distributing device that can include a front manifold 550C and left and right manifolds 550D and 550E for distributing the purge gas to the interior of the substrate container at a front side of the substrate container." *Id.* As a result, the "purge flow distribution system 540 is configured in a way such that the supply line can be adjusted to set the amount of purge gas that flows to at least one of the front gas distributing device and the rear gas distributing device, and/or can also be set to adjust the amount of purge gas to the separate gas distributing surfaces." *Id.*

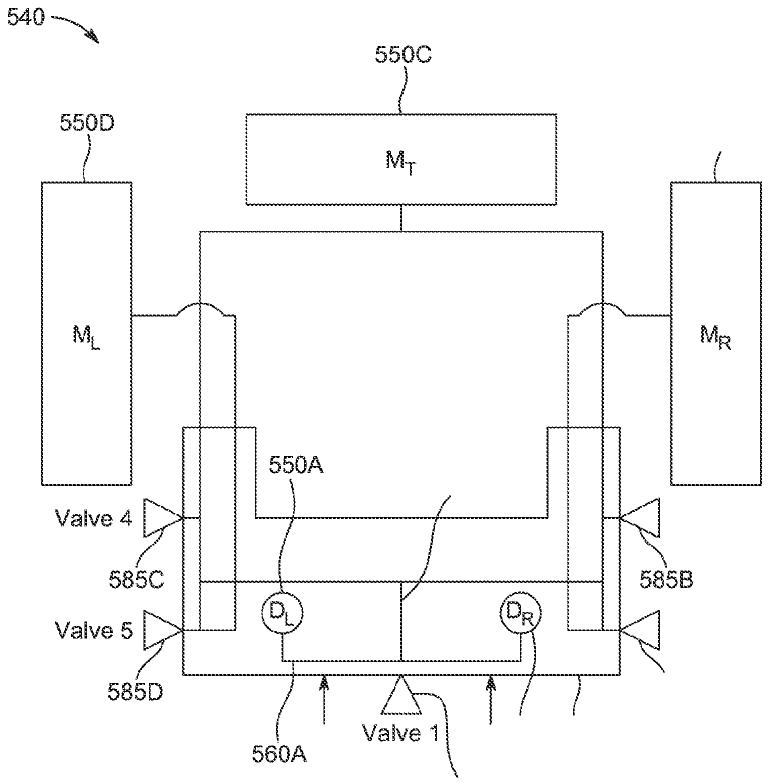


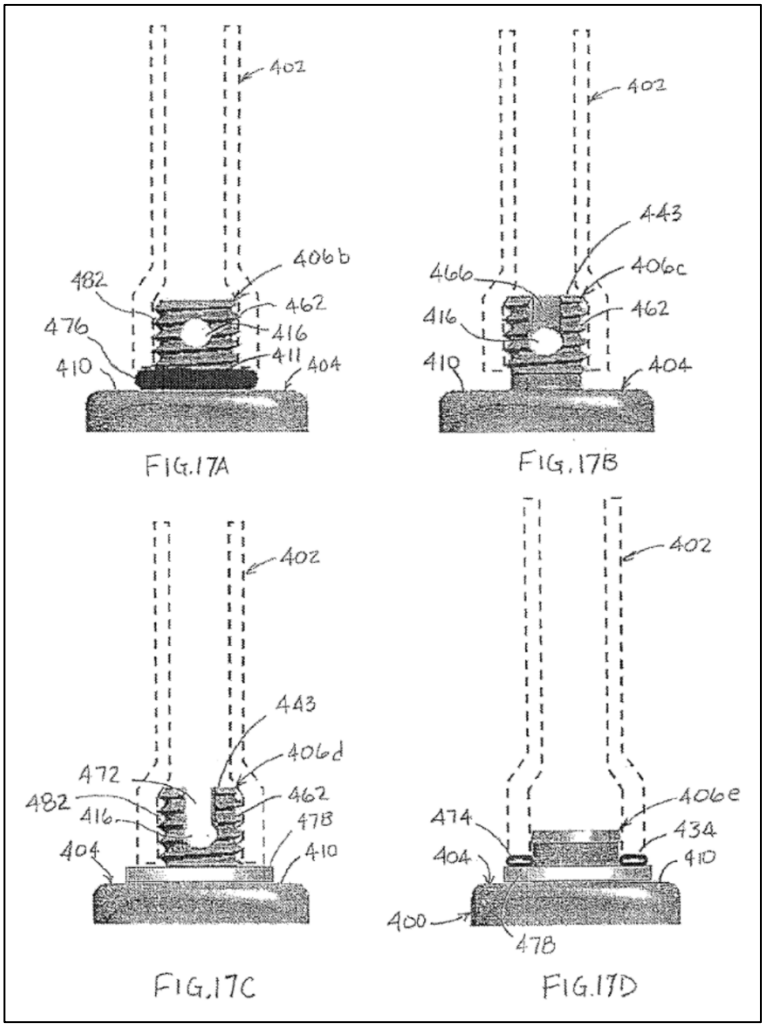
FIG. 5B

Ex1008, Fig. 5B.

C. Mechanical couplings and materials

52. By 2021, there were several known techniques in the art relating to the types of couplings used between components in a purge gas distribution system for a wafer container, and a variety of known materials that could be used to construct gas distribution systems.

53. For example, it was known that couplings could be constructed with internal threads, external threads, O-rings, welds, and/or a variety of compression or nipple structures. Ex1011, 15:7-49, 17:11-16, Figs. 17A-D. A POSITA would have chosen the mechanical coupling best suited to the application at hand, particularly when retrofitting a container, which would require working within existing mechanical constraints.



Ex1011, Figs. 17A-D.

54. A POSITA would also have known that numerous components of the purge flow distribution system could be connected so as to be removable. Indeed, it was known that detachable porous tube assemblies enabled easier installation during retrofitting and greater flexibility for maintenance, replacement, and cleaning. *See*, *e.g.*, Ex1013, 6-12.

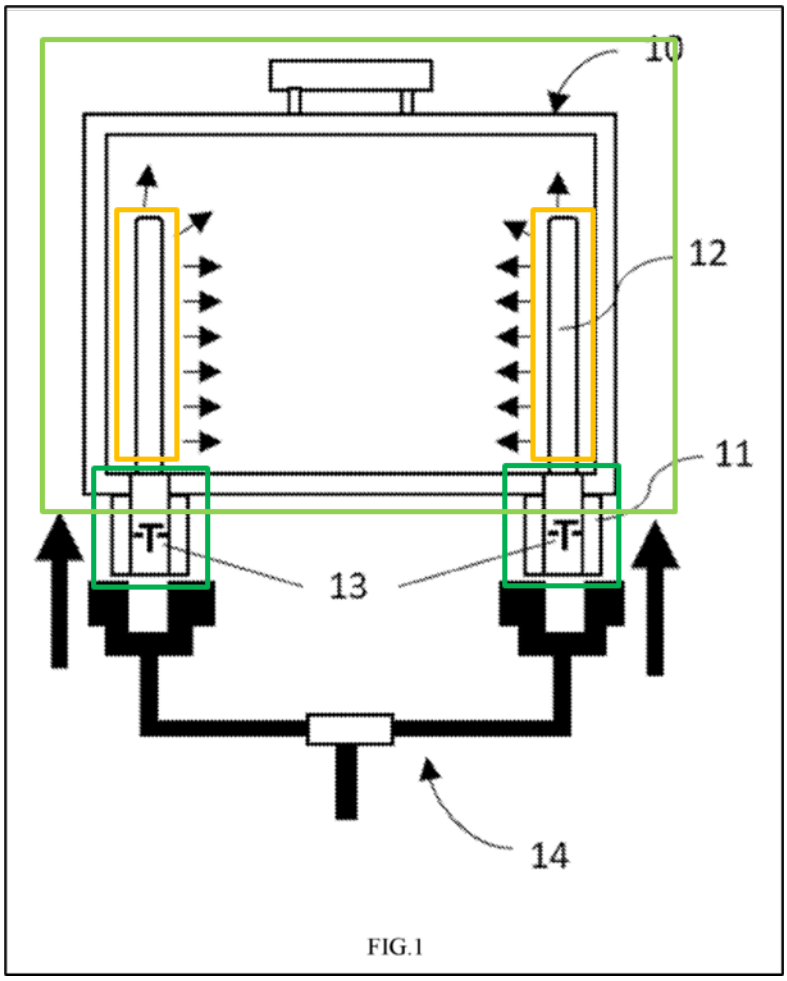
55. Regarding materials, it is well known in the art that the process of manufacturing wafers generates substantial heat. It can be unsafe to place hot

wafers on to certain polymer materials as it may increase the risk of a fire. Therefore, it was common to use thermally resistant materials such as polyether ether ketone ("PEEK") for components to ensure that the risk of fire is minimized. Ex1012, 5:14-23; Ex1018; Ex1019, 1; *see also* Ex1016 ¶¶ 4, 8. PEEK and similar materials may further contain additives to produce additional benefits such as self-lubrication. Ex1019, 1.

V. OVERVIEW OF THE '711 PATENT

A. Subject Matter of the '711 Patent

56. The '711 Patent describes "a wafer container 10 [light green square]" that stores and transports wafers during the fabrication process. The wafer container also includes well known components, including a "gas diffusion device applied in the wafer container," comprising gas intake modules 13 (dark green), which contain check valves, and porous tubes 12 (orange) for diffusing gas inside the container. Ex1001, 2:5-30.



Ex1001, Fig. 1 (annotated).

57. These basic elements of a wafer container were all in the admitted prior art. Ex1001, 2:5-30. The ’711 Patent alleges that it tries to improve on the admitted prior art in two ways. As I describe throughout this declaration, the purported improvements, however, were also well known in the prior art.

1. Buffering Gas Chamber

58. The patent alleges that prior art structures had “uneven airflow entering the interior of the container or an insufficient total flow caused by a

difference in the incoming air of a conventional diffuser." Ex1001, Abstract, 1:44-53, 14:57-15:8; *see also id.*, 2:10-16. The '711 Patent purports to solve this problem using a "buffering gas chamber" (shown below as element 97, red, in Fig. 19). This buffering gas chamber (97) has "an elongated narrow space" that "provides a common buffering space" for the gas from one or more gas intake modules (25, dark green, below). Ex1001, 14:35-41. Like other known buffering structures before 2021, buffering gas chamber 97 balances gas pressure, allowing gas to flow through a channel (blue dashed line) at "a balanced air pressure." Ex1001, 14:57-15:3. Specifically, the gas enters multiple porous tubes (orange) via "coupling structure (205) [not shown in Fig. 19];" and from the porous tubes, the gas is diffused throughout the container. *Id.* Thus, buffering gas chamber (97) "is capable of balancing air pressures" so that gas "the gas diffusion performance of [each] porous tube (27) is consistent." Ex1001, 15:3-4.

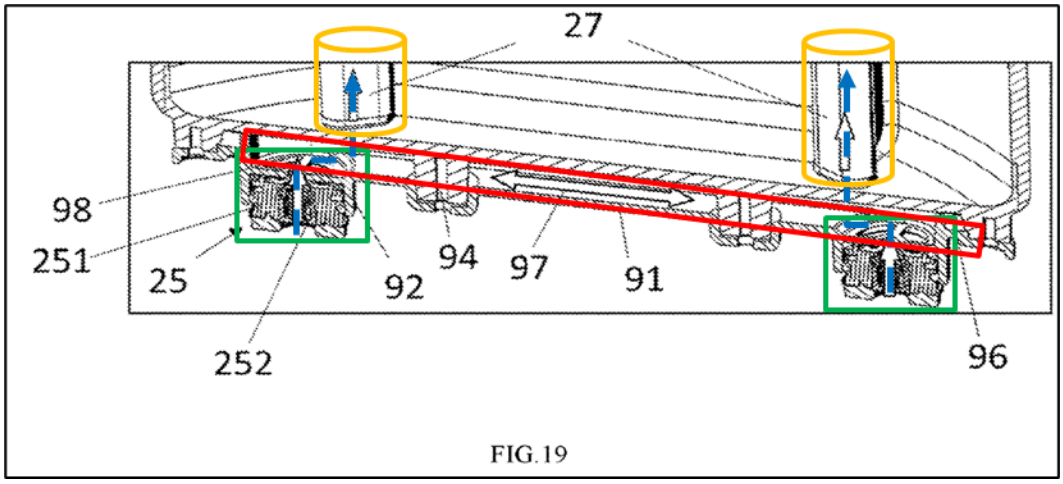
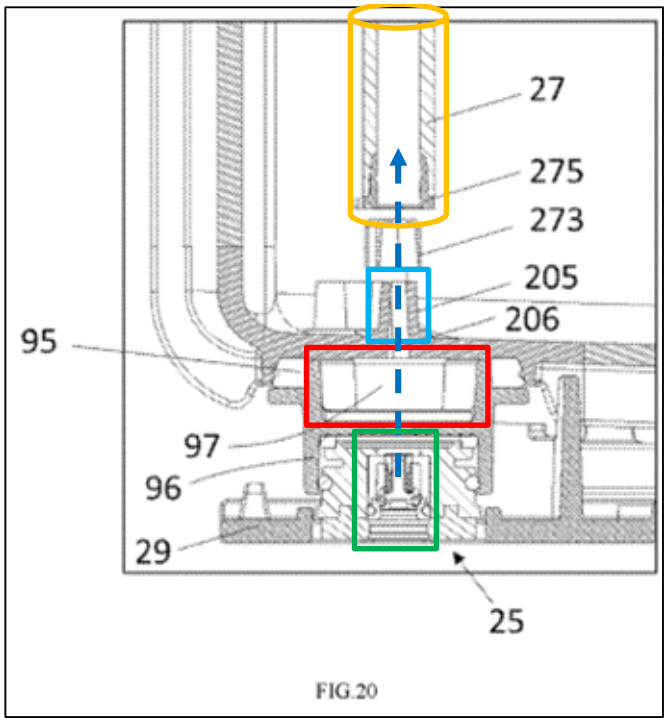


FIG. 19

Ex1001, Fig. 19 (annotated).

59. Figs. 20 (below) and Figs. 21A-D likewise show an enlarged, partial section of the buffering gas chamber from a side-view (in Fig. 20, the back of the container is on the left; in Figs. 21A-21D, the back of the container is on the right). Fig. 20, for example, shows the gas intake module (25, dark green) connected to the buffering gas chamber (97, red), allowing gas to flow through each through channel (206, blue dashed line) into porous tube 27 (orange). Fig. 20 also shows additional detail of a "coupling structure (205)" (light blue) that is "configured to connect [to] the porous tube (27)." Ex1001, 14:42-44.

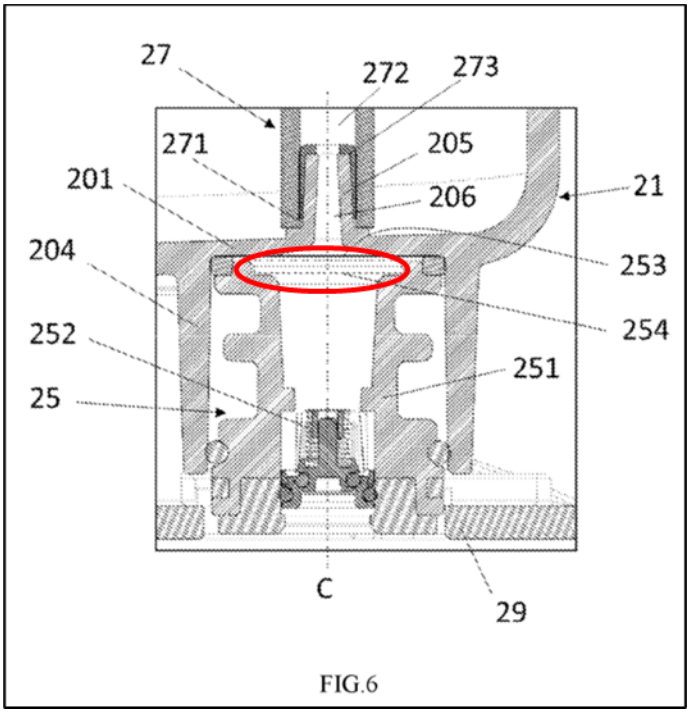


Ex1001, Fig. 20 (annotated).

60. Buffering gas chambers, however, were not new. As I describe further below in §IX.E (*see also* ¶62), it was well known that wafer containers could

include buffering gas chambers to balance pressure of purge gas for distribution to the interior of the container.

61. I note that the patent also purports to disclose a "buffering gas chamber" as element 254 in Figure 6 (below). Ex1001, 8:6-15. But, unlike Figs. 19, 20, 21A-D, in which the buffering gas chamber balances pressure across two porous diffuser tubes, Figure 6 does not disclose multiple diffuser tubes communicating with the alleged buffering gas chamber, element 254. Ex1001, 13:47-49. The patentee described element 254 as simply "reduc[ing] the pressure applied on the filter membrane (253)," not balancing pressure across channels.



Ex1001, Fig. 6 (annotated).

62. Element 254 simply provides an increased surface area for the filter membrane 253 and laterally disperses the gas over the filter membrane surface. ’711, 8:4-15. To the extent patentee calls this a buffering gas chamber, such a configuration was also well known before the ’711 patent, as I describe further in this declaration. *Infra* §IX.E.

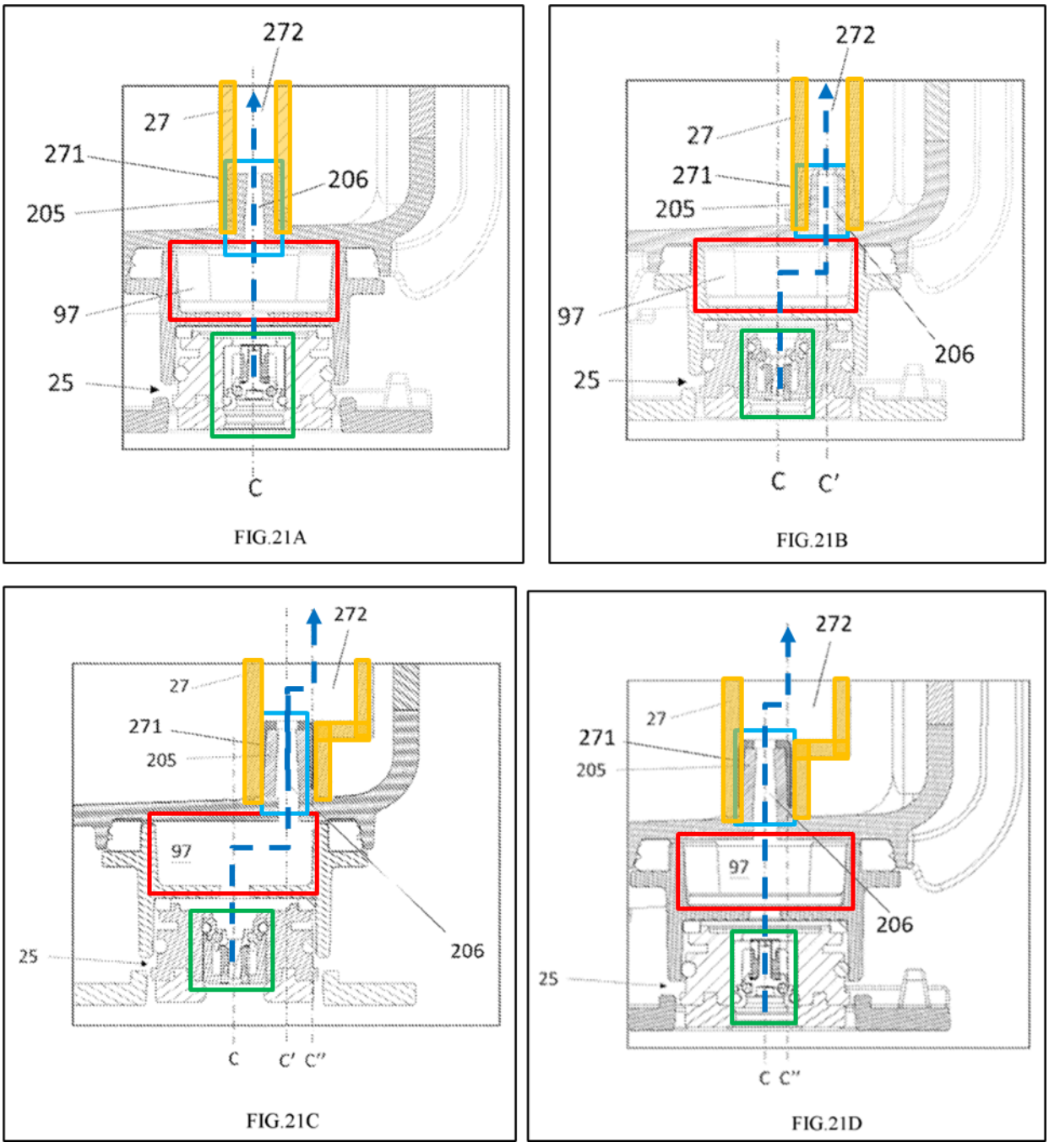
2. Coaxial Alignment

63. The ’711 Patent also purports to address the problem of “an increase of flow time and poor fluency due to the winding during the traveling process of the gas” caused by an “offset configuration” of the gas intake modules and the porous tubes. Ex1001, 1:47-53. The ’711 Patent purports to solve the problem by implementing coaxial alignment of various components such as the “gas intake,” the “coupling structure,” and/or the “open end [] of the porous tube.” Ex1001, 1:44-53, 9:7-13, 9:23-32, 9:39-43. According to the applicant, this configuration “ensures that the airflow follows a straight path to enter the porous tube . . . and provides a shortest path for the gas to directly purge the wafers . . . enhancing purging efficiency. *Id.*, 14:32-39.

64. Coaxial alignment, however, was not new. As I describe further below, it was well known that various elements of a diffusion system could be coaxially aligned in various circumstances.

65. I also note that not all Challenged Claims recite coaxial alignment,

and several embodiments of the ’711 Patent disclose alignments that are not coaxial and thus do not even address the stated problem that the ’711 Patent purports to solve. For example, Figures 21B-D below show various configurations where the buffering gas chamber (red), gas intake channels (green), through channel (blue dashed line), coupling structure (light blue), and porous tubes (orange) have multiple unaligned axes C-C”. Ex1001, 15:34-16:46; Figs. 21B-D. As shown in Fig. 21C, the ’711 Patent discloses an embodiment with three separate axes and two turns in the primary flow direction for the gas.



Ex1001, Figs. 21A-D (annotated).

B. Overview of the Prosecution History

1. Election Requirement

66. The application was filed with 38 claims. Claims 1-7 were directed to

a "gas diffusion device" similar to Figure 6, with at least one porous tube and a "collar" configured to buffer a coupling structure. Ex1002, 1297-1298. Claims 8-38, on the other hand, recited a "buffering gas chamber" and, for most claims, expressly required a plurality of tubes to communicate with the "buffering gas chamber." *Id.*, 1299-1307.

67. On July 15, 2024, the Examiner (a) issued a requirement for restriction to either claims 1-7 or claims 8-38; and (b) required Applicant to "elect a single disclosed species, or a single grouping of patentably indistinct species, for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable." Ex1002, 238, 240. Specifically, the Examiner classified the embodiments into the following "patentably distinct species:"

> Claim(s) 1, 8, 20 and 30 is/are generic to the following disclosed patentably distinct species:
>
> I – Figure 6;
>
> II – Figure 7;
>
> III – Figures 12A, 12B;
>
> IV – Figure 20;
>
> V – Figure 21A;
>
> VI – Figure 21B;
>
> VII – Figure 21C; and
>
> VIII – Figure 21D.

Ex1002, 240.

68. The Examiner required Applicant to (i) elect "a species or a grouping of patentably indistinct species to be examined" and (ii) to identify the "claims encompassing the elected species or grouping of patentably indistinct species." *Id.*

69. Applicant responded by cancelling claims 1-7 and electing to proceed with claims 8-38 (which issued as Challenged Claims 1-31). *Id.*, 233. Applicant acknowledged that it was required "to elect a single disclosed species or a single grouping of patentably indistinct species" of the species that the Examiner identified. *Id.* To address this requirement, Applicant expressly elected "Species IV to VIII, *i.e.*, claims 8-38." *Id.* I note that Species IV to VIII, as excerpted above, correspond to Figures 20 and 21A-21D and exclude Figures 6, 7, and 12A-B. *Id.* As I described above in §V.A, Figures 20 and 21a-21d all disclose a buffering gas chamber communicating with multiple porous tubes. By electing Figures 20 and 21a-21d (multiple tubes) and excluding Figure 6 (single tube), a POSITA would have understood that the Applicant intended to limit its claims to a buffering gas chamber communicating with multiple porous tubes.

2. Applicant's Distinctions Over Prior Art

70. After Applicant's election, the Examiner rejected claims 8-38 under § 102(a)(1) as being anticipated by U.S. Pat. 10,923,373 ("Ogawa"). Ex1002, 178-188.

71. In response, Applicant distinguished the claims in two ways. First, for

claim 8, Applicant relied on the "coaxial" limitation of the claim and argued that "Ogawa does not disclose or otherwise teach at least the limitation" "a gas intake center axis of the gas and a center axis of the coupling structure being **coaxial**." Ex1002, 167 (emphasis original). Second, for Claims 20 and 30, Applicant relied on the "buffering gas chamber" and argued that "Ogawa does not disclose . . . the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber." Ex1002, 169, 171-172. Patent Owner did not amend the claims. Ex1002, 160-166.

72. On March 24, 2025, the Examiner issued a Notice of Allowance without further rejection over the prior art. *Id.* 19. The Examiner stated "[n]one of the prior art of record, alone or in combination, teach:" the Claims 8, 20 and 30. *Id.* 24-25. The '711 Patent issued on July 1, 2025, with 31 claims. Ex1002, 3; Ex1001.

73. As I describe herein, it is my opinion that the Examiner's allowance was materially erroneous for multiple reasons.

74. As one example, the Examiner entirely overlooked the teachings of U.S. Pat. Pub. 2023/0128154 ("Smith '154"), which was submitted in a third-party submission under 37 CFR 1.290 on August 17, 2023. Ex1002, 1163. The concise description of relevance indicated that Smith '154 "shows features of the recited 'buffering gas chamber'…with multiple intake channels or porous tubes" and cited to paragraphs [0033], [0038]-[0041], and Figures 3A-3C. Ex1002, 1168. But even

with that submission, the Examiner entirely ignored Smith ’154. If the Examiner had reviewed Smith ’154, he would have understood that a buffering gas chamber was not novel and would not have issued the claims as proposed by Applicant.

75. Second, the Examiner entirely overlooked the teachings of U.S. 10,347,517 (“Smith ’517”) and its Taiwanese counterpart. Smith ’517 was submitted to the Examiner on September 8, 2023 in an Information Disclosure Statement. Ex1002, 249. Additionally, the Taiwanese counterpart (TW I606534) to Smith ’517 was directly referenced as prior art in the Provisional Application No. 63/233,878 (Ex1003) to which the ’711 Patent claims priority. The Examiner failed to appreciate that both Smith ’517 and TW I606534 disclose multiple coaxial embodiments. Ex1003, 3; *see* Ex1011, Ex1014, Ex1015. Had the Examiner appreciated these disclosures, he would have understood that the coaxial limitation in issued claim 1 was not novel and would not have issued the claims as proposed by Applicant.

VI. PRIORITY DATE

76. The ’711 Patent claims priority to three provisional applications: App. No. 63/233,878 filed on August 17, 2021 (Ex1003), App. No. 63/284,105 filed on November 30, 2021 (Ex1004), and App. No. 63/316,391 filed March 3, 2022. (Ex1005).

77. I understand that for a patent’s claims to be entitled to an earlier

claimed priority date, the patentee must demonstrate that the issued claims of the patent meet the requirements of 35 U.S.C. § 119(e), which include fulfilling the written description requirements of § 112. I further understand that the hallmark of written description is disclosure, and the test for satisfaction of the written description requirement requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. The written description must clearly allow a POSITA to recognize that the inventor invented what is claimed, and reasonably convey to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date. Stated another way, one skilled in the art, reading the original disclosure, must immediately discern the limitation at issue in the claims.

78. Below, I provide (a) my opinions regarding the correct priority date of the Challenged Claims and (b) an assessment of potential arguments by Patent Owner related to the priority date issue.

A. Correct Priority Date of the Challenged Claims

79. It is my opinion that none of the Challenged Claims are entitled to the priority date of August 17, 2021 because App. No. 63/233,878 ("the 878 Application") does not satisfy the written description requirement for the Challenged Claims. The 878 Application does not convey to a POSITA that the inventors of the '711 Patent had possession of the claimed subject matter in any of

the Challenged Claims.

80. More specifically, the 878 Application fails to convey to a POSITA that the inventors had possession of the claimed "buffering gas chamber," which is recited in every Challenged Claim of the '711 Patent. The 878 Application does not once refer to a "buffering gas chamber" or the function of "buffering." Rather, as excerpted below, the 878 Application describes the "present invention" in terms of a new design with a changed shape of "porous pipe," "change in gas flow path," "the feeding gas channel being straight rather than bent," the position of a "central axis of the inflation valve," and "a baffle disposed at the rear of the porous pipe."

How does the present invention address the aforesaid issues?

1. The new design of the present invention has advantageous technical features as follows: the gas channel from the inflation valve to the porous pipe is modified to the slender, longitudinal space within the straight porous pipe; and the porous pipe is of any desirable shape subject to changes as needed rather than a round shape, rendering it feasible to change the direction of gas flow and increase the discharging area.
2. The new design of the present invention provides a high-performance blow-clean module which features enhanced wipping capabilities and reduced chance of resurging internal humidity otherwise caused by door opening. The advantageous features are attained by a change in the shape of the porous pipe, a change in gas flow path, and the feeding gas channel being straight rather than bent.
3. The new design of the present invention is characterized by a baffle disposed at the rear of the porous pipe and adapted to change the gas current direction as needed.
4. The new design of the present invention enables the central axis of the inflation valve to locate within the cross-sections or the slender, longitudinal spaces of porous pipes of different shapes in order to overcome the drawback of the prior art: the prior art discloses an eccentrically-located inflation valve and an eccentrically-located inlet connector and is restricted to the offset positions and a round pipe with a view to achieving gas diffusion capabilities. However, an eccentrically-located gas channel inevitably causes gas flow to wiggle along its course, and thus the gas flow to the porous pipe is sluggish and bumpy.

Ex1003, 4 (annotated).

81. Likewise, the proposed claims in the 878 Application (Ex1003, 18) and embodiments described in the application (Ex1003, 5-17) focus on the same features and never mention a "buffering gas chamber" or other buffering structure. Based on these disclosures, a POSITA would not have understood the 878 Application to describe or refer to a buffering gas chamber—by name,

functionality, structurally, or otherwise. The application does not reasonably convey to those skilled in the art that the inventor had possession of a "buffering gas chamber."

82. Additionally, the 878 Application also fails to disclose multiple "porous tubes" communicating with a "buffering gas chamber" or multiple "coupling structures" with through channels communicating with the "buffering gas chamber." Ex1001, cls. 13, 23; Ex1002, 169-172 (distinguishing claims 13 and 23 based on prior art failing to disclose a "buffering gas chamber" communicating with multiple porous tubes). A POSITA would not have understood the 878 Application to include any buffering gas chamber with a plurality of coupling structures defining through channels or porous tubes communicating with it.

83. My opinion that the 878 Application does not provide a written description of the claimed "buffering gas chamber" is further supported by comparison of the disclosures of the 878 Application to the disclosures of App. No. 63/284,105 ("the 105 Application") filed on November 30, 2021.

84. Unlike the 878 Application, the 105 Application does, in fact, disclose the concept of a "buffering gas chamber," and a POSITA would have understood that this application, filed in November 2021 two months after the 878 Application, was the first application by the inventors disclosing the claimed buffering gas chamber. For example, as shown in the excerpt below, the named

inventors described the "present invention" of the 105 Application in terms of a "buffer air chamber." Likewise, the proposed claims in the 105 Application (Ex1004, 14) and embodiments of that application (Ex1004, 5-12) reference the same "buffer air chamber" or related "air cartridge." A POSITA would have understood the "buffer air chamber" and related "air cartridge" in the 105 Application to refer to the claimed "buffering gas chamber."

Means of the present invention for solving technical problems

1. Means of the present invention for solving the technical problems provides a buffer air chamber or a buffer space among the air inlet channels, as shown in FIG. 2A, and all the air in the buffer air chamber or the buffer space enter a wafer storage space of the carrier of the present invention through a plurality of multi-pore tubes.
2. Compared to a conventional wafer carrier, once inflation modules are configured for the air inlet channels, the limited space of each air inlet channel permits only the arrangement for a filter membrane for filtering air. However, a buffer air chamber or a buffer space configured in the present invention provides an inlet air accommodation space which can be placed with a desiccant, an organic absorbing agent or an additional particle filtering material, thereby improving air cleanliness of the wafer storage space.
3. In view of the issues such as the susceptibility to breakage and air leakage caused by poor sealing of a conventional multi-pore tube when assembled to a container, the present invention provides a solution, as shown in FIG. 2B; that is, a collar is disposed at an opening end of the multi-pore tube to prevent breakage at the opening end of the multi-pore tube, and an airtight sleeve is also arranged to prevent the issue of air leakage caused by poor sealing.

- **Carrier of the present invention – during partial malfunction of check valves**

The carrier of the present invention achieves the same amount of air output for multi-pore tube or filter membranes at two sides, by configuring a buffer air chamber or a buffer space for balancing the air pressures of air inlet channels

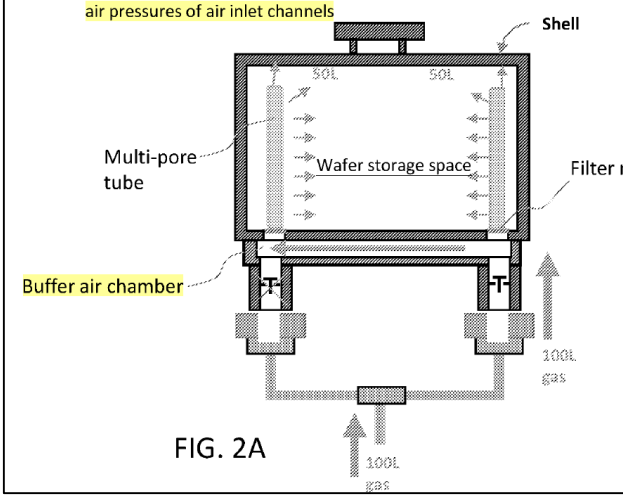


FIG. 2A

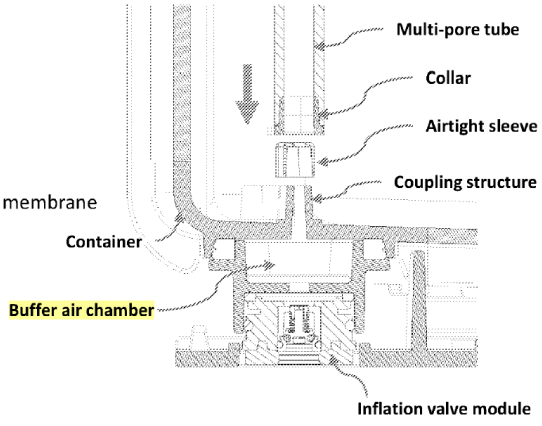


FIG. 2B

3

Ex1004, 4 (annotated).

85. Based on my analysis of the provisional applications, I conclude that the Challenged Claims—all of which recite the claimed "buffering gas chamber"—

are not disclosed in the 878 application. Thus, the Challenged Claims are not entitled to the August 17, 2021 date of the 878 Application and instead, are entitled to claim priority to November 30, 2021, at the earliest, which is the filing date of the 105 Application. My opinions regarding invalidity in Grounds 1-5 assume that the Challenged Claims have a November 30, 2021 priority date.

B. Patent Owner's Potential Position Regarding Priority Date

86. If Patent Owner argues that the Challenged Claims should be entitled to an August 17, 2021 priority date based on the 878 Application, I disagree for the reasons explained above. The 878 Application does not disclose a "buffering gas chamber" under any reasonable understanding of that term.

87. Nonetheless, I have also considered a potential argument by Patent Owner that the 878 Application discloses a "buffering gas chamber" under an overly broad understanding of "buffering gas chamber." Specifically, I consider the possibility that Patent Owner will interpret certain Challenged Claims of the '711 Patent to cover the structure of Fig. 6 of the '711 Patent, shown below. As I explained above, in describing this figure, the '711 Patent specification refers to element 254 as a "buffering gas chamber." *E.g.*, Ex1001, 8:6-12.

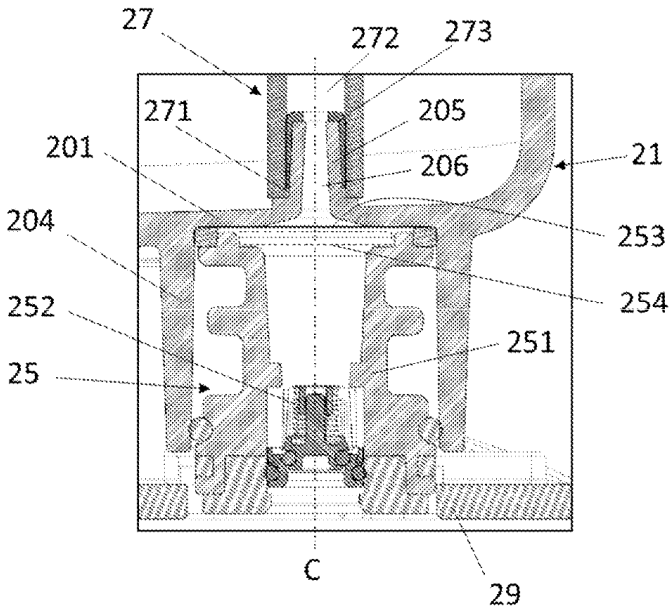


FIG.6

Ex1001, Fig. 6.

88. Moreover, to the extent Patent Owner argues that the "buffering gas chamber" covers element 254 of Figure 6, Patent Owner may also argue that the 878 Application discloses a "buffering gas chamber," because Figure 7 of the 878 Application, excerpted below appears similar to Figure 6 of the '711 Patent. Thus, although Figure 7 of the 878 Application has no reference to a buffering gas chamber at all, based on the similarity of the figures, I consider the possibility that Patent Owner may argue that Figure 7 of the 878 Application discloses a "buffering gas chamber."

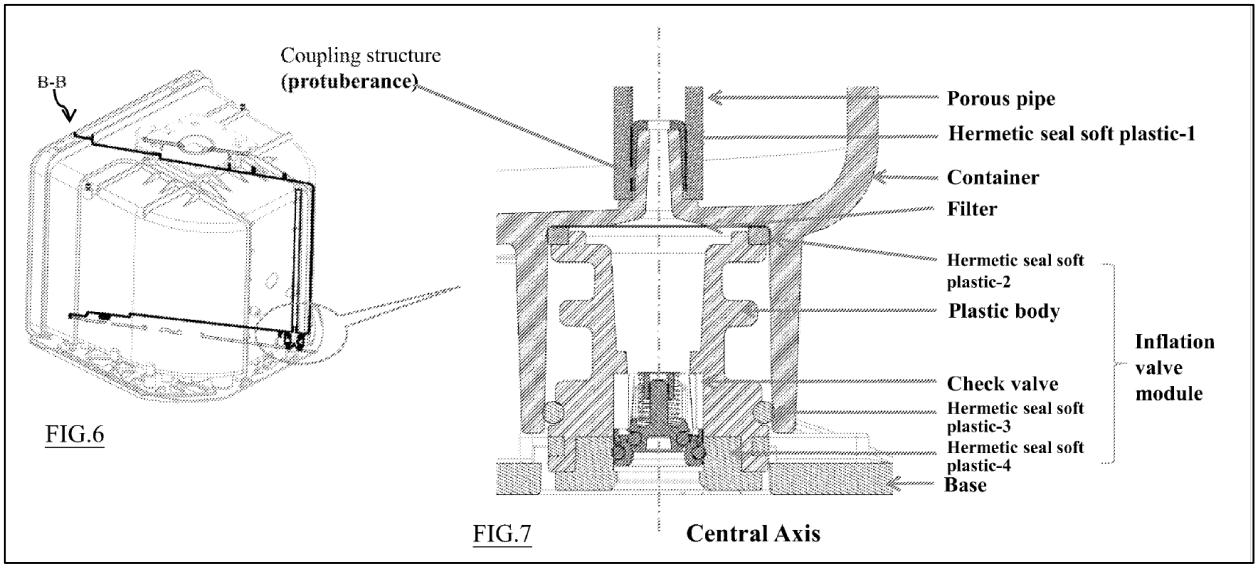


FIG.6 FIG.7

Ex1003, 7.

89. To the extent Patent Owner makes the above arguments, I disagree for several reasons.

90. First, neither Figure 6 of the ’711 Patent nor Figure 7 of the 878 Application can be reasonably interpreted to disclose Challenged Claims 13-31. Claim 13 (from which claims 14-22 depend) and claim 23 (from which claims 24-31 depend) both expressly recite a “buffering gas chamber” that communicates with “two porous tubes” or a “plurality of porous tubes” and a plurality of coupling structures. Ex1001, cls. 13, 23; *see also* Ex1002, 169-172 (distinguishing pending claims 20 and 30, which correspond to issued claims 13 and 23, from prior art based on prior art failing to disclose a “buffering gas chamber” that communicates with multiple porous tubes). And, even assuming Figure 6 discloses a “buffering gas chamber,” it does not disclose a plurality of porous tubes communicating with

the purported buffering gas chamber. Similarly, neither Figure 7 nor any other part of the 878 Application discloses a plurality of porous tubes, much less a plurality of tubes communicating with any element that could be identified as a "buffering gas chamber." Accordingly, neither Figure 6 of the '711 Patent nor Figure 7 of the 878 Application can be reasonably interpreted to disclose claims 13-31.

91. Second, even for Challenged Claims 1-12, which do not expressly recite a plurality of porous tubes, I disagree that a reasonable construction of "buffering gas chamber" can cover element 254 of Figure 6 of the '711 Patent or any element in the 878 Application. To the contrary, as I explained above, Applicant made clear during prosecution that pending claims 8-19 (which issued as claims 1-12) were directed to "Species IV to VIII" and *exclude* Species I. Ex1002, 233. As I described above, (a) the claimed Species IV to VIII, as defined by Examiner, correspond to Figures 20 and 21a-21d of the '711 Patent, *id.*, 240, which all disclose a buffering gas chamber communicating with *multiple* porous tubes, Ex1001, 14:42-44; and (b) excluded Species I corresponds to Figure 6, Ex1002, 240, which only discloses a *single* porous tube, Ex1001, 7:62-66. Based on this prosecution history, a POSITA would have understood the applicant to have disclaimed any "buffering gas chamber" in Figure 6 (including element 254) of the '711 Patent or any buffering gas chamber that does not communicate with multiple porous tubes. For this reason alone, a POSITA would not have understood

the 878 Application to disclose claims 1-12 because neither Figure 7 nor any other part of the 878 Application discloses a plurality of porous tubes, much less a plurality of tubes communicating with any element that could be identified as a "buffering gas chamber."

92. Thirdly, a POSITA would not have understood the element pointed to as a "buffering gas chamber" in Figure 6 (element 254) to have a buffering function. The volume of item 254 is too small to buffer the flow to multiple porous tubes. Non-critical flow plenums must be designed to not create excessive static pressure. The air in a purported buffer or plenum as small as 254 would be depleted too quickly to be effective at any reasonable pressure. Similarly, the item 254 of Figure 6 of the '711 patent is in the gas flow path *before* the filter. The filter will restrict any pressure or flow buffering that item 254 could hope to offer.

93. My conclusion is further supported by the fact that, as I explained above, the 878 Application has no reference whatsoever to a "buffering gas chamber." Even with respect to Figure 7 of the 878 Application, which resembles Figure 6 of the '711 Patent, Applicant did not identify any element as performing a buffering function at all, much less as serving as a buffering gas chamber element. Especially without any such description, a POSITA would not have interpreted Figure 7 as disclosing a buffering gas chamber as Figure 7. As I described in the State of the Art (§IV), a buffering gas chamber was not new in 2021. Other

systems disclosed "plenum" chambers or other types of buffer chambers for allowing gas intakes at different pressures to reach an equilibrium state. A POSITA, however, would not have understood the structure of Figure 7 of the 878 Application to disclose such a chamber.

94. Accordingly, to the extent Patent Owner contends that claims 1-12 have an August 17, 2021 priority date based on the 878 Application, I disagree. Nonetheless, in Ground 6-7 below I have assumed the August 17, 2021 priority date for claims 1-12 and demonstrate that, even if that priority date applies, claims 1-12 are invalid in view of the prior art.

VII. CLAIM CONSTRUCTION

95. I understand that claim terms should be given their ordinary and accustomed meaning as understood by one of ordinary skill in the art in view of the patent and its file history.

96. As I explain in §VI, which I incorporate herein, there is a potential dispute between the parties regarding the meaning of "buffering gas chamber" in the Challenged Claims. Under a correct interpretation of the Challenged Claims, the recited "buffering gas chamber" excludes element 254 in Figure 6 and other similar elements and figures. I have applied this correct interpretation of the claims in Grounds 1-5. In addition, under Patent Owner's incorrect potential interpretation of "buffering gas chamber" to include element 254 in Figure 6, the claims are also

invalid, as I show in Grounds 6-7.

97. For purposes of my analysis of the prior art, I do not believe that any other terms of the Challenged Claims require construction.

VIII. OVERVIEW OF THE PRIOR ART

A. U.S. Patent Pub. No. 2023/0128154 to Smith *et al*. (Ex1008)

98. U.S. Patent Pub. No. 2023/0128154 to Smith *et al*. ("Smith '154") (Ex1008) was filed on October 25, 2022 and claims priority to a provisional patent filed on October 27, 2021. Ex1008, (22), (60). Although Smith '154 was the subject of a third party submission, Smith '154 was not cited or discussed during prosecution of the '711 Patent. *See* Ex1002. As explained below, Smith '154 discloses a buffering gas chamber, as claimed in the '711 Patent.

1. Status As Prior Art

99. It is my opinion that Smith '154 is entitled to the October 27, 2021 filing date of the Smith '154 Provisional (Ex1010). I understand an application can claim priority to a provisional application if the provisional's description of the claimed invention satisfies the requirements of § 112(a) and the nonprovisional application is filed within 12 months of the provisional application. 35 U.S.C. § 119(e)(1).

100. Here, Smith '154 expressly claims priority to its provisional and was filed within 12 months of the provisional. Ex1008, (60). Moreover, the text of Smith '154 is identical to text of the Smith '154 Provisional. *Compare* Ex1008,

with Ex1009, 871-891, and Ex1010, 45-79. Each of the figures, claims, embodiments, and background disclosures of Smith ’154 are identical to the figures, claims, embodiments, and background disclosures of Smith ’154 Provisional. Accordingly, all subject matter from Smith ’154 relied on in my analysis herein is found identically in Smith ’154 Provisional.

101. It is therefore my opinion that Smith ’154 is entitled to the October 27, 2021 priority date of the Smith ’154 Provisional. Because the ’711 Patent is entitled to, at best, a November 30, 2021 priority date (*see* § VI), Smith ’154 has an early priority date than ’711 Patent, and I understand it is therefore prior art under 35 U.S.C. § 102(a)(2).

2. Relevant Disclosure

102. Smith ’154 is directed to an improved “substrate container [] used to store and transport the in-process wafers.” Ex1008 ¶ 1. Smith ’154 specifically describes a “purge flow distribution system” which acts as a buffering gas chamber and distributes purge gas to the interior of the substrate container. Ex1008 ¶¶ 1, 5. The purge gas system can “minimize any inward flows into the interior space” of the substrate container, which can reduce the ingress of the external environment (“gas, particles, humidity, etc.”). *Id.* ¶ 31.

103. The “purge flow distribution system” of Smith ’154 specifically discloses a buffering gas chamber for the substrate container. The “purge flow

distribution system," for example, includes a "supply line" connected to an inlet, where the supply line buffers the purge gas from the inlet—more specifically, the supply line is "the piping, tubing, plumbing that is connected to the inlet port that receives the purge gas and is used to divide and supply the purge gas to the input purge port(s) for the gas distributing device(s) and/or gas distributing surface(s)." *Id.* ¶¶ 5, 18. The supply line therefore "can be used for setting/adjusting the flow of gas through the network of gas distributing devices." *Id.* ¶ 18.

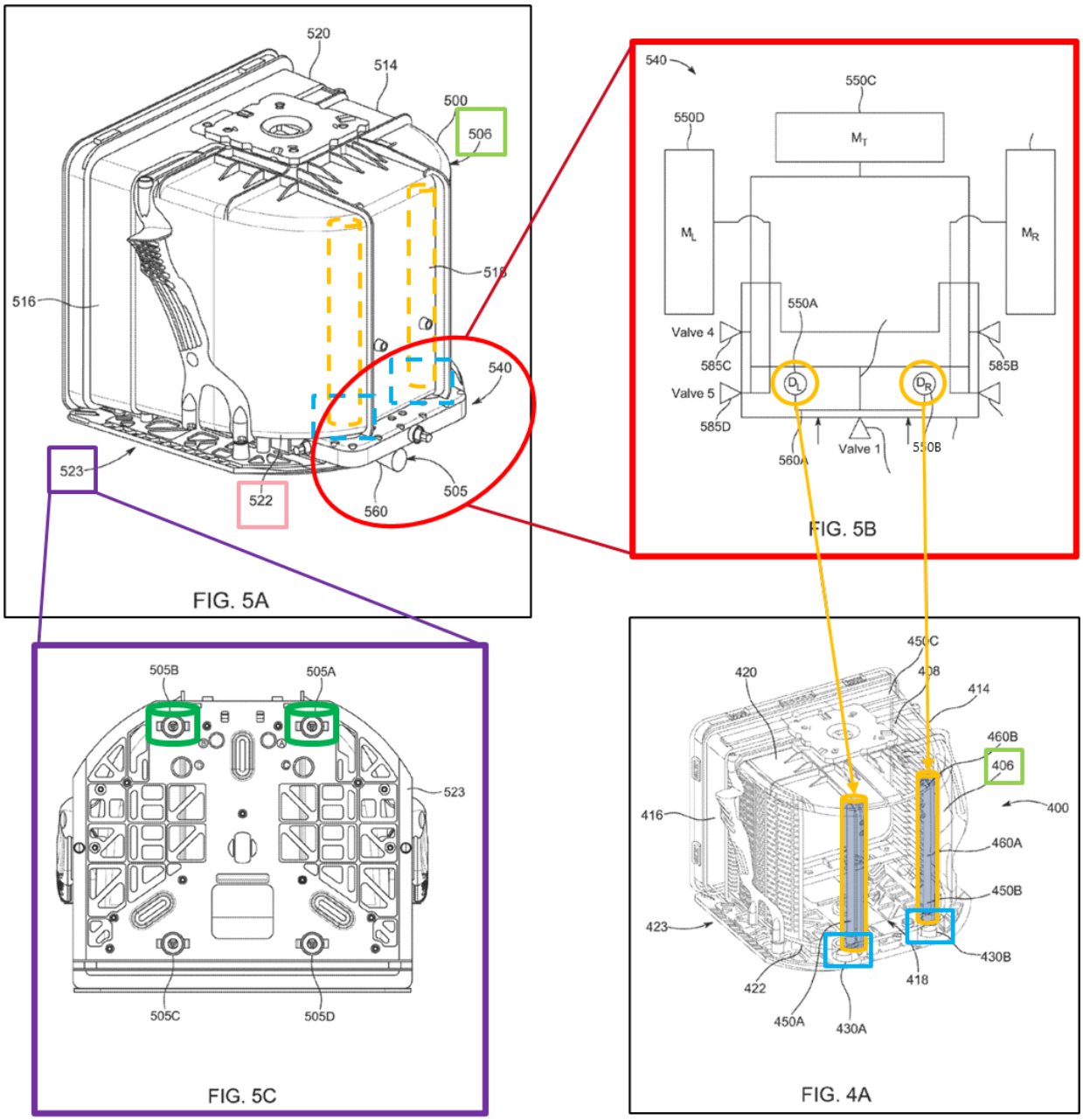
104. As an example, Fig. 5A (top left, below) discloses a substrate container with shell 506 (light green square) connected to a (a) base plate 523 (blue dashed line), (b) "purge flow distribution system" 540 (red) between shell and base plate, and (c) diffusers 550A and 550B for introducing purge gas into the shell. Ex1008 ¶¶ 49-50.

a. The base plate 523 is shown in Fig. 5C (bottom left, below), and includes inlet ports 505A, 505B, 505C, and 505D for supplying purge gas to the purge flow distribution system. Ex1008 ¶ 53.

b. The purge flow distribution system 540 is shown in Fig. 5B (top right, below) and includes a manifold base 560 that "is configured to divide the stream of purge gas to the network of gas distribution devices." *Id.* As shown in more detail in Fig.

5B, for example, manifold base 560 includes a first flow path 560A for supplying purge gas to rear "left and right diffusers 550A and 550B" (orange). *Id.* ¶ 50. Another flow path can provide purge gas to front gas distributing devices. *Id.*

c. Diffusers 550A and 550B in Fig. 5B are shown within the shell as diffusers 450A and 450B in Fig. 4A (bottom right, below) and distribute "the purge gas" from the "purge flow distribution system" into the interior of the substrate container and can have a variety of different structures with "slits or nozzles or made of porous material." *Id.* ¶ 47. For example, Fig. 4A of Smith '154 discloses diffusers 450A and 450B (orange) as tubular porous structures positioned at the rear of the container, connected to the purge flow distribution system via inlet purge ports 430A and 430B. *Id.* ¶¶ 46, 50.



Ex1008, Figs. 5A, 5B, 5C, 4A (annotated).

105. The flow distribution system 540 has a buffering function between the purge gas inlet ports and the diffusers. For example, it can, using adjustable valves, set "the amount of purge gas that flows to at least one of the front gas distributing device and the rear gas distributing device." *Id.* ¶¶50, 51-52. In addition, the flow

distribution system can combine purge gas from multiple inlet ports. *Id.* ¶ 53. In this way, "the amount of purge gas can also be controlled or set using any combination of different structures that allow setting the pressure drop or flow rate based on the conservation of energy." *Id.* ¶ 54.

106. Additionally, Smith '154 discloses a number of aspects or embodiments. *See e.g.*, Ex1008 ¶¶ 63-83. Smith '154 further describes that any aspects of embodiments 1-17 can be combined with aspects 18-19. *Id.* ¶ 63. Smith teaches numerous configurations and encourages combining the many aspects in a modular manner.

B. U.S. Patent No. 10,347,517 to Smith *et al.* (Ex1011)

107. U.S. Patent No. 10,347,517 to Smith *et al*. ("Smith '517") (Ex1011) was filed on April 14, 2014 and issued July 9, 2019. Ex1011, (22), (45). Smith '517 was first published at U.S. Pat. Pub. No. 2016/0276190 A1. This publication was considered by the Examiner during prosecution but the Examiner failed to appreciate its disclosures. Ex1001, (56); Ex1002, 14.

1. Status As Prior Art

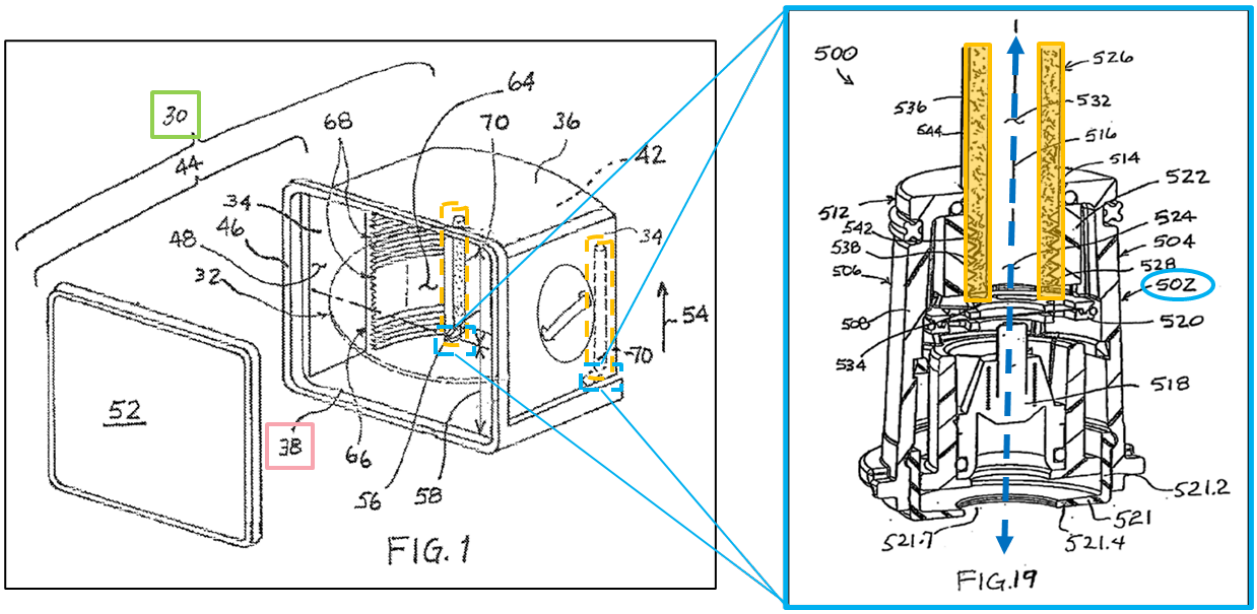
108. Smith '517 issued more than a year before the '711 Patent's earliest alleged priority date. I understand that Smith '517 is therefore prior art under 35 U.S.C. § 102(a)(1).

2. Relevant Disclosures

109. Smith '517 discloses a substrate container for use in storing or

transporting semiconductor wafers, Ex1011, 1:16-20, that can minimize the introduction of dust, impurities, or humidity from an external environment, *id.*, 1:25-32. Smith ’517 specifically focuses on different connections between a “diffuser tube” and a purge port assembly. *Id.*, 1:60-62. Additionally, Smith ’517 teaches that “diffuser tower assemblies may be in the form of a kit for retrofitting existing front opening wafer containers.” Ex1011, Abstract. Smith ’517 further explains that “diffuser assemblies can be tailored to provide a desired flow profile” based on the “plenum charge effect.” *Id.*, 11:27-31. The term plenum occurs 34 times in the ’517 specification.

110. For example, Figure 1 (below left) depicts substrate container 30 with one or more tubular diffuser assemblies 70 (orange) that can connect to purge gas assemblies for introducing a gas into the container. *Id.*, 5:53-54. Smith ’517 describes various structures and connections for tubular diffuser assemblies that can facilitate desirable air flow to prevent the introduction of impurities or humidity. *See, e.g.*, *id.*, Figs. 9-15. Fig. 19 (below right) depicts an exploded view of one such structure, as well as its connection to a purge gas assembly at the bottom of the wafer container.

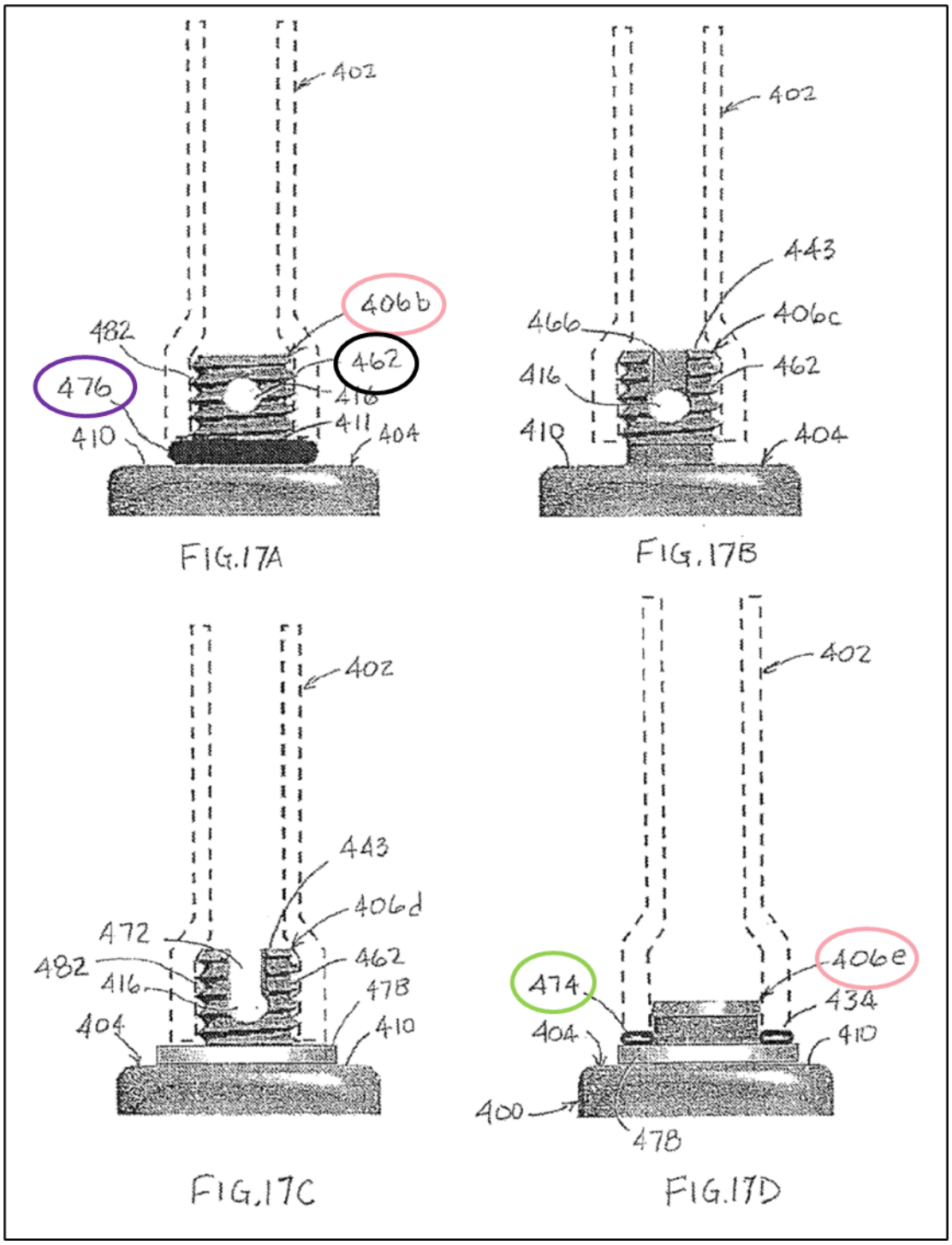


Ex1011, Figs. 1, 19 (annotated).

111. Specifically, the tubular diffuser 526 (orange) with an opening at the bottom (534) is coupled, via coupling member 522, to "purge module" 502 (light blue) with housing 506 that is installed at the bottom portion of substrate container 30. *Id.*, 16:28-37, 16:55-67. The housing of the purge module 502 and the opening of the tubular diffuser 526 are "concentric" about central axis 516 (blue dashed line). *Id.*, 16:37-40, 16:64-67. This configuration "enables the air that exists the porous sidewall portion 536" of the diffuser to "sweep the interior surface 40" of the substrate container with greater efficiency. *Id.*, 17:21-26.

112. Regarding the mechanics of coupling 522, Smith '517 discloses that "[i]n some embodiments, the coupling 522 . . . can include internal threads 538." Ex1011, 17:11-12. Additionally, Smith '517 discloses multiple alternative configurations where coaxial porous diffusers are coupled via an inlet fitting.

Ex1011, 15:7-9, 15:29-31, Figs. 17A-17D. For example, the embodiment in Figure 17A uses a threaded nipple 406b (pink) with an O-ring 476 (purple) and external threads 462 (black), while the embodiment in Figure 17D uses a weld-joint 474 (light green) and shorter nipple 406e (pink).



Ex1011, Figs. 17A-D (annotated).

113. In my opinion, a POSITA would have known that the teachings of Figures 17A-D are interchangeable methods for coupling to the porous diffuser.

When retrofitting components to an existing shell, methods may need to be selected based on the specific constraints of the current project. For example, Figure 19's coupling 522 with internal threads 538 could be replaced with the external threads and O-ring of Figure 17A. This may be required in situations where the porous diffuser lacks the matching external threads 542 and has internal threads instead. Alternatively, the short nipple and weld joint of Figure 17D may be required by applications where the porous diffuser does not have any threads at all.

C. U.S. Patent No. 10,923,373 to Ogawa (Ex1012)

114. U.S. Patent No. 10,923,373 to Smith *et al*. ("Ogawa") (Ex1012) was filed on August 2, 2017 and issued February 16, 2021. Ex1012, (22), (45). Ogawa was first published as PCT Pub. No. WO2018/047541 on March 15, 2018. This publication was considered by the Examiner during prosecution, but the Examiner failed to consider its relevant teachings in light of the Smith '154 and Smith '517. Ex1001, (56); Ex1002, 178-188.

1. Status As Prior Art

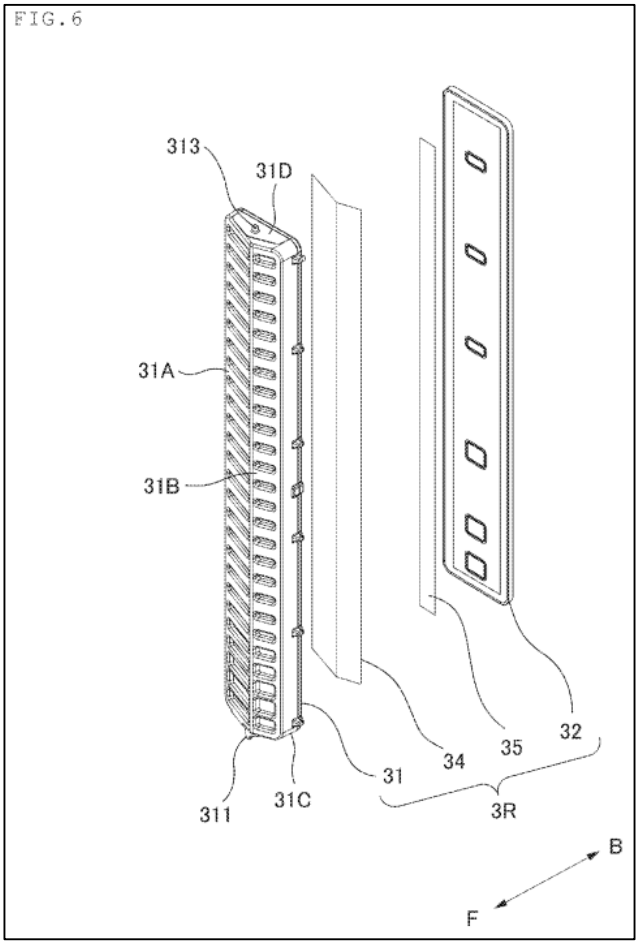
115. Ogawa was filed and issued before the '711 Patent's earliest alleged priority date. I understand that Ogawa is therefore prior art under 35 U.S.C. § 102(a)(1).

2. Relevant Disclosures

116. Like Smith '154 and Smith '517, Ogawa discloses a substrate

container for use in storing or transporting semiconductor wafers. Ex1012, 1:16-18. Ogawa specifically focuses on "blowing the stored gas" in specified directions, as well as the construction of the container and components of the gas replacement unit. Ex1012, Abstract. There is "at least one intake valve for supplying an external gas to the internal space of the container body, and gas replacement units for blowing the supplied gas into the internal space of the container body." *Id*.

117. For example, as shown in Figure 6, Ogawa discloses that "gas G passes through the filter members 34, 35, and is blown out from the first group blowout holes 31a-z, [and] the second group blowout holes 32a–f . . . into the internal space of the container body 2." Ex1012, 9:15-20.



Ex1012, Fig. 6.

118. In my opinion, a POSITA would have understood that using Ogawa's housing member 31 and cover member 32 to direct the gas entering the internal space of the substrate container would enable efficient distribution of purge gas to the interior of the substrate container.

119. Additionally, the process of manufacturing wafers generates substantial heat and results in wafers being at high temperatures. *See* Ex1016 ¶ 4 (four FOUPS have been shown to have "peak heat release rates of more than 1 MW."). Thus, the hot wafers can increase the risk of a potential fire. *Id.* A

manufacturer is thus well advised to use thermally resistant materials to minimize the risk of a fire. *Id.* ¶¶4, 8. To handle this heat, Ogawa teaches that the container and associated components, including "bottom plate 26" may be made of "resin molding material," including "thermoplastic resins such as polycarbonate, cyclic olefin polymer, polyether imide, polyether ketone, polyether ether ketone, polybutylene terephthalate, polyacetal, liquid crystal polymer, or alloys thereof." Ex1012, 5:14-23. Ogawa further explains that "additional conductive substances composed of carbon fibers, carbon powders, carbon nanotubes, conductive polymers or the like, or antistatic agents such as anions, cations, nonionic additives or the like can be added as required to these resins." *Id.*, 5:24-28.

120. Therefore, a POSITA would be motivated to use thermally resistant polymers such as polyether ether ketone ("PEEK") and others to ensure that the risk of fire is minimized.

D. U.S. Patent No. 11,551,957 to Eggum *et al*. (Ex1013)

121. U.S. Patent No. 11,551,957 to Eggum *et al*. ("Eggum") (Ex1013) was filed on April 17, 2020 and issued January 10, 2023. Ex1013, (22), (45). Eggum was first published at U.S. Pat. Pub. No. 2020/0343117 A1. My opinions do not require Eggum as a reference for any ground, under a proper interpretation of the Challenged Claims, but I describe Eggum here because it provides helpful disclosures to understand the state of the art, as described herein.

1. Status As Prior Art

122. Eggum was filed before the ’711 Patent’s earliest alleged priority date and was issued on January 10, 2023. I understand that Eggum is therefore prior art under 35 U.S.C. § 102(a)(2).

2. Relevant Disclosures

123. Eggum also relates to a substrate container for use in storing or transporting semiconductor wafers. Ex1013, 1:7-12. Eggum specifically focuses on “connectors and purge modules for use in substrate containers.” *Id.*, 1:6-9.

124. For example, as shown in Figure 1, Eggum discloses “[p]urge connectors and modules for a substrate container” “including a plate, a shell, a connector and a seal, where the connector is threaded and secured via a nut.” Ex1013, (54); Abstract. Eggum discloses that this connectivity enables “removable purge module.”

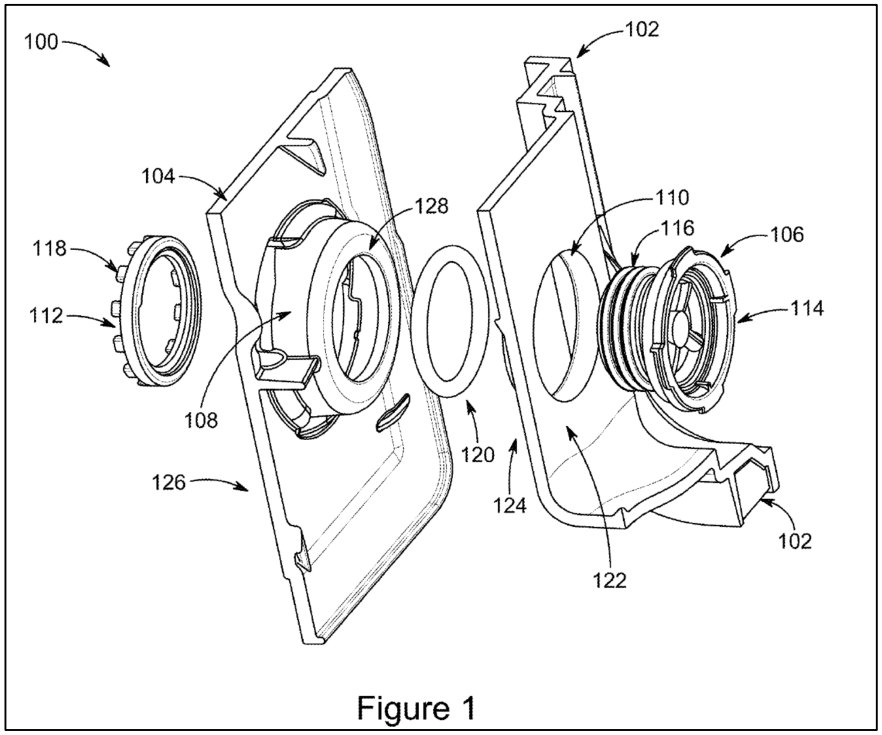


Figure 1

Ex1013, Fig. 1.

125. Figure 1 shows "a portion of a substrate container 100 where a shell 102 is joined to a plate 104 via a connector 106." *Id.*, 4:8-10. This connector is secured with nut 112 "to join the shell 102 and plate 104." *Id.*, 4:10-11. Further, "[c]onnector 106 has a passage through which fluid, such as a purge gas…may travel into" the shell. *Id.*, 5:7-10.

126. In my opinion a POSITA would have understood that Eggum disclosed a connection system for a purge flow distribution system that would enable efficient retrofitting, and maintenance of the purge flow distribution system.

127. Eggum discloses a number of embodiments, including some wherein the axis of the inlet of the connector and the axis of the outlet connected to the

diffuser are offset. *See e.g.*, Ex1013, 2:41-45, 10:1-8 and Fig. 8A. One advantage of an offset connector is taught. Ex1013, 11:21-25. Eggum further describes that any aspects of embodiments 1-18 can be combined with aspects 19-20. Ex1013, 12:10-13:61. For example, in Aspect 8, "The substrate container according to any of aspects 1-7, wherein the connector includes an outlet having an opening, wherein a center of the opening is offset from a center of the inner diameter of the connector." Ex1013, 12:64-67. One could choose not to combine Aspect 8 with Aspects 19 and 20. None of the claims require an offset connector.

IX. COMPARISON OF THE PRIOR ART TO THE CLAIMS OF THE '711 PATENT

A. Grounds 1-2: Anticipation of 23-24, 26-27, 30 and Claims 13, 18-19, 21 and Obviousness of Claims 23, 24, 26-28, 30 and Claims 13, 18-21 in view of Smith '154

1. Independent Claim 23

a. 23[pre]: A wafer container, comprising:

128. To the extent the preamble is limiting, it is my opinion that Smith '154 anticipates or at least renders obvious limitation 23[pre]. As shown below in Fig. 5A, Smith '154 includes *a wafer container* [e.g., substrate container with shell 506/406]. *See also* Ex1008, Abstract. Smith '154 explains that "[a] substrate container is used to store and transport the in-process wafers." Ex1008 ¶ 2. The wafer container (e.g., shell 506/406) defines an interior (*accommodating*) space to store and transport the wafers. Ex1008 ¶49.

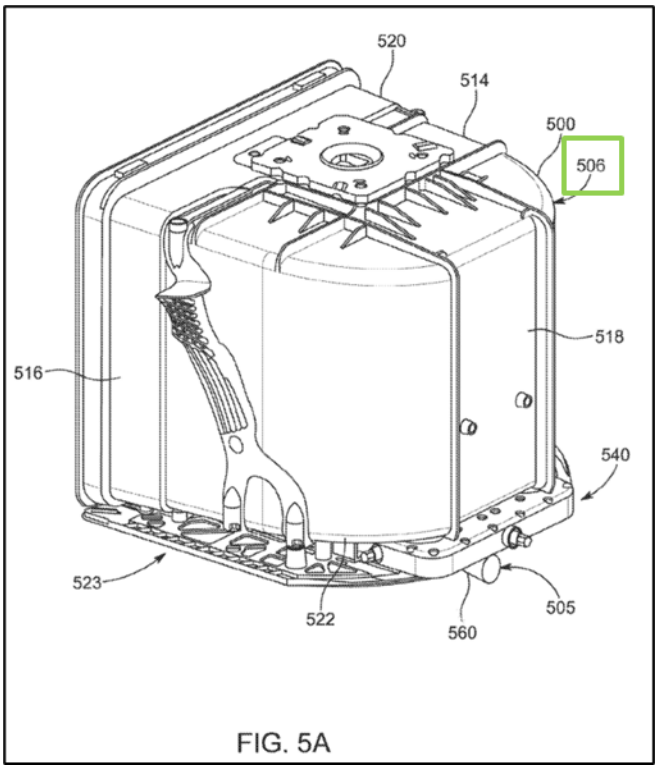


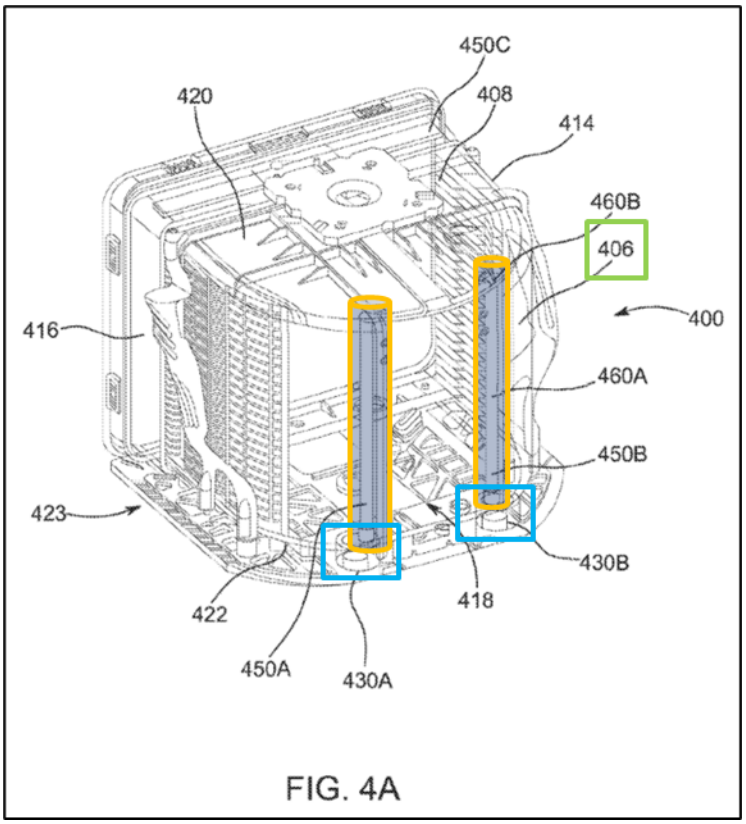
FIG. 5A

Ex1008, Fig. 5A (annotated); *see also* Fig. 4A.

b. 23[a]: a shell, comprising a bottom portion, the bottom portion configured with a plurality of coupling structures, the coupling structures defining a plurality of through channels;

129. Smith ’154 anticipates or at least renders obvious limitation 23[a]. Specifically, as shown in Fig. 4A, Smith ’154 has *a shell* [e.g., shell 406/506], *comprising a bottom portion* [e.g., bottom wall 422/522], *the bottom portion configured with a plurality of coupling structures* [e.g., inlet ports 430A/430B (light blue)], *the coupling structures defining a plurality of through channels* [e.g., inlet ports 430A/430B define flow paths for purge gas to enter tubular diffusers 450A/B or 550A/B (orange) for distributing the purge gas in the interior space of

the shell 406/506].



Ex1008, Fig. 4A (annotated).

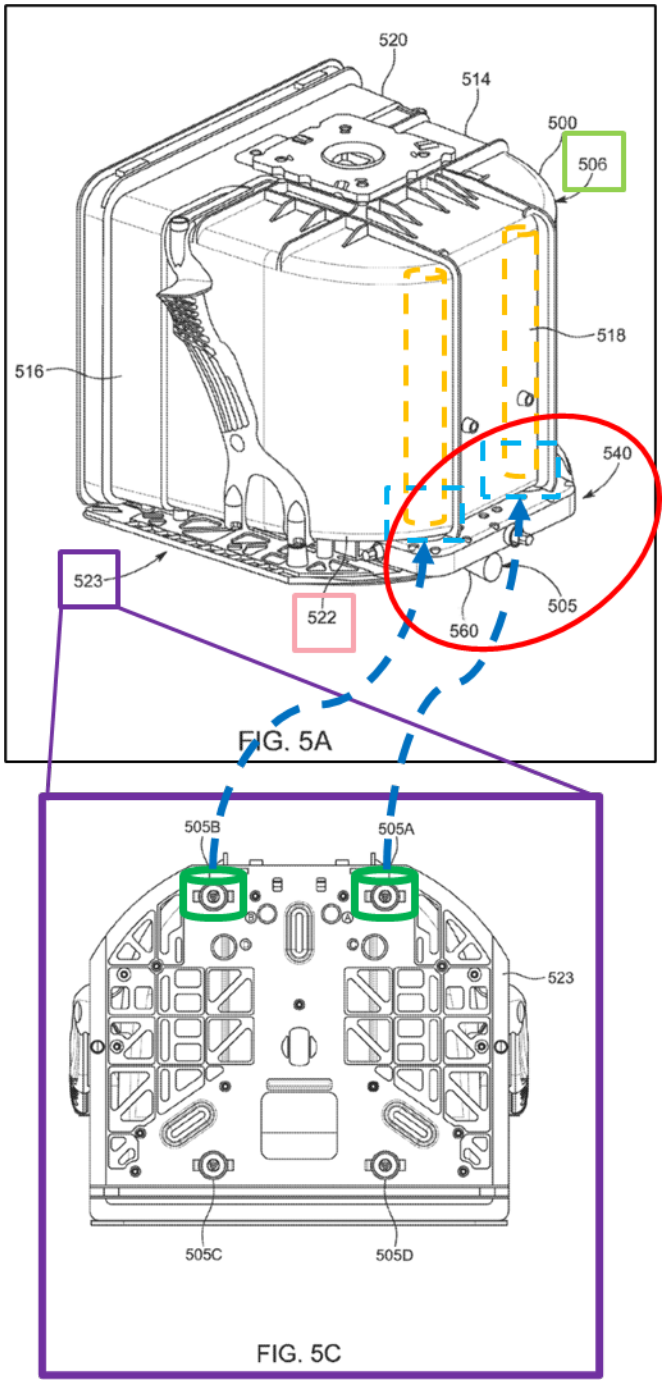
130. For example, Smith '154 describes: "The purge flow distribution system includes at least one supply line that is connected to at least one inlet purge port 430A, 430B on the bottom wall 422. The supply line includes a first flow path 460A connected to the inlet purge ports 430A, 430B for supplying purge gas to the rear gas distributing devices 450A, 450B, in which the rear gas distributing devices can include at least two diffusers. The at least two diffusers 450A, 450B include a plurality of openings for distributing the purge gas at the rear of the substrate container 400." Ex1008 ¶ 46; *see also id.* ¶¶ 49, 50, 75, cl. 12. A POSITA would

have known that Fig. 4A-B and Figs. 5A-5C describe the same embodiment and depict the claimed arrangement. Both have the same general structure of a wafer container with a shell, inlet ports, and a "purge flow distribution system." Figure 4A depicts an interior view of Figures 5A-5C. To the extent Patent Owner argues that Figures 4A-4B and 5A-5C depict different embodiments or arrangements, a POSITA would have found it obvious to combine them with a reasonable expectation of success. The two sets of figures show different perspectives of the same wafer container and purge flow distribution system, with the same elements, including diffusers 450A/450B and 550A/550B identically positioned at the rear of the wafer container shell.

c. 23[b]: a buffering gas chamber, formed below the bottom portion, the buffering gas chamber having a plurality of gas intake channels, the gas intake channels communicating with the corresponding through channels; and

131. Smith '154 anticipates or at least renders obvious limitation 23[b]. Specifically, Smith '154 anticipates or at least renders obvious *a buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red)], *formed below the bottom portion* [e.g., bottom wall 522], *the buffering gas chamber having a plurality of gas intake channels* [e.g., channels formed by inlet supply ports 505A-B in Fig. 5C (green)], *the gas intake channels communicating with the corresponding through channels* [e.g., channels formed by inlet supply

ports 505A-D communicate with flow paths through 430A/430B (annotated in light blue dashed outline)].



Ex1008, Figs. 5A, 5C (annotated).

132. The purge flow distribution system 540 in Smith '154 is a buffering

gas chamber and distributes purge gas to the interior of the substrate container. Ex1008 ¶¶ 1, 5. Like the buffering gas chamber in the '711 Patent, the purge flow distribution system balances gas pressure, allowing gas to flow through each diffuser (e.g., orange above) at "a balanced air pressure." *See* Ex1001, 14:57-15:3. Moreover, the purge flow distribution system 540 is configured at the bottom of the wafer container 522 in Smith '154. The purge flow distribution system 540 (red) is specifically installed between the bottom portion of the shell 522 and base plate 523. Ex1008 ¶¶ 49-50; *see also* Ex1008 ¶ 5 ("a substrate container includes a shell defining an interior space, in which the shell includes a bottom wall"). "In this embodiment, the purge flow distribution system 540 includes a manifold base 560 provided on the bottom wall 522 that is configured to divide the stream of purge gas to the network of gas distributing devices." Ex1008 ¶ 49. Purge flow distribution system 540 (red) is connected to the "inlet purge port[s] [light blue dashed outlines] in the bottom wall of the shell" (pink square) which in turn are connected to flow paths 560A/B that supply gas to the tubular diffusers 450A/B or 550A/B (orange). Ex1008 ¶¶ 49, 50, 75, cl. 12.

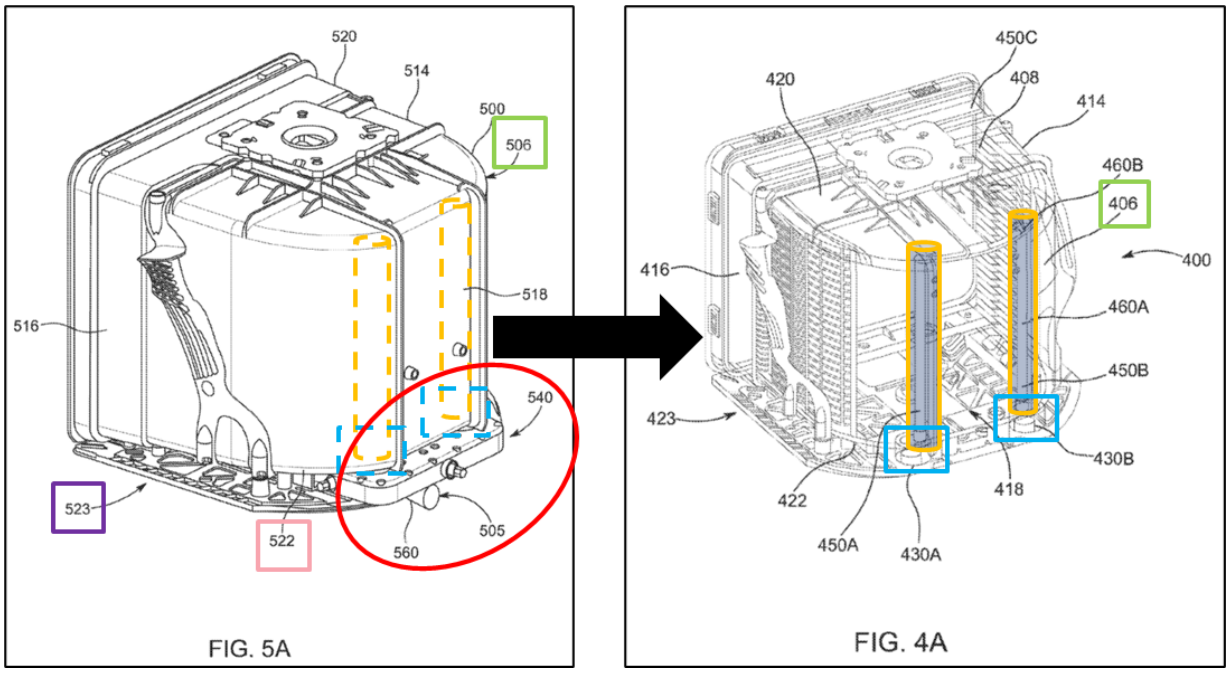
133. The purge flow distribution system 540 is formed at the bottom of the wafer container 522 by nature of being installed between the bottom portion of the shell 522 and base plate 523. Ex1008 ¶¶ 49-50; *see also* Ex1008 ¶ 5 ("a substrate container includes a shell defining an interior space, in which the shell includes…a

bottom wall"). The purge flow distribution system 540 also has gas intake channels formed by 505A-505D. For example, "the purge gas can be supplied to a number of inlet port(s) (or outlet port(s)) 505A, 505B, 505C, 505D provided through the carrier plate 523 depending on the nature of the application/docking arrangement for the substrate container. It is appreciated that the purge gas from the inlet ports 505A, 505B, 505C, 505D can be combined before being supplied to manifold base 560 or provided/combined as necessary to supply different purge flow distribution systems in the substrate container." Ex1008 ¶ 53.

134. The gas intake channels formed by 505A-505D communicate with flow paths through inlet ports 430A/430B. Inlet ports 430A/430B are "connected to a purge gas supply system" (via gas intake channels 505A-505D) for supplying the purge gas to the network of separate gas distributing devices. As described for limitation 23[a], Figure 4A with those of Figures 5A-C describe the same embodiment and arrangement, and it would also have been obvious to combine the components of Figure 4A with those of Figures 5A-C (to the extent they are different embodiments). §IX.A.1.b.

d. 23[c]: a plurality of porous tubes, each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the porous tubes and enter an accommodating space of the shell.

135. Smith '154 anticipates or at least renders obvious limitation 23[c]. Specifically, Smith '154 anticipates or at least renders obvious *a plurality of porous tubes* [e.g., tubular diffusers 450A/450B or 550A/B (orange)], *each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion* [e.g., inlet purge port 430A/430B on bottom wall 422/522]. For example, as shown below in Fig. 4A, which depicts an interior view of the container in Fig. 5A, the tubular diffusers are connected to inlet purge ports 430A/430B on bottom wall 422. Ex1008 ¶ 46; *see also id.* ¶¶ 49 50, 75, cl. 12. The tubular diffusers have an open end at the connection point "for supplying purge gas to the rear gas distributing devices 450A, 450B." *Id.* As described for limitation 23[a], Figure 4A with those of Figures 5A-C describe the same embodiment and arrangement, and it would also have been obvious to combine the components of Figure 4A with those of Figures 5A-C (to the extent they are different embodiments). §IX.A.1.b.



Ex1008, Figs. 5A, 4A (annotated).

136. In addition, the tubular diffusers are *communicating with the buffering gas chamber via the corresponding through channel* [e.g., flow paths through 430A/430B], *allowing a gas to pass through the porous tubes and enter an accommodating space of the shell* [e.g., interior space 408]. As explained, the flow paths through 430A/430B are "for supplying purge gas to the rear gas distributing devices 450A, 450B." *Id.* ¶ 46. And rear gas tubular diffusers 450A/B then "distribut[e] the purge gas into the interior of the substrate container 400." *Id.* ¶ 47.

137. Whether the claim term "correspondingly connecting" means fluidly connected or directly or physically connected, the open end of each of the porous tubes 550A-550B are correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the

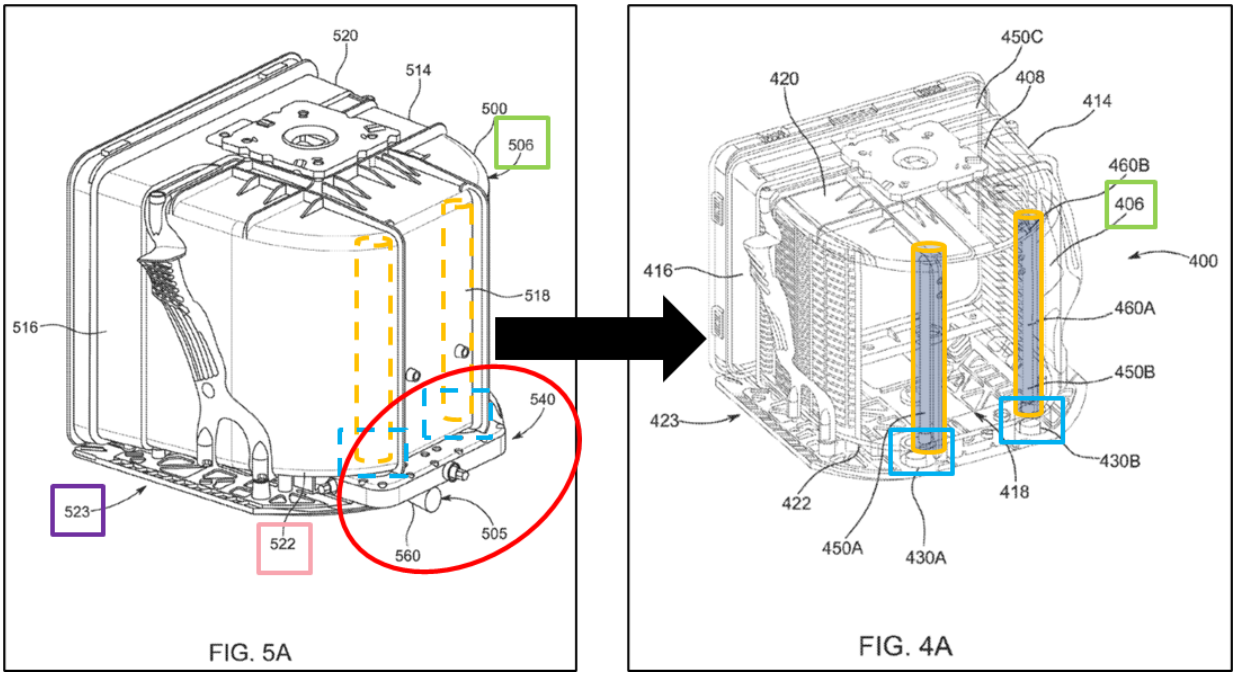
corresponding through channel, allowing a gas to pass through the porous tubes and enter an accommodating space of the shell. *Id*. ¶¶ 48-53, Figs 5A-5C.

2. <u>Dependent Claims 24, 26-28, and 30</u>

a. Claim 24: The wafer container according to claim 23, wherein the porous tube has a longitudinal space, the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber is capable of passing through the open end to enter the longitudinal space.

138. Smith ’154 anticipates or at least renders obvious Claim 24. Specifically, as shown in Figure 4A and described for claim 23[c], *the porous tube* [e.g., tubular diffusers 450A/450B or 550A/550B (orange)] *has a longitudinal space* [e.g., internal space of the tubular diffuser (shaded)], *the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red)] *is capable of passing through the open end to enter the longitudinal space* [as described for limitation 23[c]]. I incorporate my analyses from limitations 23[b] and 23[c]. In addition, the tubular diffuser has an open end, as described for limitation 23[c]. §IX.A.1.d. Smith ’154 also teaches that some of the tubular diffusers would have a closed end. Ex1008 ¶46. For example, Smith ’154 describes that a tubular diffuser alternatively has an “open end” near the top wall of the substrate container ***if*** it is connected to another gas distributing device, which a POSITA would have recognized means, or at least renders obvious, that the end would be “closed” near

the top wall if there is no such connection. Ex1008 ¶ 46. Further, one of skill in the art would understand that the end of the tubular diffuser would have to be closed for there to be flow out of the pores of the diffuser.



Ex1008, Figs. 5A, 4A (annotated).

b. Claim 26: The wafer container according to claim 23, further comprising: a gas cartridge, having a bottom portion and a sidewall extending from the bottom portion, the bottom portion of the gas cartridge having the gas intake channels formed thereon.

139. Smith ’154 renders Claim 26 obvious. Specifically, Smith ’154 anticipates or at least renders obvious *a gas cartridge having a bottom portion and a sidewall extending from the bottom portion* [*e.g.*, purge flow distribution system 540, red, with manifold base 560, with bottom portion (horizontal red arrow) and sidewall (vertical red arrow)], *the bottom portion of the gas cartridge having the*

gas intake channels formed thereon [e.g., bottom portion of purge flow distribution system 540 has inlet ports, e.g., 505A-D (green), defining intake channels formed on the gas cartridge].

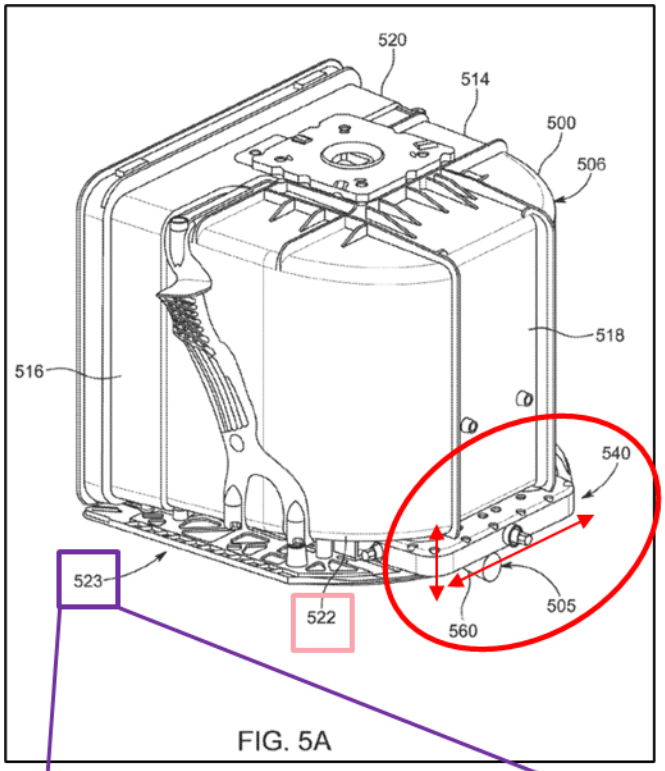


FIG. 5A

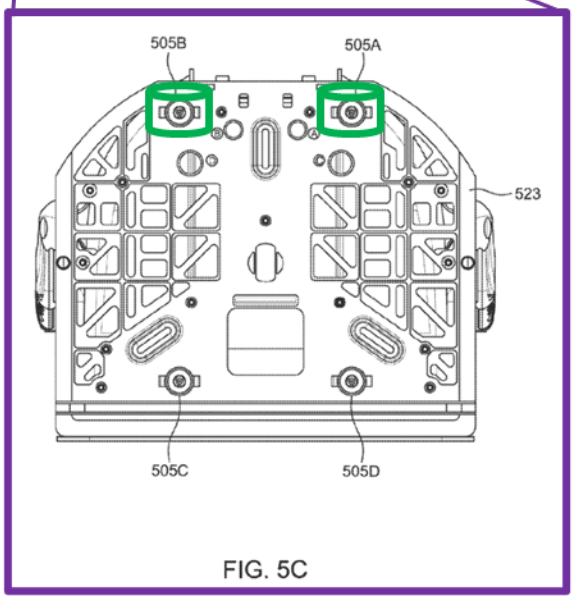


FIG. 5C

Ex1008, Figs. 5A, 5C (annotated).

140. The purge flow distribution system is a gas cartridge. It forms a buffering gas chamber, as described in limitation 23[b], with a structure having a sidewall between a bottom portion of shell 522 and bottom portion of buffering gas chamber 540, as depicted in Fig. 5A. A POSITA would further understand that Figure 5A shows that purge flow distribution system 540 is a unit separable from the container body. This is consistent with the description of a "gas cartridge" in the '711 Patent. *See* Ex1001, 13:49-52 ("The gas cartridge (90) consists of a bottom portion (91), a sidewall 50 (92) extending from the bottom portion (91) and the bottom portion (201) of the shell (21).").

141. Moreover, the bottom portion of the purge flow distribution system 540 has gas intake channels formed thereon: "The purge flow distribution system 540 is connected to at least one inlet port 505 that is connected to a purge gas supply system for supplying the purge gas to the network of separate gas distributing devices." Ex1008 ¶ 49. For example, as shown in Fig. 5C above, gas inlet ports define channels formed at the base of the manifold 560 to supply purge gas to the gas cartridge 540. Ex1008 ¶ 53.

142. I note that the gas cartridge in the '711 Patent may also be detachable. To the extent Patent Owner argues that the claimed gas cartridge must also be detachable, that would have been obvious. A POSITA would have constructed separate structures attached to a wafer container, such as purge flow distribution

system 540, as detachable elements for maintenance, replacement, and cleaning. The benefits and implementation of detachable elements were well known in the art by 2021. For example, Eggum, which also describes a wafer container and is analogous art to the ’711 Patent and Smith ’154, anticipates or at least renders obvious a detachable base: “[p]urge connectors and modules for a substrate container” “including a plate, a shell, a connector and a seal, where the connector is threaded and secured via a nut.” Ex1013, (54); Abstract. Eggum discloses that this connectivity enables a “removable purge module.” *Id.* A POSITA would have been motivated to use the same teachings and connectors with the purge flow distribution system of Smith ’154, with a reasonable expectation of success, using the same threaded connector mechanism disclosed in Eggum.

c. Claim 27: The wafer container according to claim 26, wherein the gas cartridge is installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber.

143. Smith ’154 anticipates or at least renders obvious Claim 27. Specifically, Smith ’154 anticipates or at least renders obvious *a gas cartridge installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red) installed at the bottom portion 522 of shell 506 to define the buffering chamber].

144. As described for claim 26 and limitation 23[b], Figure 5A depicts a

gas cartridge at the bottom portion of the container shell, defining a buffering gas chamber between a bottom portion of shell 522 and bottom portion of purge flow distribution system 540. *See* Ex1008 ¶ 49 ("The purge flow distribution system 540 includes at least one supply line that is connected to at least one purge port on the bottom wall 522. In this embodiment, the purge flow distribution system 540 includes a manifold base 560 provided on the bottom wall 522 that is configured to divide the stream of purge gas to the network of gas distributing devices."); §§IX.A.1.c, IX.A.2.b.

145. It is my opinion that, to the extent Patent Owner argues that the gas cartridge must be detachable, that would have been obvious for the reasons described in claim 26.

d. Claim 28: The wafer container according to claim 26, wherein a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module.

146. Smith '154 renders obvious Claim 28. Specifically, as described for Claims 26 and 27, Smith '154 anticipates or at least renders obvious *a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module* [e.g., annular sidewalls on bottom portion of purge flow distribution system 540 with manifold base 560 (red) that connect to inlet ports, e.g., 505A-D

(green)]. §§IX.A.2.b-IX.A.2.c. The bottom portion of the purge flow distribution system 540 has gas intake channels formed thereon: "The purge flow distribution system 540 is connected to at least one inlet port 505 that is connected to a purge gas supply system for supplying the purge gas to the network of separate gas distributing devices." Ex1008 ¶49. For example, as shown in Figure 5C above, inlet ports 505A-D supply purge gas to the manifold 560 of the gas cartridge 540. Ex1008 ¶53.

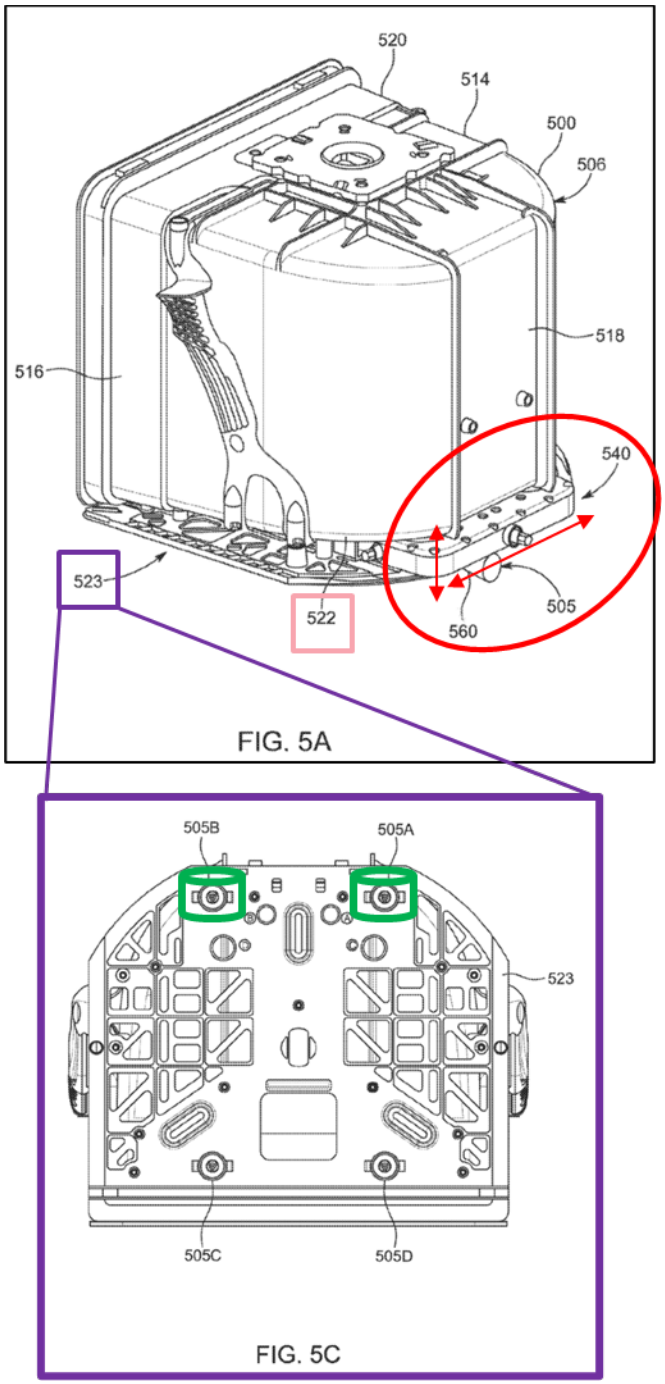


FIG. 5A

FIG. 5C

Ex1008, Figs. 5A, 5C (annotated).

147. Smith ’154 also renders obvious *a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space*.

148. As described for claim 26, the bottom portion of the purge flow distribution system 540 has gas intake channels formed thereon: "The purge flow distribution system 540 is connected to at least one inlet port 505 that is connected to a purge gas supply system for supplying the purge gas to the network of separate gas distributing devices." Ex1008 ¶ 49. For example, as shown in Fig. 5C above, inlet ports 505A-D supply purge gas to the manifold 560 of the gas cartridge 540. Ex1008 ¶ 53.

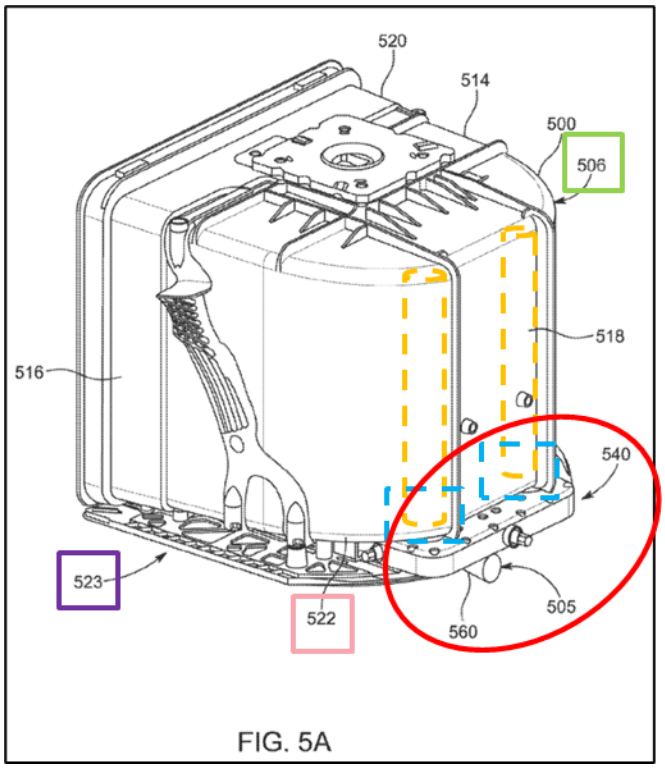
149. A POSITA would have been motivated to implement the connections to input ports 505A-D with annular sidewalls extending from the bottom portion of the purge flow distribution system 540 defining installation space for filling with a gas intake module. Input ports 505A-D are annular, and having annular sidewalls on the bottom of the purge flow distribution system 540 to connect to the annular input ports 505A-D to receive purge gas would have been an obvious design choice. Indeed, Smith '154 itself motivates this configuration, as it depicts annular sidewalls for connecting to inlet purge ports 430A/B on the top of the purge flow distribution systems. *See* Ex1008, Fig. 4A, ¶ 46. A POSITA would have been motivated, with a reasonable expectation of success, to use the same connection mechanism for the input ports 505A-D on the bottom of the gas cartridge as well because they would have understood that using the same connection mechanism would be the most efficient implementation as it entails using the same structure

disclosed by Smith ’154 to perform a similar function in the device.

150. Finally, it is my opinion that, to the extent Patent Owner argues that the gas cartridge must be detachable, that would have been obvious for the reasons described in claim 26.

e. Claim 30: The wafer container according to claim 23, further comprising: a base plate, connected below the shell to support the shell; wherein the buffering gas chamber is between the bottom portion and the base plate of the shell.

151. Smith ’154 anticipates or at least renders obvious Claim 30. Specifically, as shown in Figure 5A, Smith ’154 has *a base plate* [e.g., carrier plate 523 (purple square)], *connected below the shell to support the shell* [e.g., shell 506 (light green square)]*; wherein the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red)] *is between the bottom portion* [e.g., bottom wall 522 of shell 506 (pink square)] *and the base plate of the shell* [e.g., carrier plate 523 (purple square)].



Ex1008, Fig. 5A (annotated).

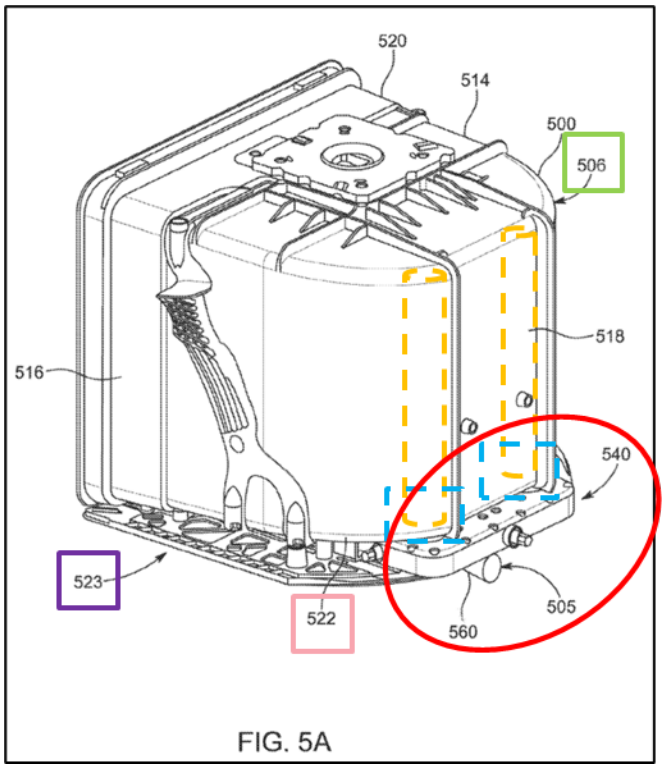
152. As I described for limitation 23[b], the purge flow distribution system 540 (red) is installed between the bottom portion of the shell 522 and base plate 523. Ex1008 ¶¶ 49-50; *see also* Ex1008 ¶ 5 ("a substrate container includes a shell defining an interior space, in which the shell includes . . . a bottom wall"). Smith '154 further explains that "a carrier plate 523 [purple]" "can provide a base that the shell 506 can be attached to" [e.g., base plate]. Ex1008 ¶ 48.

3. Independent Claim 13

a. 13[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising:

153. To the extent the preamble is limiting, Smith '154 anticipates or at

least renders obvious 13[pre]. Smith '154 has a *gas diffusion device* [*e.g.*, purge flow distribution system 40 (red) and tubular diffusers 550A/550B or 450A/450B (annotated in orange)] installed in *a wafer container* ("[a] substrate container is used to store and transport the in-process wafers"). Ex1008 ¶ 2. The disclosed wafer container includes a shell (e.g., shell 506) that defines an interior (*accommodating*) space [e.g., interior space in the shell 506]. Ex1008 ¶ 49.



Ex1008, Fig. 5A (annotated).

b. 13[a][1]: a gas cartridge, configured at a bottom portion of the wafer container to define a buffering gas chamber,

154. Smith '154 anticipates or at least renders obvious limitation 13[a][1] *a gas cartridge, configured at a bottom portion of the wafer container to define a*

buffering gas chamber [*e.g.*, purge flow distribution system 540 with manifold 560], for the same reasons as I described for claims 26 and 27. *Supra* §§IX.A.2.b-IX.A.2.c.

c. 13[a][2]: the bottom portion provided with at least two coupling structures, each of the coupling structures defining a through channel having a center axis,

155. Smith '154 anticipates or at least renders obvious limitation 13[a][2]—*the bottom portion provided with at least two coupling structures* [e.g., 430A and 430B], *each of the coupling structures defining a through channel having a center axis*" [e.g., center of coupling structures], for the same reasons as limitation 23[a]. §IX.A.1.b. As shown below, each of the coupling structures (e.g., 430A and 430B, light blue) at the bottom portion of the wafer container (e.g., 422) are annular structures that have a center axis defining flow paths for purge gas to enter tubular diffusers 450A/B or 550A/B (orange).

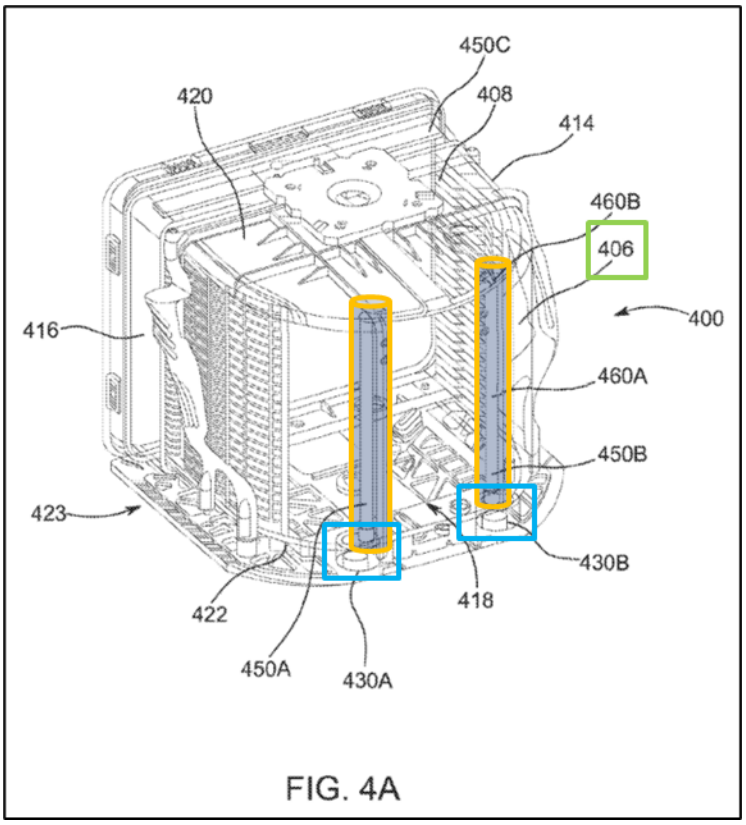


FIG. 4A

Ex1008, Fig. 4A (annotated).

d. 13[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and

156. Smith '154 anticipates or at least renders obvious limitation 13[a][3]—*the buffering gas chamber having at least one gas intake channel* [e.g., inlet ports, e.g., 505A-D (green), defining intake channels], *the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another*, as described in 23[b] and 23[c]. *Supra* §IX.A.1.c-IX.A.1.d.

e. 13[b]: at least two porous tubes, each of the porous tubes having a longitudinal space, the at least two porous tubes respectively installed to corresponding coupling structures of the wafer container, the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the at least two porous tubes and enter the accommodating space.

157. Smith ’154 anticipates or at least renders obvious 13[b] for the same reasons discussed with respect to limitation 23[b], 23[c], and 24. *Supra* §§IX.A.1.c-IX.A.2.a.

4. <u>Dependent Claims 18-21</u>

a. Claim 18: The gas diffusion device according to claim 13, wherein the gas cartridge has a bottom portion and a sidewall extending from the bottom portion, and the gas intake channel is formed at the bottom portion of the gas cartridge.

158. Smith ’154 anticipates or at least renders obvious Claim 18 for the same reasons described for claim 26.

b. Claim 19: The gas diffusion device according to claim 13, wherein the gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber.

159. Smith ’154 anticipates or at least renders obvious Claim 19 for the same reasons described for claim 27.

c. Claim 20: The gas diffusion device according to claim 13, wherein a plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an

> ***installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber.***

160. Smith ’154 renders obvious claim 20. For the same reasons discussed with respect to claim 28, Smith ’154 renders obvious *a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module* [e.g., annular sidewalls on bottom portion of purge flow distribution system 540 that connect to inlet ports, e.g., 505A-D (green below)]. §IX.A.2.d.

161. A POSITA would have understood that *gas intake module* [e.g., inlet supply ports 505A/B (green)] has *a gas intake center axis* because all such structures necessarily have a center axis. As shown in Figure 5C, a center axis through both 505A and 505B would exist running perpendicular to the plane of the figure and carrier plate 523.

162. Additionally, Smith ’154 anticipates or at least renders obvious: *a gas intake module* [e.g., inlet supply ports 505A/B (green)] *has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red)] *communicate with one another*. §IX.A.1.c. Based on

the configuration of inlet supply ports 505A/B (green) as shown in Figure 5C, a POSITA would have understood that the most efficient means of supplying gas from *the gas intake module* would be to pass *through the gas intake channel and enter the buffering gas chamber* in *one single air intake direction* along the center axis of the gas intake module. This would be the most efficient method of installation because it entails connecting the inlet structures disclosed by Smith '154 directly to the purge flow distribution system 540 without the need for additional piping or other connections. §IX.A.1.c; Ex1008 ¶53.

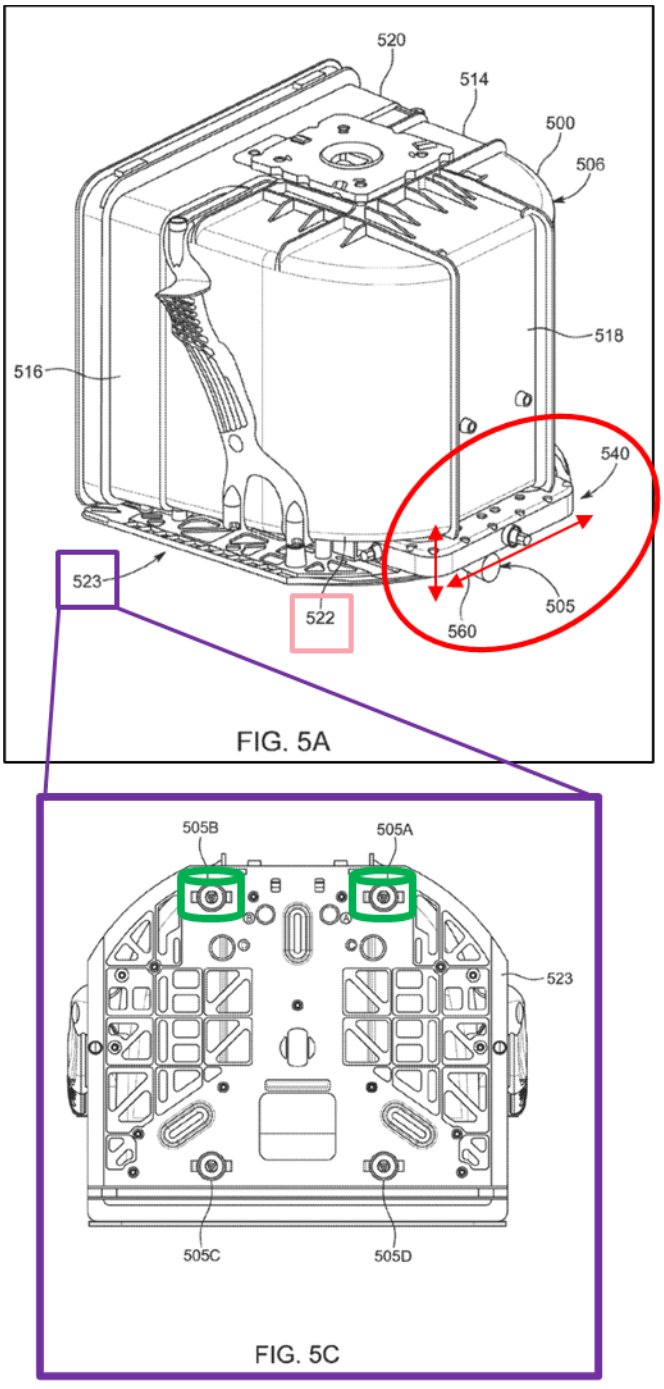


FIG. 5A

FIG. 5C

Ex1008, Figs. 5A, 5C (annotated).

d. Claim 21: The gas diffusion device according to claim 13, wherein the wafer container comprises a base plate installed at the bottom portion of the wafer container, and the buffer gas chamber is between the bottom portion and the base plate of the wafer container.

163. Smith ’154 anticipates or at least renders obvious Claim 21 for the same reasons discussed with respect to Claim 30. *Supra* §IX.A.2.e.

B. Ground 3: Obviousness of Claims 23, 24, 26-31, and 13, 18-22 in View Smith ’154 in further view of Ogawa

164. As I explained for Grounds 1-2, claims 23, 24, 26-28, and 30 and claims 13, 18-21 are anticipated or at least rendered obvious in view of Smith ’154 alone. Dependent claims 29, 31, and 22 are further rendered obvious in view of Smith ’154 and Ogawa.

1. Motivation to Combine Smith ’154 with Ogawa

165. In my opinion a POSITA would have been motivated to combine the teachings of Ogawa with Smith ’154 with a reasonable expectation of success.

166. Smith ’154 and Ogawa are analogous art to the ’711 Patent, each being directed to “distributing purge gas to the interior of the substrate container.” Ex1008 ¶ 1; Ex1012, 3:20-22 (“a gas replacement unit in which variations in humidity or concentration of the gas are small within the internal space is possible”).

167. Smith ’154 does not discuss the materials used to construct the substrate container. A POSITA would have been motivated to look to Ogawa’s material-related teachings to implement the elements in Smith ’154.

168. Specifically, it is well known in the art that the process of manufacturing wafers generates substantial heat, and it can be unsafe to place hot wafers on certain plastic materials as there is a “non-trivial risk of fire in such facilities associated with polycarbonate wafer carriers.” Ex1016 ¶ 4. Because a fire

poses "a risk of significant property loss and hazards to the life safety of occupants in the facility . . . [and] may cause extreme disruption to the semiconductor production" use of "a fire retardant wafer container" is well known in the art. Ex1016 ¶¶ 4, 8. A POSITA would have therefore been motivated to look to Ogawa's teachings of thermally resistant materials for "the container body 2" and associated components, including "bottom plate 26" may be made of "resin molding material," including "thermoplastic resins such as polycarbonate, cyclic olefin polymer, polyether imide, polyether ketone, polyether ether ketone, polybutylene terephthalate, polyacetal, liquid crystal polymer, or alloys thereof." Ex1012, 5:14-23; *see also* Ex1018; Ex1019. Ogawa further explains that "additional conductive substances composed of carbon fibers, carbon powders, carbon nanotubes, conductive polymers or the like, or antistatic agents such as anions, cations, nonionic additives or the like can be added as required to these resins." *Id.*, 5:24-28. A POSITA would have understood that thermally resistant polymers such as polyether ether ketone ("PEEK") minimize the risk of fire. *See* Ex1018. Further, adding carbon to wafer carriers was well known and commercially available. For example, Entegris advertised their A300 FOUP with "Carbon-filled PC, carbon-filled barrier material," *See* Ex1020.

169. It is my opinion that such a combination would have been well within the level of skill, as taught by Smith '154, Ogawa, and the knowledge of a

POSITA. A POSITA would have understood that Ogawa's techniques would be entirely complementary to the purge flow distribution system disclosed by Smith '154. Thus, a POSITA would have successfully implemented the combination, where the purge flow distribution system disclosed by Smith '154 is constructed according to Ogawa's material-related teachings. This straightforward combination simply uses a known technique (e.g., Ogawa's material-related teachings) to improve a similar device (e.g., the purge flow distribution system disclosed by Smith '154) by reducing the risk of a fire, while providing predictable results (e.g., a thermally resistant substrate container).

2. Claim 29: The wafer container according to claim 23, wherein the wafer container further comprises a door detachably combined with the shell, and a pair of support portions configured on an inner side of the shell, and the wafer container is made of a thermal resistance material, which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.

170. As discussed previously for Grounds 1-2, Smith '154 renders claim 23 obvious. *Supra* §IX.A.1.

171. Smith '154 in view of Ogawa discloses Claim 29. For example, as shown in Figure 2, Smith '154 discloses that *the wafer container* [e.g., substrate container 1] *further comprises a door* [e.g., door 4] *detachably combined with the shell* [e.g., substrate container 1], *and a pair of support portions* [e.g., plurality of

shelves 28] *configured on an inner side* [e.g., side wall 14/16] *of the shell* [e.g., substrate container 1]. Smith '154 specifically teaches that "substrate container 1 can be accessed by moving (e.g., opening, removing) the door 4" and "includes a first side wall 14, a second side wall 16." Ex1008 ¶¶ 25-26. Further, Smith '154 teaches that "substrate container 1 can include a plurality of shelves 28 for holding substrates (not shown) in the interior space 8" which are located side wall 14/16 "(e.g., slots in the substrate container)." Ex1008 ¶ 28.

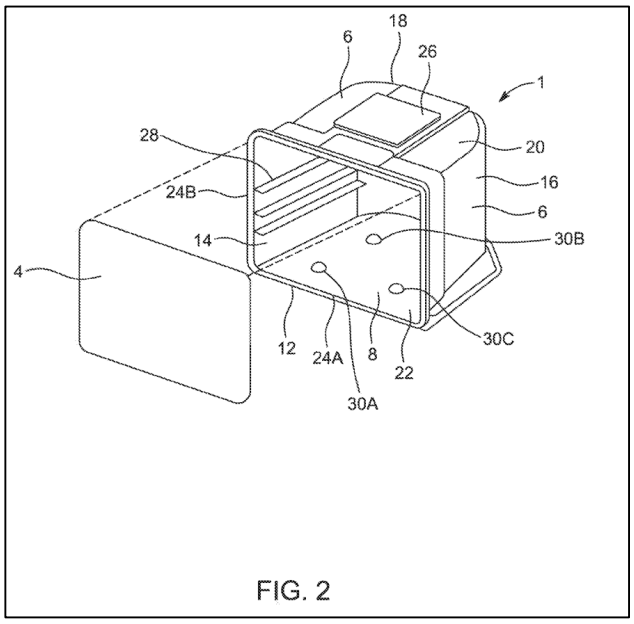


FIG. 2

Ex1008, Fig. 2.

172. Additionally, Ogawa discloses that *a wafer container is made of a thermal resistance material, which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP* [e.g., resin molding material, including

thermoplastic resins such as polyether ether ketone ("PEEK")]. Ex1012, 5:14-23 (container and associated components may be made of "resin molding material," including "thermoplastic resins such as polycarbonate, cyclic olefin polymer, polyether imide, polyether ketone, polyether ether ketone, polybutylene terephthalate, polyacetal, liquid crystal polymer, or alloys thereof"); *see also* §IX.B.1. Note that polyether imide is "PEI", poly ether ether ketone is "PEEK."

3. Claim 31: The wafer container according to claim 30, wherein the base plate is made of a material comprising a self-lubricating material.

173. As discussed previously, Smith '154 renders Claim 30 obvious and includes a base plate 523. *Supra* §IX.A.2.e.

174. Smith '154 in view of Ogawa also renders obvious Claim 31. For example, Ogawa discloses that *a base plate is made of a material comprising a self-lubricating material* [e.g., resin molding material, including thermoplastic resins such as polyether ether ketone ("PEEK") with additional conductive substances composed of carbon powders, or the like].

175. For example, Ogawa teaches that the container and associated components, including "bottom plate 26" may be made of "resin molding material," including "thermoplastic resins such as polycarbonate, cyclic olefin polymer, polyether imide, polyether ketone, polyether ether ketone, polybutylene terephthalate, polyacetal, liquid crystal polymer, or alloys thereof." Ex1012, 5:14-

23. Ogawa further explains that "additional conductive substances composed of carbon fibers, carbon powders, carbon nanotubes, conductive polymers or the like, or antistatic agents such as anions, cations, nonionic additives or the like can be added as required to these resins." *Id.*, 5:24-28; *see also* Ex1018; Ex1019.

176. A POSITA would have understood that the inclusion of at least the carbon powders additives in the disclosed resin would result in *a self-lubricating material* as disclosed by the '711 Patent, which describes that a *self-lubricating material* "is fundamentally a composite material including at least two materials" wherein "the coefficient of friction of part or all of the base plate (29) is lower than the coefficient of friction of a contact interface of the load port, so as to more readily move the base plate (29) on the interface of the load port." Ex1001, 8:46-53; *see also* Ex1018; Ex1019 (self-lubricating compound PEEK products were well known in the art). Also the Entegris A300 FOUP discloses carbon-filled materials for shell, door housing, door panels, wafer supports and contact areas. Ex1020.

4. Claim 22: The gas diffusion device according to claim 21, wherein the base plate is made of a material comprising a self-lubricating material.

177. Smith '154 in view Ogawa renders obvious Claim 22 for the same reasons I explained for Claim 31. *Supra* §IX.B.3.

C. Ground 4: Obviousness of Claims 1-9, 12, 13-21, 23-28, and 30 in view of Smith ’517 in further view of Smith ’154

178. In my opinion, Claims 1-9, 12, 23-28, and 30 would have been obvious in view of Smith ’517 in further view of Smith ’154.

1. Motivation to Combine Smith ’517 (Ex1011) with Smith ’154 (Ex1008)

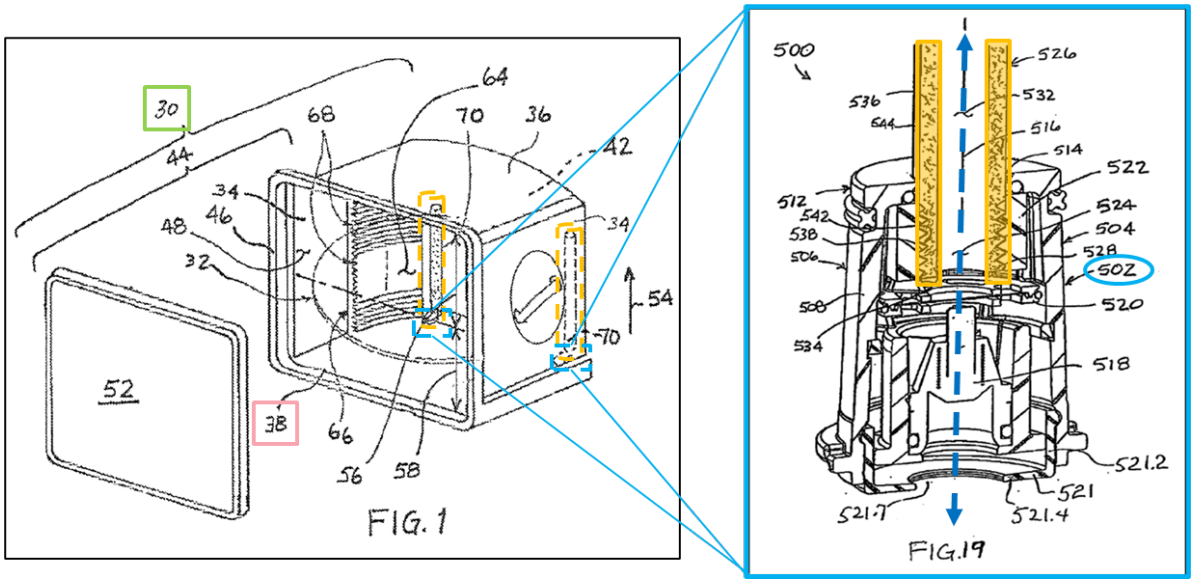
179. In my opinion, a POSITA would have been motivated to combine the teachings of Smith ’517 and Smith ’154 with a reasonable expectation of success.

180. Smith ’517 and Smith ’154 are analogous art to the ’711 Patent, each being directed to substrate containers with mechanisms for “distributing purge gas to the interior of the substrate container.” Ex1008 ¶ 1; *see also* Ex1011, 1:16-21; Ex1001, 18-22.

181. Smith ’517 discloses a substrate container for use in storing or transporting semiconductor wafers, Ex1011, 1:16-20, that can minimize the introduction of dust, impurities, or humidity from an external environment by controlling “the flow rates and velocity profiles” of the purge gas entering the container. *Id.*, 1:25-32, 2:4-17. Smith ’517 specifically focuses on different connections between “diffuser tube[s]” and a purge port assembly, *id.*, 1:60-62, that can be used as “a kit for retrofitting existing front opening wafer containers.” Ex1011, Abstract. Smith ’517 further explains that “diffuser assemblies can be tailored to provide a desired flow profile” based on the “plenum charge effect.” *Id.*,

11:27-31. Smith '517, however, does not describe a system that can regulate, buffer, and distribute purge gas across different diffusers spread throughout a container.

182. For purposes of retrofitting, Smith '517 discloses that the "connections between a diffuser tube" and "a purge port assembly" are "robust" and "low profiled so as not to interfere with the wafer slots." Ex1011, 1:60-64. For example, Smith '517 teaches an embodiment where the diffuser and purge port assembly are coaxially aligned. Specifically, Figure 19 discloses that the following elements are "concentric" with a central axis 516 (blue dashed line below): (a) opening 534 at the proximal end 528 of the porous media diffuser 526 (orange), (b) "a check valve 518 that permits flow to enter the substrate container," (c) a coupling 522. Ex1011, 16:28-58; Fig. 19.



Ex1011, Figs. 1, 19 (annotated).

183. Retrofitting thus enables a POSITA to update and modify existing prior art wafer containers with new and improved components to prolong their useful lifespans.

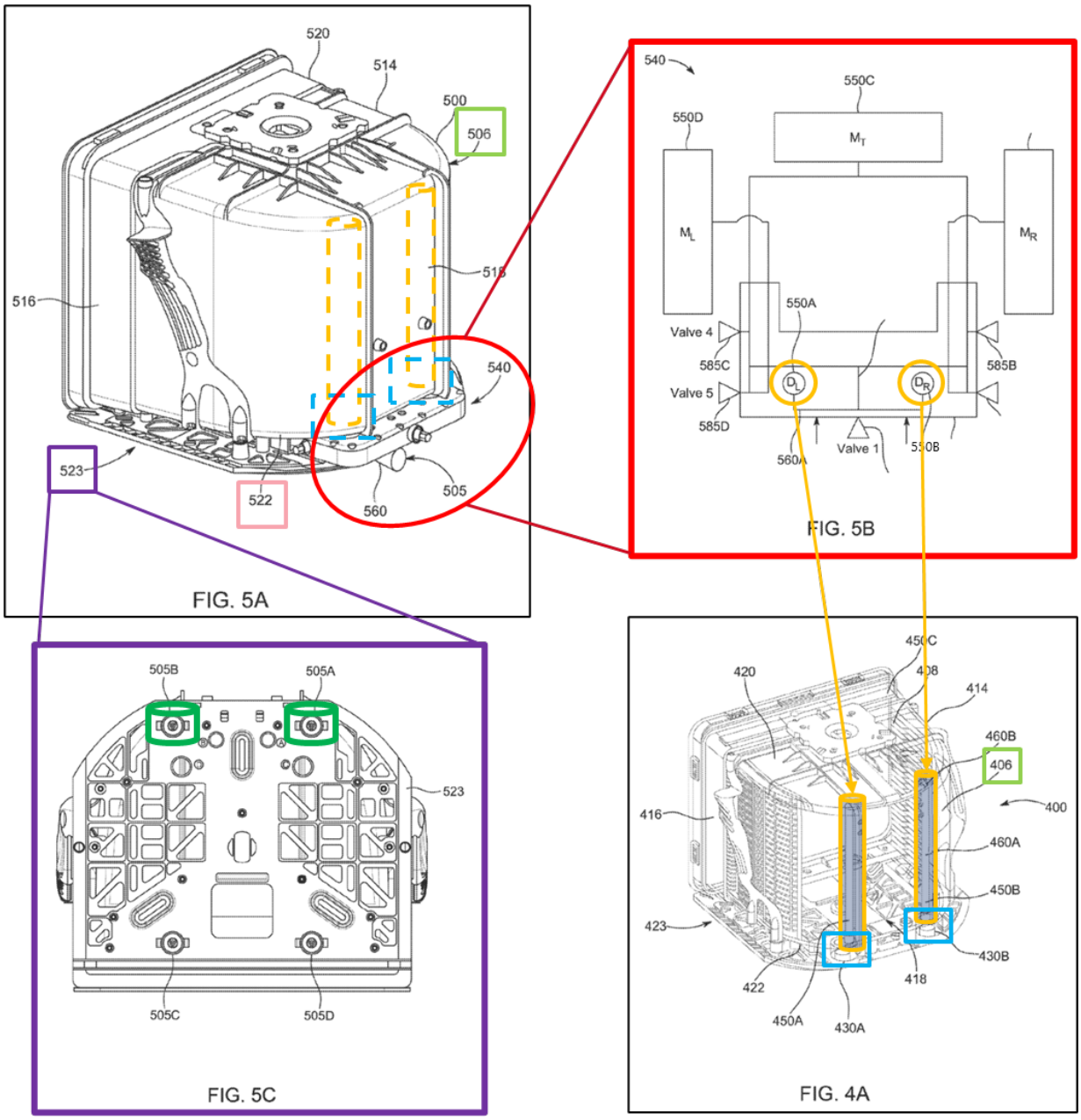
184. Smith ’517 also discloses that Fig. 19 can be implemented with specific couplings such as those depicted in Figs. 17A-17D, and 19: a nipple, nipples with exterior threads, lateral apertures, channels, channels, shortened, with glue joints and weld joints, and O-rings, raised faces, interior threads, etc. Ex1011, 15:7-31, Figs. 17A-17D, 19.

185. These couplings can have various alignments and “may include structure that enhances purge characteristics near the base” of the tubular diffusers, to “effectively purge the high flow of air entering the substrate container at these locations.” *E.g.*, Ex1011, Abst., 3:4-8. One such coupling for retrofitting is shown in Figure 19 and is structured so that a threaded connection between the tubular diffuser (orange) and inlet port assembly (check valve 518) is “concentric” with a central axis 516 (blue dashed line below). Ex1011, 16:28-58; Fig. 19. Alternatively, Figure 19’s coupling 522 with internal threads 538 could be easily replaced with (a) the external threads 462 and O-ring 476 of Figure 17A, or (b) the short nipple and weld joint of Figure 17D—both well known options in the finite set of coupling mechanisms for connecting to a tubular element. A POSITA would have had a reasonable expectation of success in using these couplings with Fig. 19,

and a POSITA would have been motivated to do so. When retrofitting components to an existing shell, for example, a POSITA would have been motivated to select the known coupling structure most applicable to the current project, which may have required using internal threads such as in Fig. 17A instead of the external threads in Fig. 19 or using a short nipple and weld joint as in Fig. 17D where the porous diffuser does not have any threads at all.

186. As I described above, like Smith '517, Smith '154 teaches substrate container communicating with "a purge flow distribution system for distributing purge gas to the interior of the substrate container." Ex1008 ¶ 1. The system enables gas to flow (a) from a base plate (523) that receives purge gas from inlet supply ports (505A-D) (green), (b) to a purge flow distribution system 540 including a manifold base 560 above the baseplate for distributing purge gas, and (c) to tubular diffusers 550A/B or 450A/B[1] (orange) (via inlet purge ports 430A/B in the bottom wall of the shell) connected to the purge flow distribution system that introduces the gas into the interior of the container. *See* Ex1008 ¶¶ 45-50, 53, 75, cl. 12, Figs. 4A, 4B, and 5A-C.

[1] As I described for Ground 1, a POSITA would have understood that Fig. 4A and Figs. 5A-5C depict the same embodiment, or at least would have been obvious to combine. §IX.A.1.b. The two sets of figures show different perspectives of the same wafer container and purge flow distribution system, with the same elements, including diffusers 450A/450B and 550A/550B identically positioned at the rear of the wafer container shell.



Ex1008, Figs. 5A, 5B, 5C, 4A (annotated).

187. Notably, similar to Smith '517, an embodiment of Smith '154 discloses that a purge flow distribution system 340 shown in schematic Fig. 3B, with multiple inlet ports for introducing purge gas 305A-B (similar to 505A-D above in Fig. 5C) and multiple diffusers 350A/B (similar to tubular diffusers

450A/450B above in Fig. 4A) may be constructed with coaxial alignment (see added blue dashed line). [2]

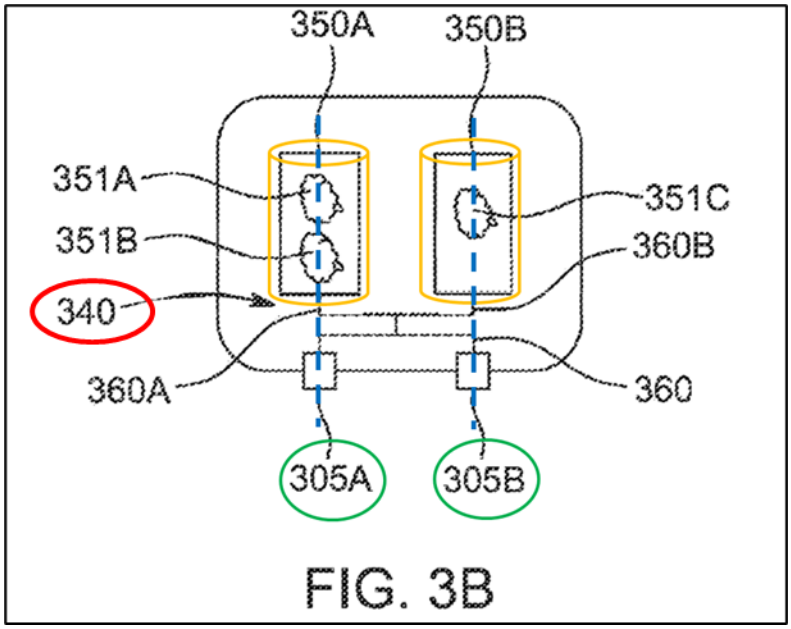


FIG. 3B

Ex1008, Fig. 3B (annotated).

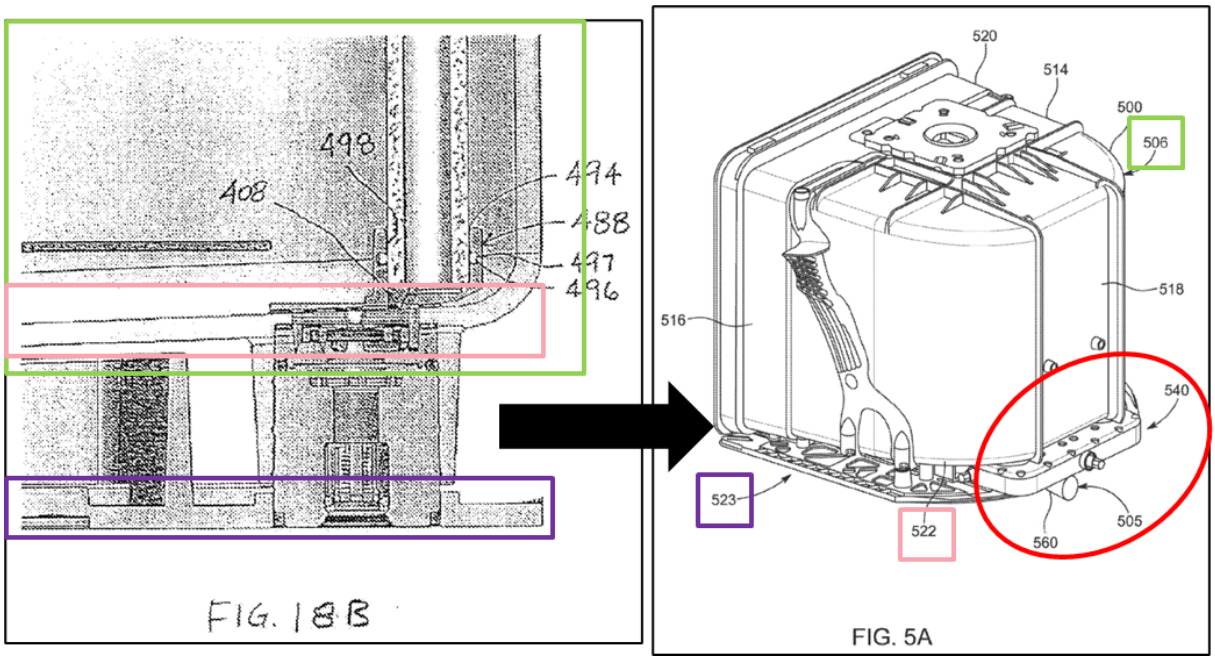
188. A POSITA would have readily implemented the purge flow distribution system Smith '154 into the container of Smith '517 using Smith '517's retrofitting kit. A POSITA would have understood that purge flow distribution system 540 is a type of plenum installed as the base of the container, outside or below the portion of the container that holds the wafers. A POSITA would have

[2] It would have been obvious to a POSITA that the various embodiments shown in Fig. 3B would have been combined with the embodiments in Figs. 4A, and 5A-5C. Each figure shows different perspectives of the same wafer container and purge flow distribution system, with the same elements, including diffusers 350A/350B, 450A/450B and 550A/550B, and inlet ports 305A/305B and 505A/505B all identically positioned around the wafer container shell.

been motivated to incorporate Smith ’154’s purge flow distribution system into Smith ’517’s existing container and plenum system in order to achieve the benefits of the purge flow distribution system, namely dividing “the supply of purge gas from both inlet ports. . . so that [a] predetermined amount of purge gas is supplied to the plurality of discrete input purge ports for supplying the separate gas distributing devices.” Ex1008 ¶ 39. Such a combination would also further the goal of Smith ’517 to retrofit a container with an “improved purging apparatus and method that addresses the issue of ambient environment encroachment when the substrate container is opened to the ambient environment while maintaining a low profile inside the container. Ex1011, 1:64-67.

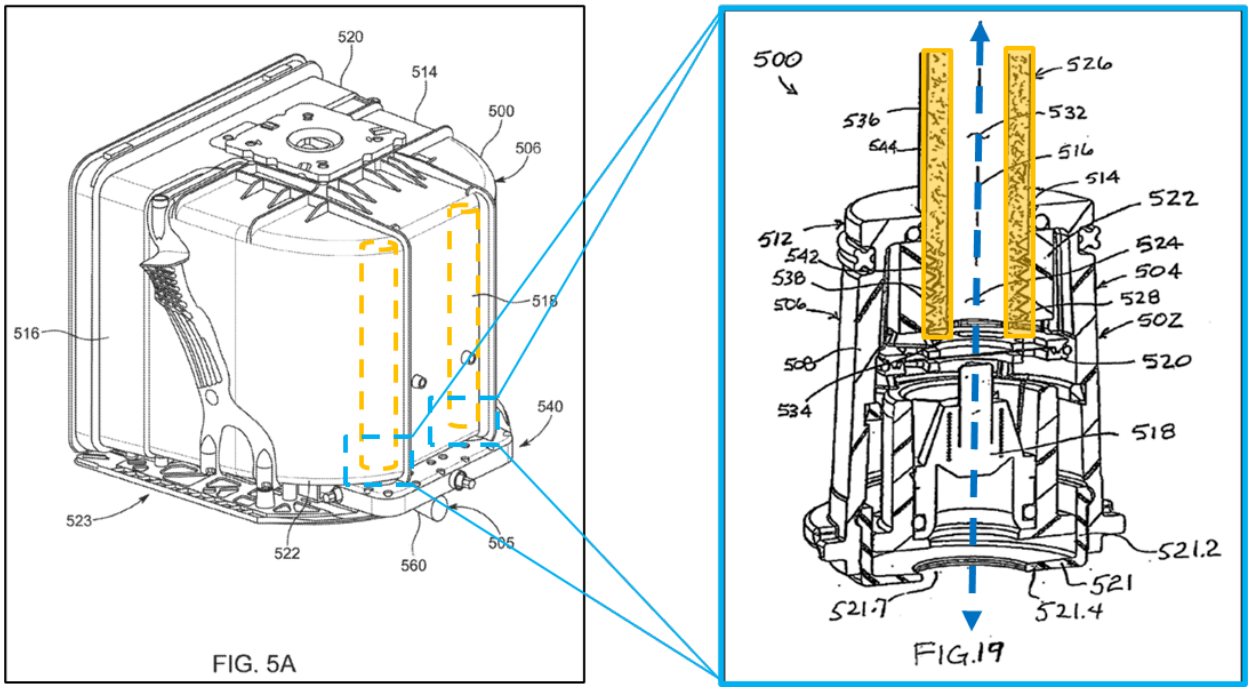
189. A POSITA would have understood that the combination would have been easily implemented using a Smith ’517 retrofitting kit. For example, beginning with an unmodified container that lacks a purge flow distribution system, similar to Fig. 3A of Smith ’517, a POSITA would start retrofitting the container (using the retrofitting kit of Smith ’517) to add in the purge flow distribution system of Smith ’154 by exposing a bottom wall of a shell. Next, the purge flow distribution system 540 of Smith ’154 would be inserted below the bottom wall along with a carrier plate 523 (purple box). The resulting combination would resemble Figure 5A of Smith ’154. Front opening unified pods (“FOUPs”) for storing and transporting wafers were well understood at the time. *See* Ex1017.

The likelihood of successfully combining the two is high for mechanical design.



Ex1011, Fig. 18B (annotated); Ex1008, Fig. 5A (annotated).

190. Second, each tubular diffuser in the combined system would also need to be retrofitted with a connection to the purge flow distribution system, as taught by Smith '154. Smith '517's retrofit couplings would be ideal for making that connection. For example, the coupling 522 of Smith '517 Figure 19 could be used at the bottom of each tubular diffuser to create a connection with the newly installed purge flow distribution system.



Ex1008, Fig. 5A (annotated); Ex1011, Fig. 19 (annotated).

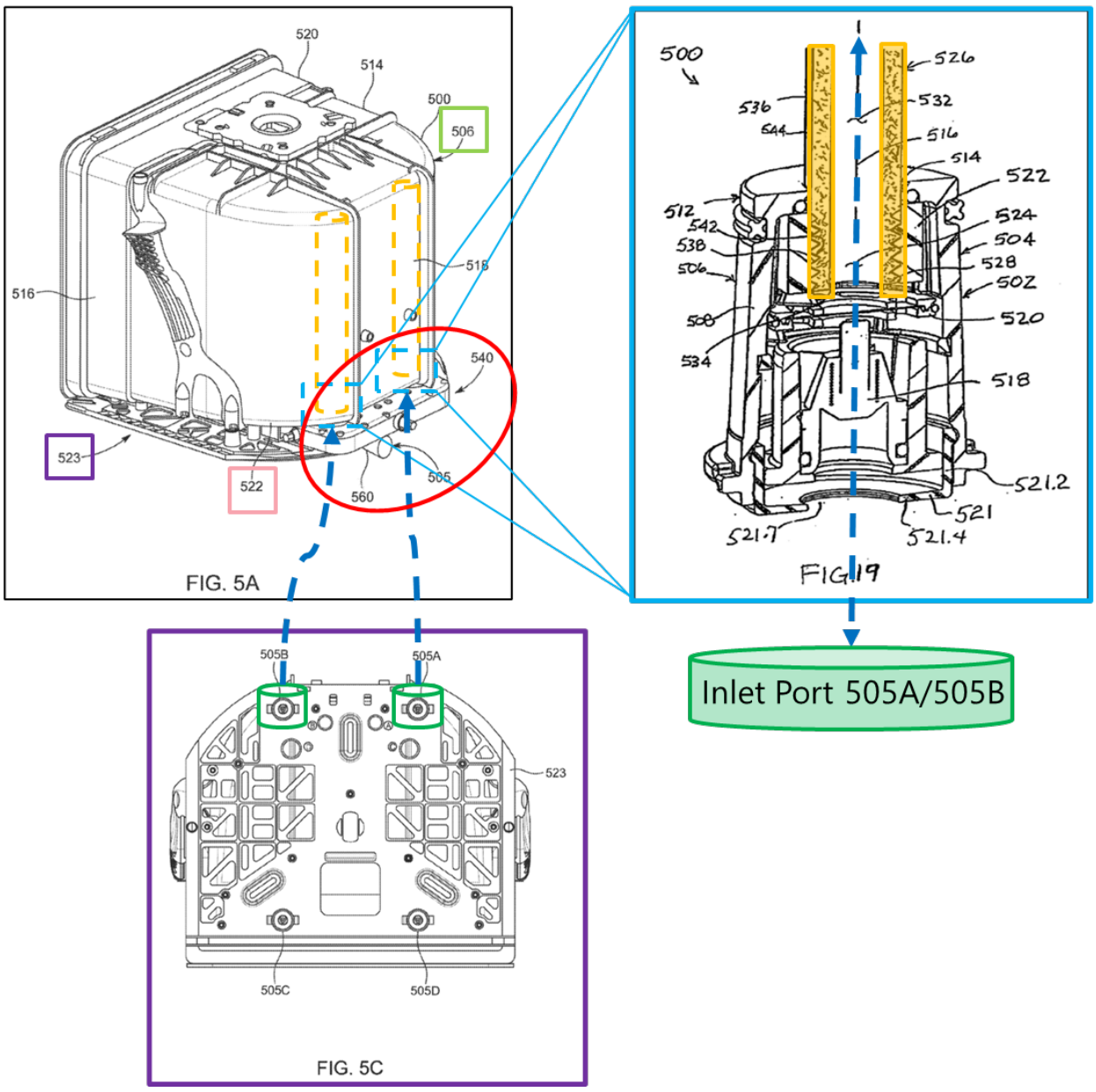
191. As previously discussed, a POSITA would have understood that the alignment of the tubular diffusers would be determined in part by the space available inside the container. *Supra* § IV.A. A POSITA would have been aware of the exclusion zone, or exclusion volume, inside the container that must be reserved for the wafers. *See e.g.*, *id.*; Ex1017, 1, 3, 9, 16; Ex1021, 3:3-12.

192. Finally, the ports for introducing purge gas to the system would maintain their position directly below the newly installed purge gas distribution system. Indeed, because the purge flow distribution system of Smith '154 would have been retrofitted to an existing container, it would also have been important to ensure that existing connections and ports are utilized. This eliminates the need to make new holes in either carrier plate or bottom wall. Therefore, when retrofitting

the purge flow distribution system of Smith ’154 in the existing container of Smith ’517, the existing inlet ports would align with newly installed coupling members in step 2.

193. The resulting system, shown below (“**Combined Smith Distribution System**”) would have included the purge flow distribution system of Smith ’154 (*e.g.*, structures shown in Figs. 5A, and 5C, below), implemented as the version of the plenum in Smith ’517 with aligned connections (*e.g.*, structures shown in Fig. 19, below bottom right). Specifically, in the combination, the structure would include (a) two tubular diffusers (orange below); (b) each tubular diffuser connected to coupling 522 in Smith ’517 (light blue); (c) each coupling 522 connected to purge flow distribution system 540 (red); (d) each inlet port 505A or 505B (green cylinders) connected to purge flow distribution system 540, which introduce purge gas similar to the check valve 518 in Smith ’517, with all elements aligned coaxially along a “central axis 516” (blue dashed line). Ex1011, 16:28-58; Fig. 19.

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

194. A POSITA would have been motivated to make this combination and to use the above disclosures of Smith '154 with Smith '517 to retrofit an existing container with a purge flow distribution system with aligned elements for several

reasons.

195. First, a POSITA starting with Smith ’517, for example, would have been motivated to include a buffering gas chamber in Smith ’517. Smith ’517 already discloses benefits of a “plenum charge effect,” *id.*, 11:25-31, and the need to maintain a “low profile so as to not interfere with the wafer slots,” *id.*, 1:63-64, inside the container. As previously discussed, plenums are regularly used to balance pressure between multiple flow outlets by using a large reservoir of pressurized gas. *Supra* §IV.B. Accordingly, a POSITA would have been motivated to add a buffering chamber to Smith ’517 to further achieve these goals, and a POSITA would have looked to the teachings of Smith ’154 to implement a gas distribution space that sits outside of the container.

196. Indeed, a POSITA starting with Smith ’517 would be well aware of the teachings of Smith ’154 given that both Smith ’517 and Smith ’154 share a common lead inventor, Mark V. Smith, as well as a common applicant and assignee, Entegris, Inc. Both references also disclose very similar substrate containers (Smith ’154’s shell 406/506; Smith ’517’s substrate container 30), e.g., “FOUPs,” having bottom sections (Smith ’154’s bottom wall 422/522; Smith ’517’s bottom portion 38) with one or more inlets for purge gas (Smith ’154’s inlet ports 505A/B; Smith ’517’s inlet 518) connected to tubular diffusers. Ex1008 ¶¶ 45-46, 48-49, 53; Ex1011, 14:1-15:6, 16:28-17:35.

197. Second, a POSITA would have readily recognized that the coupling and alignment of the elements in Smith ’517 would have been beneficial in implementing the purge flow distribution system of Smith ’154. While Smith ’154 does not discuss in detail the alignment of the connections between the elements of the disclosed system that a POSITA would have implemented when building the Combined Smith Distribution System, Smith ’517 provides predictable options among a finite set of options for these design features that would have been known and available to a POSITA for implementing in the Combined Smith Distribution System. And, specifically, the option of coaxial alignment would have been beneficial to minimize the need for additional holes in the carrier plate or the bottom wall of the container when installing the purge flow distribution system in the Smith ’517 retrofitted container. Therefore, a POSITA would have understood the benefits of Smith ’517’s coaxial alignment between elements.

198. A POSITA would have also understood that there would be efficiency and construction benefits in using Smith ’517’s alignments in the Combined Smith Distribution System. Smith ’517 describes “a purge port assembly” that ensures a “robust” connection “between a diffuser tube and an upwardly facing fitting of a purge port assembly.” Ex1011, 1:60-64. Because substrate containers are used to “transport [] in-process wafers between process steps,” it is important that the container be sturdy enough to survive repeated movement throughout the facility.

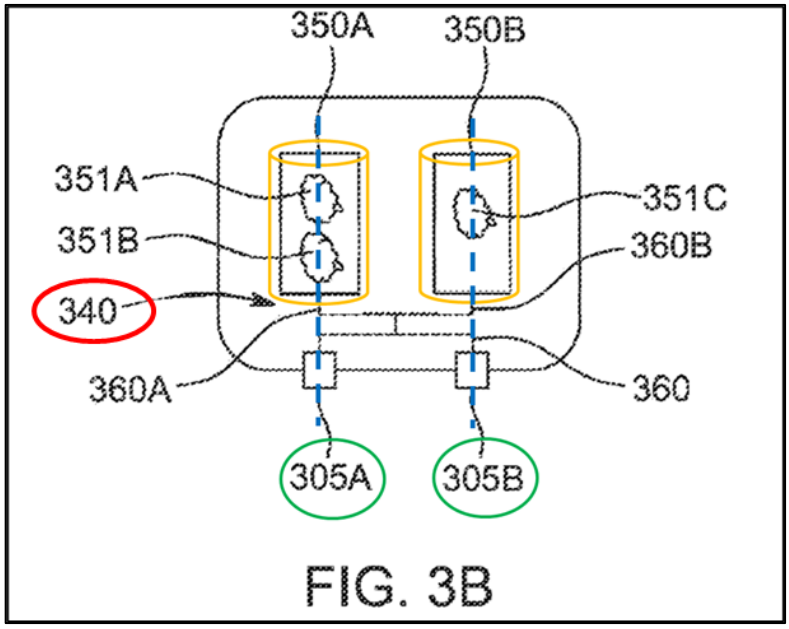
Ex1008 ¶ 2; Ex1011, 1:16-20. Similarly, Smith '517 teaches that such connections "need[] to be low profile so as not to interfere with the wafer slots." Ex1011, 1:62-64. Because a purpose of these containers is to "stor[e] or transport[] . . . wafers in a clean environment," maintaining a low profile is key so as to prevent any contact between the wafers and the purge flow distribution system, and to maximize the internal space for wafer storage. This is particularly important when retrofitting a container as there may be limitations on how and where the connections can be placed inside the container. Ex1011, 2:50-53.

199. Therefore, a POSITA would have understood that the use of Smith '517's alignments would enable the Combined Smith Distribution System to support flexible implementations in retrofitting scenarios that allow purge gas systems to be installed or upgraded on existing substrate containers to maintain a clean environment without interfering with the wafers in production. For example, this combination enables the installation of gas distribution devices at a variety of orientations using robust connections inside the container enables retrofitting through existing ports while maintaining a consistent internal volume for wafers thanks to the low-profile of said connections.

200. It is my opinion that such a combination would have been well within the level of skill, with a reasonable expectation of success, as taught by Smith '154, Smith '517, and the knowledge of a POSITA. For example, Smith

’517 teaches alignment of elements in a gas distributing devices for use in “[a]n improved purging apparatus.” Ex1011, 1:60-67. A POSITA would have understood that these alignments would be entirely complementary to Smith ’154’s purge flow distribution system, with manifold base. Indeed, in Figures 5A-5C, Smith ’154 already discloses general alignment by depicting inlet supply port(s) 505C and D installed on carrier plate 523 below the opening of diffusers 505A and B. A POSITA would have expected to successfully implemented the combination, where Smith ’154’s purge flow distribution system, is constructed using the coaxial alignment disclosed by Smith ’517 and results in a retrofitting kit as taught by Smith ’517.

201. Moreover, coaxial alignment is already indicated by Smith ’154’s Figure 3B. This Figure shows that the purge flow distribution system, taught by Smith ’154, with multiple inlet ports for introducing purge gas (green) and multiple diffusers (orange) may be constructed with an alignment (blue dashed line) between these two components. Ex1008, Fig. 3B.



Ex1008, Fig. 3B (annotated).

202. Thus, in my opinion, a POSITA would have been motivated to implement the Combined Smith Distribution System with a reasonable expectation of success. This straightforward combination simply uses known techniques (e.g., the Smith ’154 purge flow distribution system) to improve a similar device (e.g., Smith ’517’s existing containers retrofitted with aligned elements in gas distributing devices) in the same way (e.g., to maximize efficient use of space), while providing predictable results (e.g., to provide “a purge port assembly” that ensures a “robust” connection that is “low profile so as not to interfere with the wafer slots.” Ex1011, 1:60-64).

2. Independent Claim 1

a. 1[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising:

203. To the extent the preamble is limiting, it is my opinion that the Combined Smith Distribution discloses 1[pre]. As I described in §IX.C.1, the Combined Smith Distribution System includes *a gas diffusion device* [e.g., purge flow distribution system 540 (red) and tubular diffusers 550A/550B or 450A/450B (annotated in orange)], *installed in a wafer container* [e.g., substrate container with shell 506/406] *having an accommodating space* [e.g., interior space in the shell 506/406]. Ex1008, Abstract, ¶ 2.

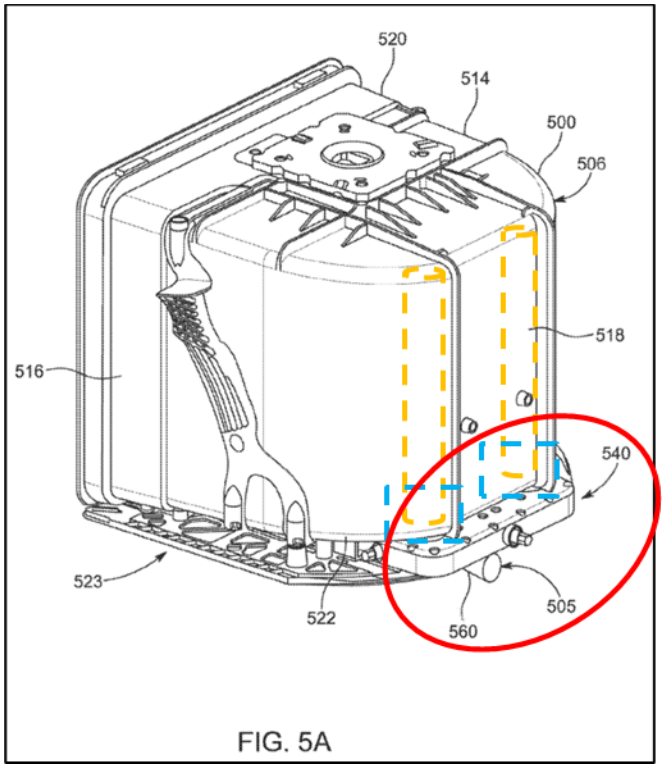
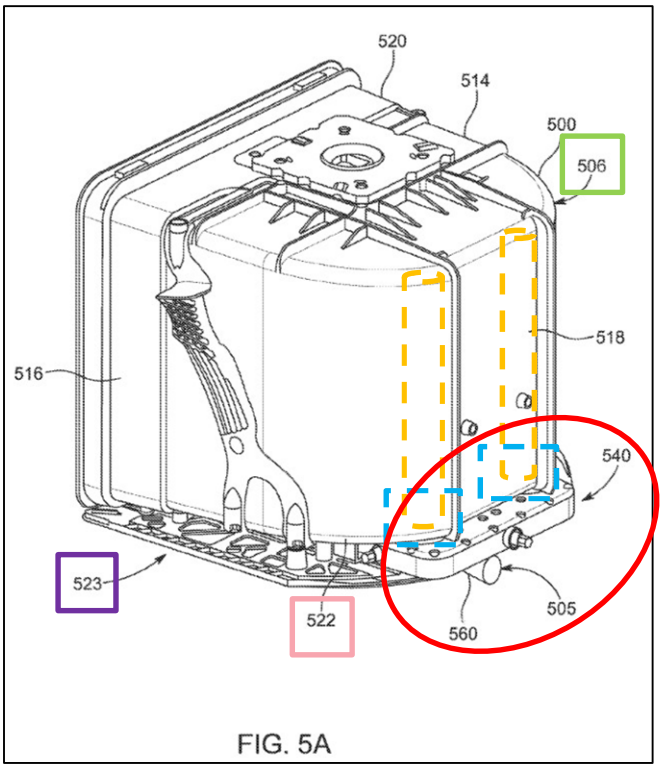


FIG. 5A

Ex1008, Fig. 5A (annotated).

b. 1[a][1]: a buffering gas chamber, configured at a bottom portion of the wafer container,

204. The Combined Smith Distribution System discloses limitation 1[a][1]. As I described in §IX.C.1, the Combined Smith Distribution System has *a buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 from Smith '154 (red)], *configured at a bottom portion of the wafer container* [e.g., bottom wall 522 or 422 from Smith '154].



Ex1008, Fig. 5A (annotated).

205. As I described in §IX.C.1, the purge flow distribution system 540 in Smith '154 is a buffering gas chamber and distributes purge gas to the interior of the substrate container. Ex1008 ¶¶ 1, 5. Like the buffering gas chamber in the '711

Patent, the purge flow distribution system balances gas pressure, allowing gas to flow through each diffuser (e.g., orange above) at "a balanced air pressure." *See* Ex1001, 14:57-15:3.

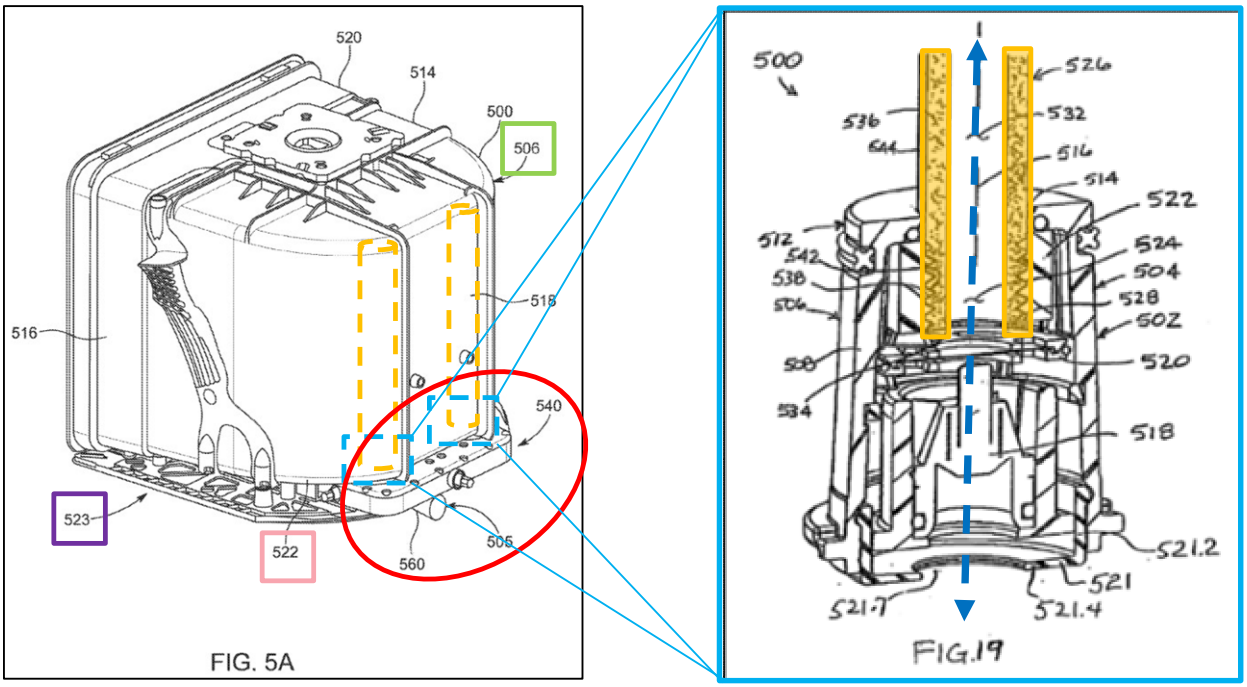
206. Moreover, the purge flow distribution system 540 is configured at the bottom of the wafer container 522 in Smith '154. In an embodiment, the purge flow distribution system 540 (red) is specifically installed between the bottom portion of the shell 522 and base plate 523. Ex1008 ¶¶ 49-50; *see also* Ex1008 ¶ 5 ("a substrate container includes a shell defining an interior space, in which the shell includes . . . a bottom wall").

207. Because the Combined Smith Distribution System may be implemented as a retrofitting kit, a POSITA would have installed the retrofitted purge flow distribution system 540 in a detachable manner as it could not, by definition, be a molded portion of the container. Ex1011, Abstract, 2:46-54, 5:27, Fig. 22; §IX.C.1. Further, a POSITA would have constructed separate structures attached to a wafer container, such as purge flow distribution system 540, as detachable elements for maintenance and cleaning.

c. 1[a][2]: the bottom portion provided with at least one coupling structure, the coupling structure defining a through channel having a center axis,

208. The Combined Smith Distribution System discloses limitation 1[a][2]. As I described in §IX.C.1, the Combined Smith Distribution System has *a bottom*

portion [e.g., bottom wall 422 or 522 of shell 406 or 506 from Smith '154] *provided with at least one coupling structure* [e.g., coupling 522 from Smith '517, light blue box below], *the coupling structure defining a through channel having a center axis* [e.g., flow path along center axis 516 (blue dashed line on right, below) in Smith '517].



Ex1008, Fig. 5A (annotated); Ex1011, Fig. 19 (annotated).

209. As I explained above (§IX.C.1), a POSITA would have been motivated to implement the input ports 430A and 430B in Smith '154 to the tubular diffusers (orange) with the coupling 522 from Smith '517, which is configured around central axis 516.

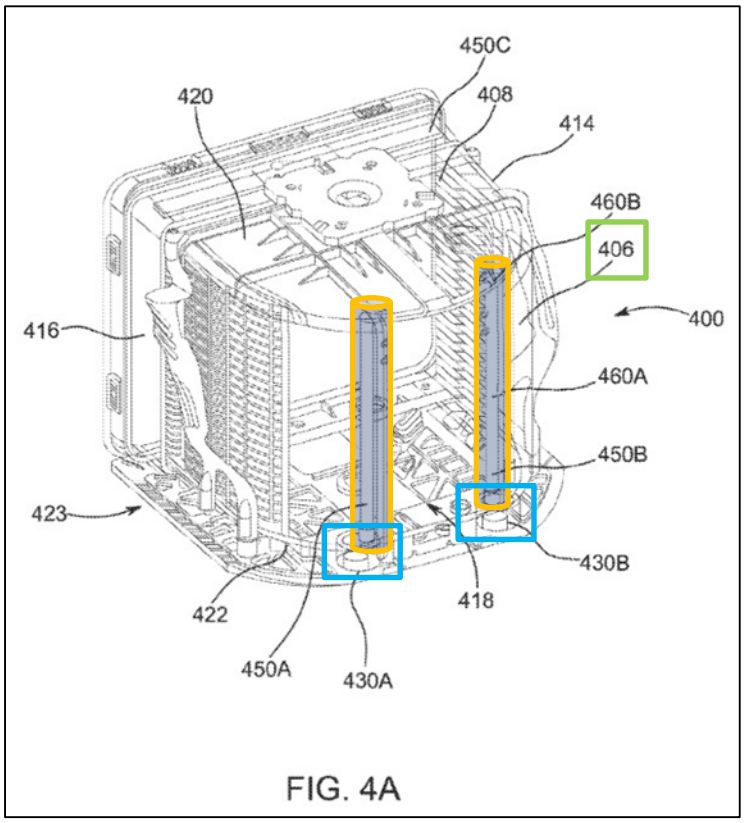


FIG. 4A

Ex1008, Fig. 4A (annotated).

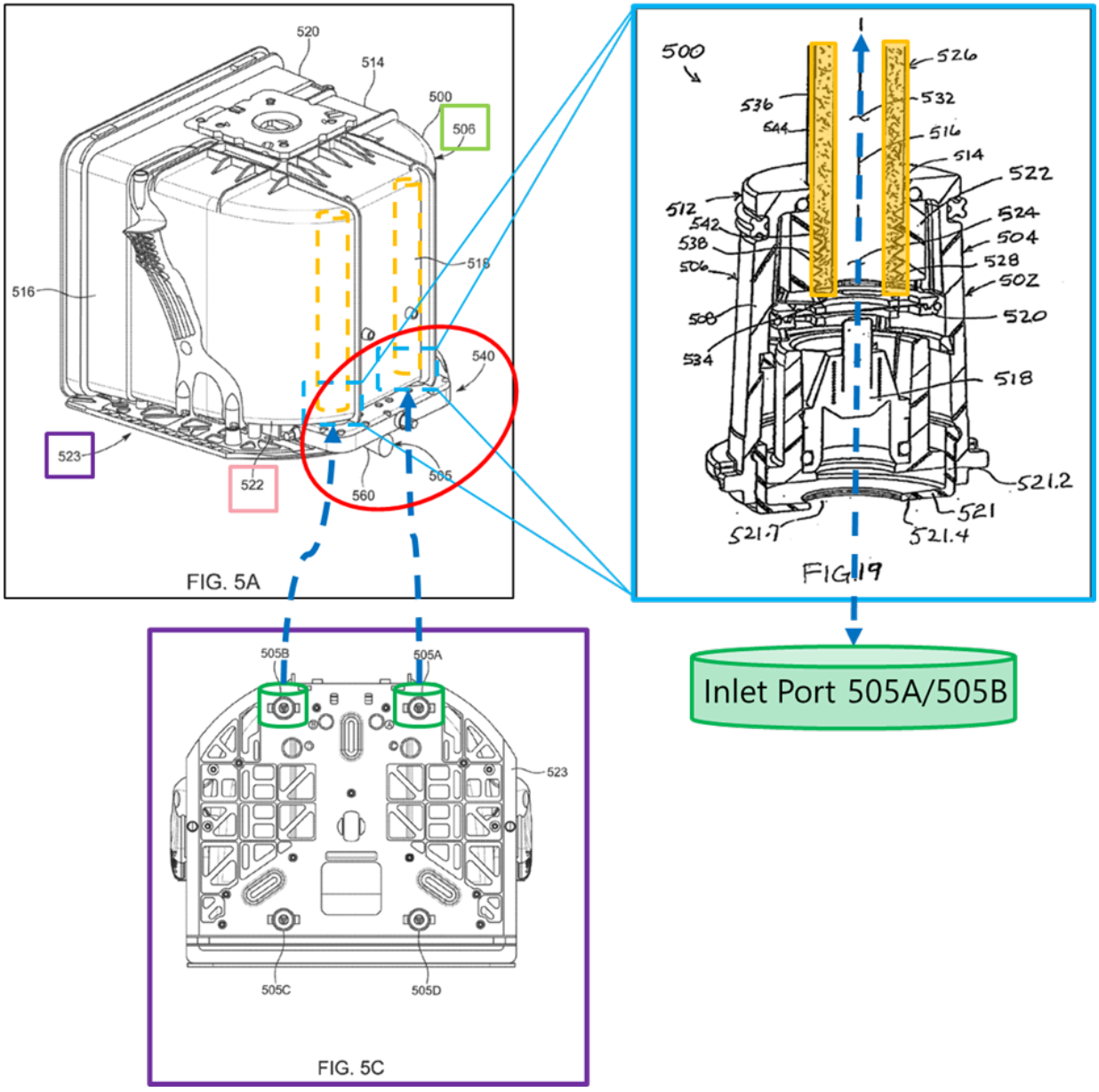
210. As shown in Fig. 4A above, input ports 430A and 430B are provided on the bottom surface of the container shell (e.g., 422), so the coupling 522 would also be provided on the bottom surface of the container shell (e.g., 422). The coupling 522 defines a through channel along the center axis 516, which allows purge gas to flow through the coupling structure to the tubular diffuser into the interior of the container.

d. 1[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and

211. The Combined Smith Distribution System discloses limitation 1[a][3]. As I described in §IX.C.1 and for limitations 1[a][1] and 1[a][2], the Combined Smith Distribution System has *a buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red) from Smith '154] *having at least one gas intake channel* [e.g., inlet supply ports 505A or 505B (green)]*, the gas intake channel*, *the buffering gas* chamber*, the through channel* [e.g., flow path along center axis 516 (blue dashed line on right, below) in Smith '517] *and the accommodating space* [e.g., interior of the container shell 506/406] *communicate*

with one another.

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

212. For example, inlet ports 505A and 505B are gas intake channels to the purge flow distribution system 540. As Smith '154 describes, "[t]he purge flow

distribution system 540 is connected to at least one inlet port 505 that is connected to a purge gas supply system for supplying the purge gas to the network of separate gas distributing devices." Ex1008 ¶ 49; *see also id*. ¶ 53 ("it is appreciated that the purge gas can be supplied to a number of inlet port(s) (or outlet port(s)) 5O5A, 505B, 505C, 505D provided through the carrier plate 523 depending on the nature of the application/docking arrangement for the substrate container…the purge gas from the inlet ports 5O5A, 505B, 505C, 505D can be combined before being supplied to manifold base 560 or provided/combined as necessary to supply different purge flow distribution systems in the substrate container").

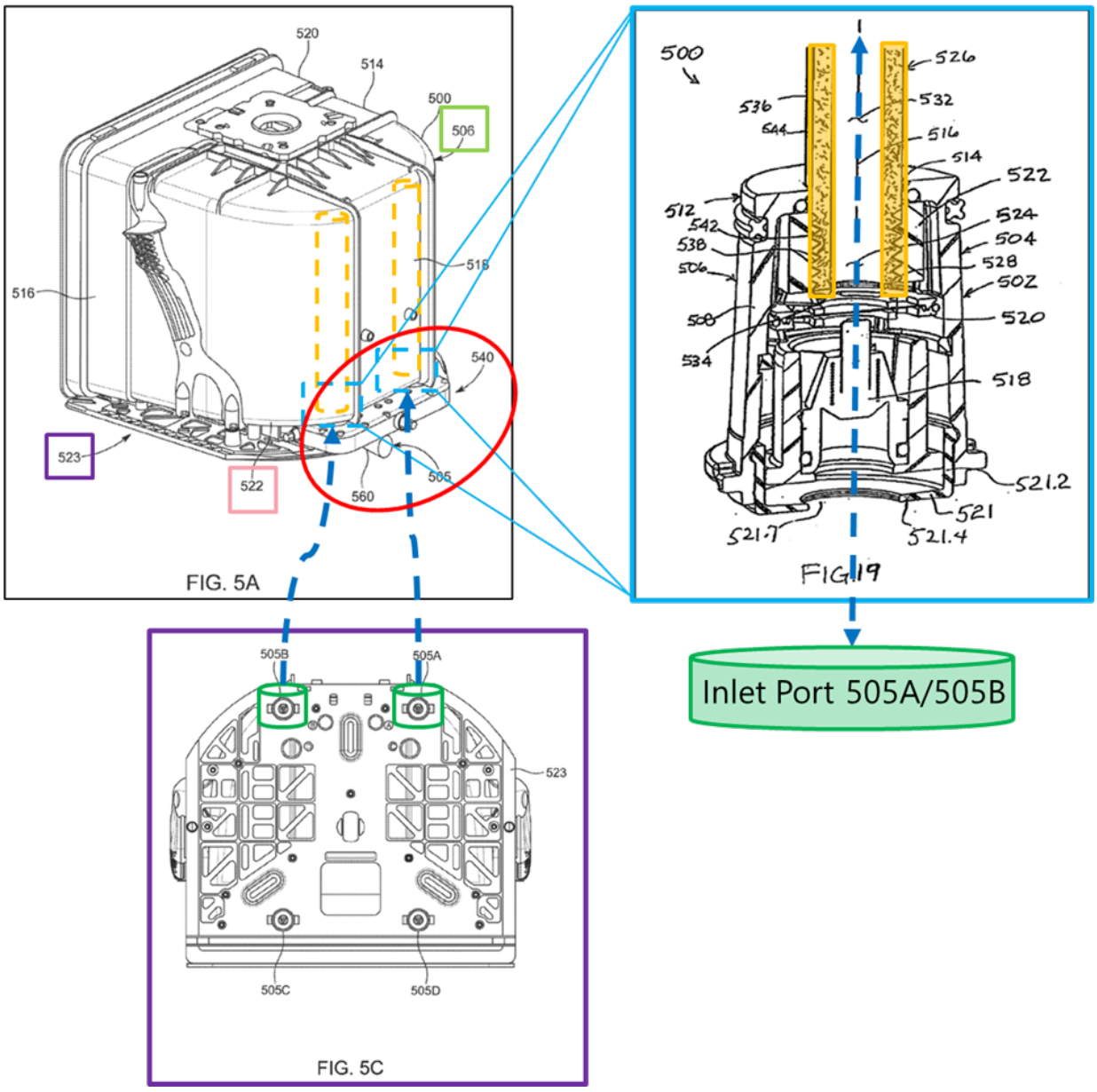
213. The inlet ports 505A and 505B (green), purge flow distribution system 540, flow path along center axis 516 in Smith '517 (blue dashed line), and interior of the container shell 506 all communicate with each other. Indeed, the design of the Combined Smith Distribution System (as I described in §IX.C.1) is intended to allow purge gas to flow from the inlet ports 505A and 505B receiving purge gas, through the coupling structure 522, to the tubular diffusers, to efficiently introduce purge gas to the interior of the container. In addition, Smith '154 specifically describes that "[t]he manifold base 560 includes a first flow path 560A . . . and a second flow path 560B connected to inlet purge port(s)" to allow communications to different tubular diffusers. Ex1008 ¶ 50, Figs. 3A-3C.

e. 1[b][1]: at least one porous tube, having a longitudinal space, the porous tube installed to the coupling structure of

the wafer container, the longitudinal space of the porous tube communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the porous tube and enter the accommodating space,

214. The Combined Smith Distribution System discloses limitation 1[b]. As I described in §IX.C.1 and for limitations 1[a][2]-1[a][3], the Combined Smith Distribution System has *at least one porous tubes, having a longitudinal space, the porous tube installed to the coupling structure of the wafer container* [e.g., tubular diffusers 450A/450B or 550A/550B extending the height of the container (orange) connected to coupling 522 (light blue)]. Moreover, as I described in §IX.C.1 and for limitation 1[a][1], *the longitudinal space of the porous tube communicating with the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red) from Smith '154], *the buffering gas chamber providing a gas to pass through the porous tubes and enter an accommodating space* [e.g., interior of container shell 506/406].

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

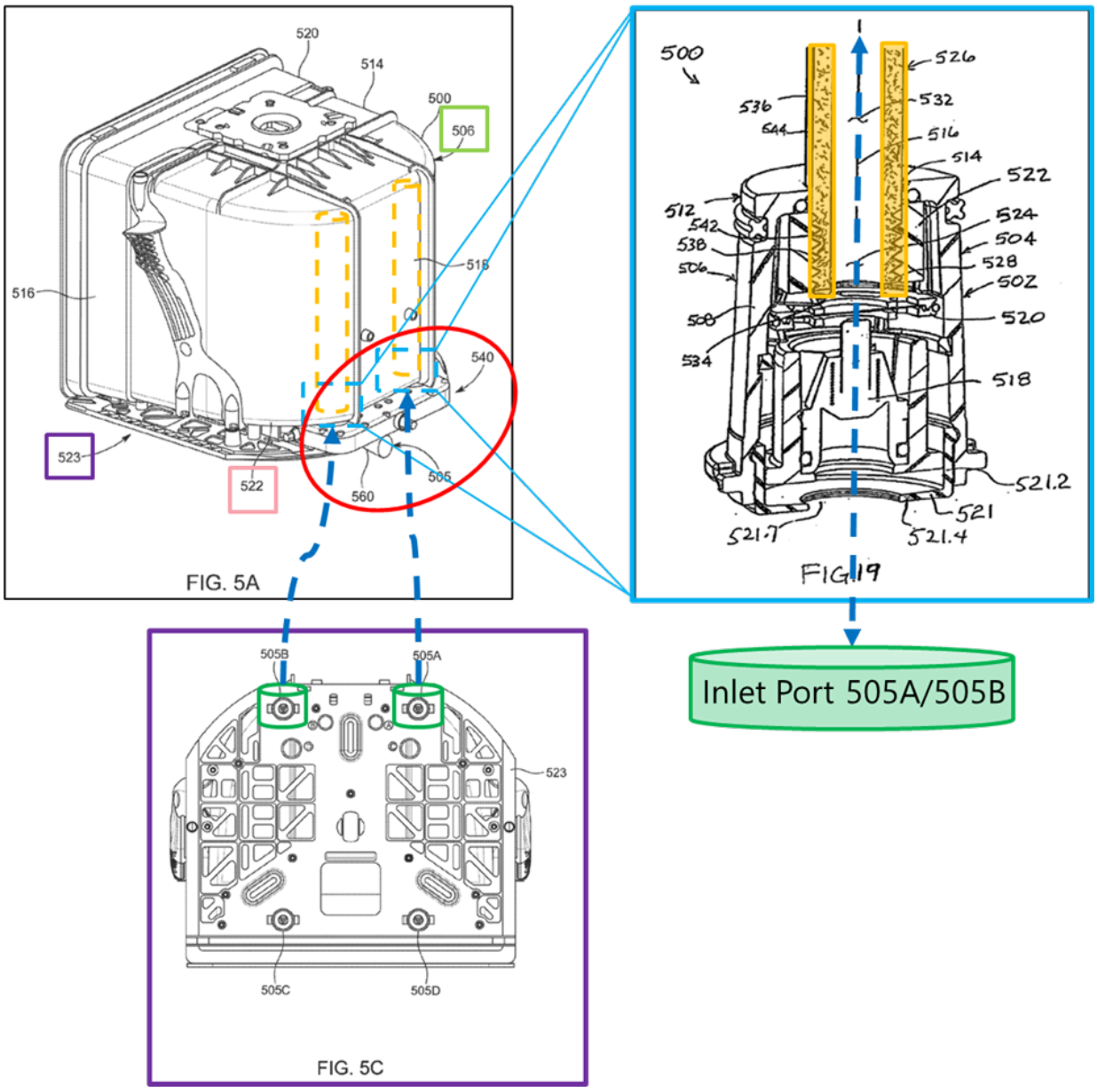
215. For example, as previously discussed, Smith ’154 teaches a purge flow distribution system 540, with manifold base 560, that includes a plurality of flow paths connected to inlet purge port(s). Ex1008 ¶ 50. Smith ’154 also teaches

"two diffusers 450A, 450B which include a plurality of openings for distributing the purge gas" into the interior of the container. Ex1008 ¶¶ 33, 46, 50. The two porous diffusers 450A, 450B (orange) are shown as tubes in Figure 4A, for example.

f. 1[b][2]: a gas intake center axis of the gas and a center axis of the coupling structure being coaxial.

216. The Combined Smith Distribution System discloses limitation 1[c]. Specifically, as I described in §IX.C.1, in the Combined Smith Distribution System (shown below), the *a gas intake* [e.g., inlet supply ports 505A or 505B, green] has a *center axis of the gas* [e.g., center axis of inlet supply ports 505A or 505B] *and a center axis of the coupling structure* [e.g., center axis of 522 coupling in Smith '517, light blue]. Moreover, the two center axes are *coaxial* [e.g., concentric with the central axis 516 (blue dashed line on right, below)]. As I described in §IX.C.1, a POSITA would have been motivated to align these structures coaxially by the teachings of Smith '154, Smith '517, and the knowledge of a POSITA.

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

217. As previously discussed, Smith '517 teaches that check valve 518 and coupling 522 are "concentric with the central axis 516" [e.g., *coaxial*] (blue dashed line on right, above). Ex1011, 16:28-58, Fig. 19; *supra* §IX.C.1. Because a

POSITA would have understood the advantages of using pre-existing connections and ports when retrofitting the Combined Smith Distribution System, it is my opinion that a POSITA would have understood that these components could be implemented with the same center axis alignment taught by Smith ’517 with a reasonable expectation of success. *Supra* §IX.C.1.

218. While Smith ’154 does not expressly describe the alignment of these components, Smith ’517 teaches that check valve 518 and coupling 522 are “concentric with the central axis 516” [e.g., *coaxial*] (blue dashed line). Ex1011, 16:28-58, Fig. 19. Because each of these components are well known in the art and could be easily implemented in the purge flow distribution system disclosed by Smith ’154, it is my opinion that a POSITA would have understood that these components could be implemented in Smith ’154 with the same center axis alignment taught by Smith ’517 with a reasonable expectation of success, for all the reasons I described in §IX.C.1.

3. Dependent Claims 2-9, and 12

a. Claim 2: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial.

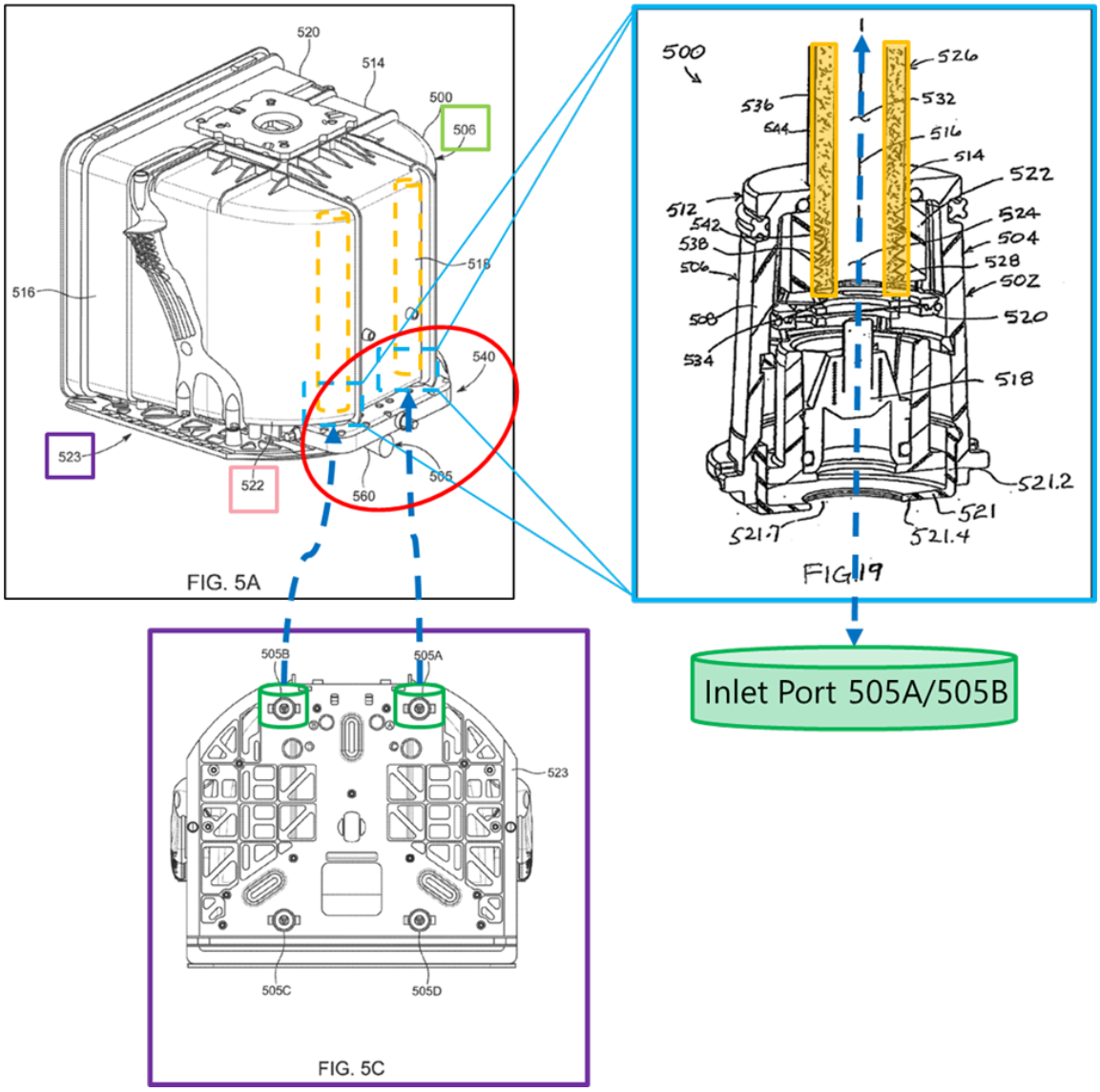
219. The Combined Smith Distribution System discloses Claim 2. For

example, as I described in §IX.C.1 and for claim 1, the Combined Smith Distribution System has:

- *the coupling structure formed as extending from the bottom portion of the wafer container* [e.g., a coupling 522 from Smith '517, light blue box below, extending from bottom wall 422/511 from Smith '154 of the wafer container], as I described for limitation 1[a][2];
- *an open end of the porous tube has a center axis and the longitudinal space of the porous tube has a center axis* [e.g., open ends and longitudinal space of tubular diffusers 450A/450B or 550A/550B (orange) have a center axis 516]. Each tubular diffuser has an open end and an elongated space extending into the container for distributing gas interior to the container, as shown below. *See also* Ex1011, 16:64-66 (describing opening 534 at proximal end 528); Ex1008 ¶ 46 (describing flow through inlet ports into open end of tubular diffusers). As I described in §IX.C.1 and as shown below, the openings and elongated portions of each tubular diffuser is centered about axis 516 (blue dashed line on right, below).
- *the center axis of the coupling structure the center axis of the open end of the porous tube and the gas intake* [e.g., inlet supply port(s) 505A and B] *center axis are coaxial* [e.g., concentric about the central axis 516]. As I described in §IX.C.1 and as shown below, inlet supply port(s) 505A and

505B are also concentric about central axis 516.

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

b. Claim 3: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the

> ***longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial; the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis.***

220. The Combined Smith Distribution System renders obvious Claim 3. Specifically, as I described in §IX.C.1, the Combined Smith Distribution System has:

- *the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis*, for the reasons described for claim 2;
- *the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial*, for the reasons described in claim 2;

221. Regarding the requirement of claim 3 that the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis, the Combined Smith Distribution System does not expressly disclose a configuration in which the opening of the porous tube and coupling structure are coaxial but the longitudinal space of the porous tube is offset, but that

configuration would have been obvious to a POSITA.

222. As described in the ’711 Patent, this configuration is met by an asymmetric tubular diffuser that extends radially in one direction more than the other. *See* Ex1001, 16:9-27, Fig. 21C. A POSITA would similarly have understood that this configuration would be achieved by including, for example, a porous tube with an elbow bend or an s-curve. Both of these options would necessitate that the axis of the open end be off-center of the longitudinal axis inside the tube.

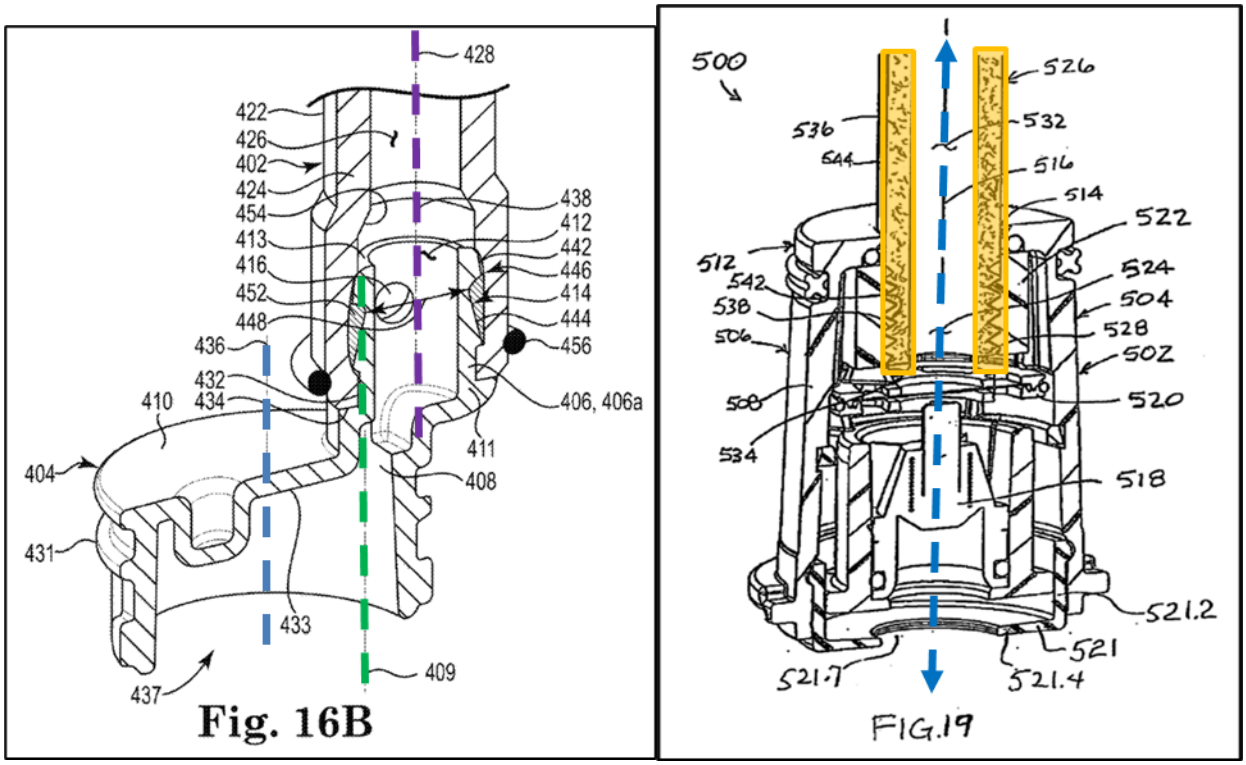
223. A POSITA would have understood that there were a finite set of predictable shapes and alignments of the porous tubes in a wafer container, and any particular alignment would have been determined in part by the space available inside the container. For example, there is an exclusion zone, or exclusion volume, inside the container that must be reserved for the wafers. *See*, *e.g.*, Ex1017, 1, 3, 9, 16; Ex1021, 3:3-12. This exclusion zone would have motivated the use of particular shapes and alignments of porous tubes for a given container. A POSITA would have known that, when retrofitting components to an existing shell, any known shape (such as a porous tube with an elbow-bend or s-curve) could have been used to meet the specific constraints of the current project and thus would have been motivated to use the alignment that was most applicable to the current project.

224. In the case of the Combined Smith Distribution System, a POSITA

would have been motivated to use an asymmetric diffuser when retrofitting a wafer container to maximize the internal space inside the container and satisfy the structure and design needs of any particular wafer container, such as avoiding the exclusion zone. *See* Ex1017; Ex1021, 3:3-12. A POSITA would have in fact been motivated by both Smith '154 and Smith '517 to use such an asymmetric diffuser. For example, Smith '154 discloses the need for a flow path to extend up a rear wall and bend across a top wall of a wafer container, to distribute gas at the front of the container. Ex1008 ¶ 46. Smith '517 also discloses that a tubular diffuser can be offset from a coupling and that the internal space of the porous media diffuser, termed the "central passageway" "can define a second axis [] that is substantially parallel to . . . [and] is radially offset from the first axis." Ex1011, 14:53-56. In this regard, Smith '517 discloses that a coupling and tubular diffuser has separate axes: first axis 436 (blue dashed line), second axis 438 (purple dashed line), and aperture axis 409 (green dashed line) defined by axial aperture 408 that is point at which gas enters the open end of the porous tube. Ex1011, 14:5-8, 14:49-54, Fig. 16B.

225. Therefore, a POSITA would have understood that the components shown in Smith '517 Figure 16B could be used in conjunction with those shown in Figure 19. A POSITA would have understood that these components could be implemented in a way where the center axis of the inlet port (blue dashed line) and the center axis of the open end of the tubular diffuser and the coupling structure

(green dashed line) were coaxial, as in Figure 19, while the center axis of the longitudinal space (purple dashed line) remains offset.

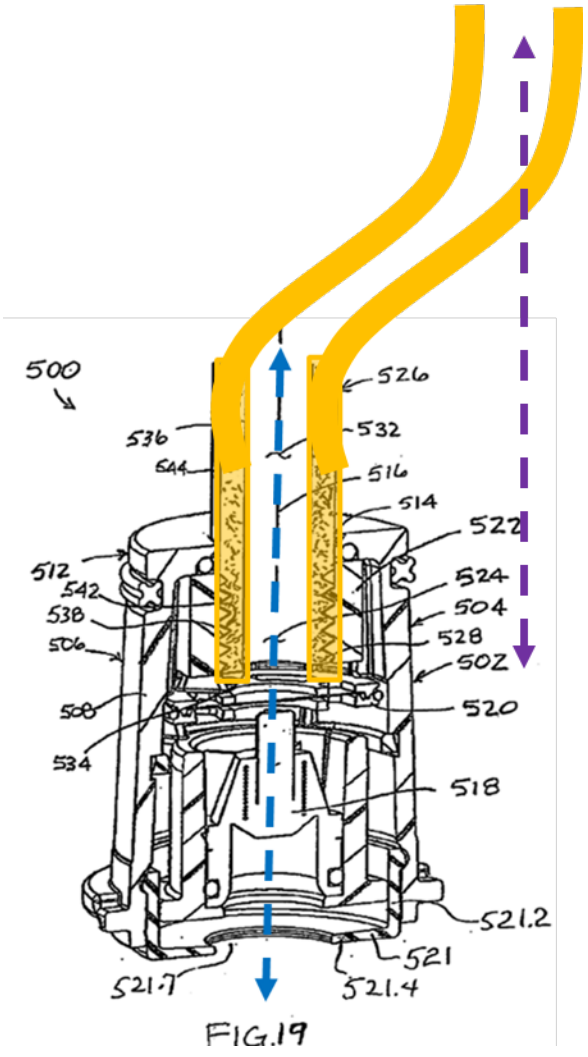


Ex1011, Figs. 16B (annotated) and 19 (annotated).

226. In view of these disclosures, a POSITA would have recognized that the Combined Smith Distribution System would have accommodated a tubular diffuser that had two axes—one at its opening and one offset and remote from the opening. A POSITA would have understood that such an arrangement could be readily implemented in the Combined Smith Distribution System.

227. A POSITA would thus have recognized that the Combined Smith Distribution System would have accommodated a tubular diffuser that had two axes—one at its opening (blue dotted line) and one offset and remote from the

opening (purple dotted line), as shown below. This type of alignment would have satisfied the desire of Smith '154 to extend along the rear wall of the wafer container, and would have fit within the constraints of Smith '154. *See, e.g.*, Ex1008, Figs. 4A-4B.



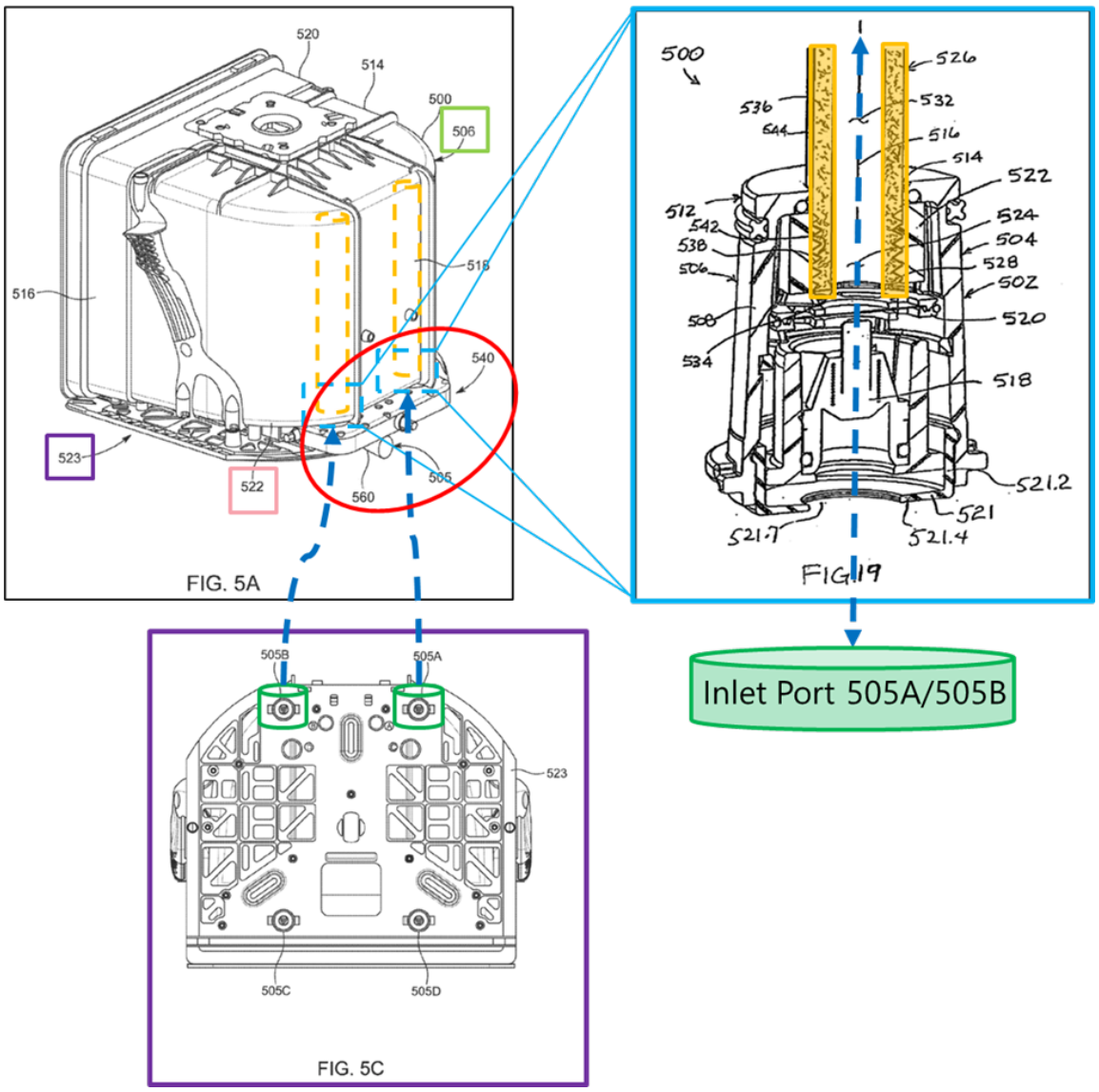
Ex1011, Fig. 19 (modified and annotated).

c. Claim 4: The gas diffusion device according to claim 1, wherein the longitudinal space of the porous tube has a closed end and an open end, and the open end receives the corresponding coupling structure, so that the gas enters

the longitudinal space by passing through the buffering gas chamber and the open end.

228. The Combined Smith Distribution System discloses Claim 4. For example, as I described in §IX.C.1, the Combined Smith Distribution System has *the longitudinal space of the porous tube has an open end, and the open end receives the corresponding coupling structure so that the gas enters the longitudinal space by passing through the buffering gas chamber and the open end* for the reasons described for claim 2. As shown below, the purge flow distribution system 540 (red) distributes purge gas to the coupling structures (light blue) into the longitudinal space of the tubular diffusers (orange).

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

229. Regarding the requirement of claim 4 *that the longitudinal space of the porous tube has a closed end*, as shown in exemplary Figure 7, Smith '517 describes a "blind end 178" that can be "solid and impermeable," i.e., closed. Ex1011, 8:49-58. A POSITA would have been motivated to use such a tube with

the buffering gas chamber and container in the Combined Smith Distribution System, with a reasonable expectation of success. Indeed, Smith '154 already teaches that a tubular diffuser would have a closed end, for example, if the tubular diffuser is intended to distribute gas in a rear portion of a container. Ex1008 ¶ 46. In this configuration, the tubular diffuser has a "plurality of openings arranged along" its length but a closed end to ensure that the gas is distributed to the wafers in the interior of the container. *See* Ex1008 ¶ 36.

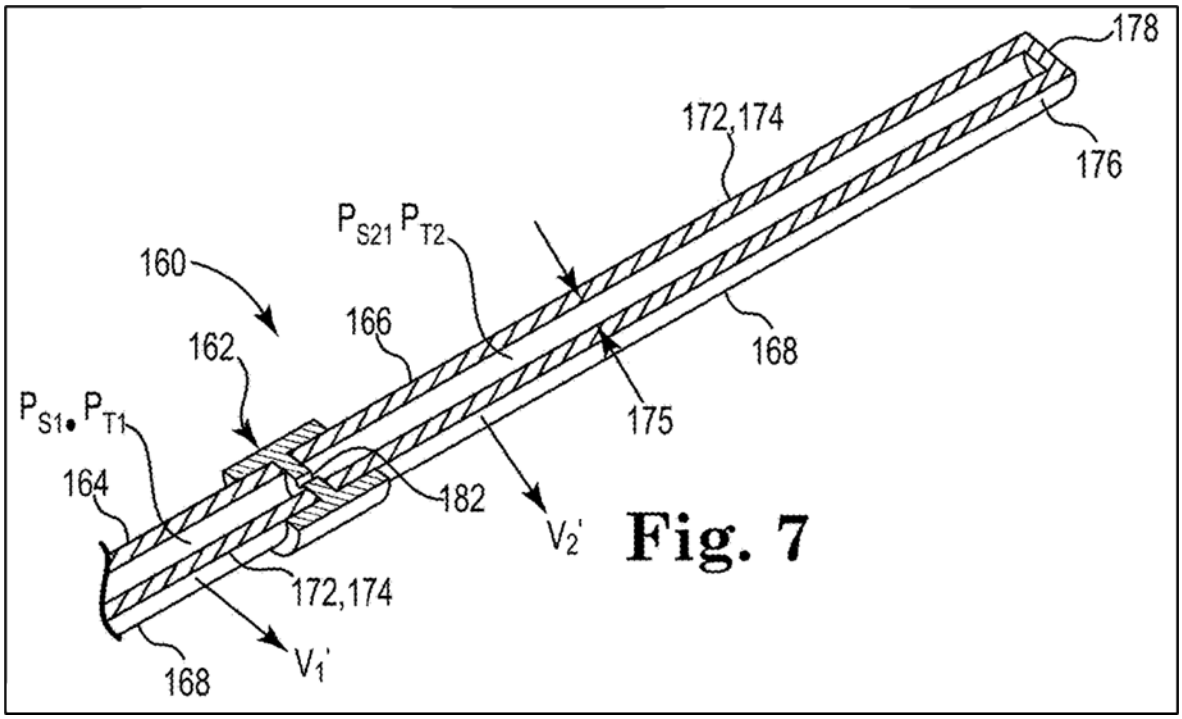


Fig. 7

Ex1011, Fig. 7.

d. Claim 5: The gas diffusion device according to claim 1, wherein a shape of a horizontal cross section of the porous tube is an ellipsoid or an elongated narrow shape having a long axis and a short axis, or a circle having a diameter.

230. The Combined Smith Distribution System discloses Claim 5. For

example, the Combined Smith Distribution System discloses *a shape of a horizontal cross section of the porous tube is . . . a circle having a diameter*. For example, Figure 7 of Smith '517 teaches a circular tubular diffuser with a diffuser body 168 formed of a POREX porous polyethylene material" that "include[s] a nominal outer diameter of 1/2 in., [and] a nominal inner diameter of 0.29 in." Ex1011, 8:38-45. As I explain for claim 4, a POSITA would have been motivated to use such a tube with the buffering gas chamber and container in the Combined Smith Distribution System, with a reasonable expectation of success.

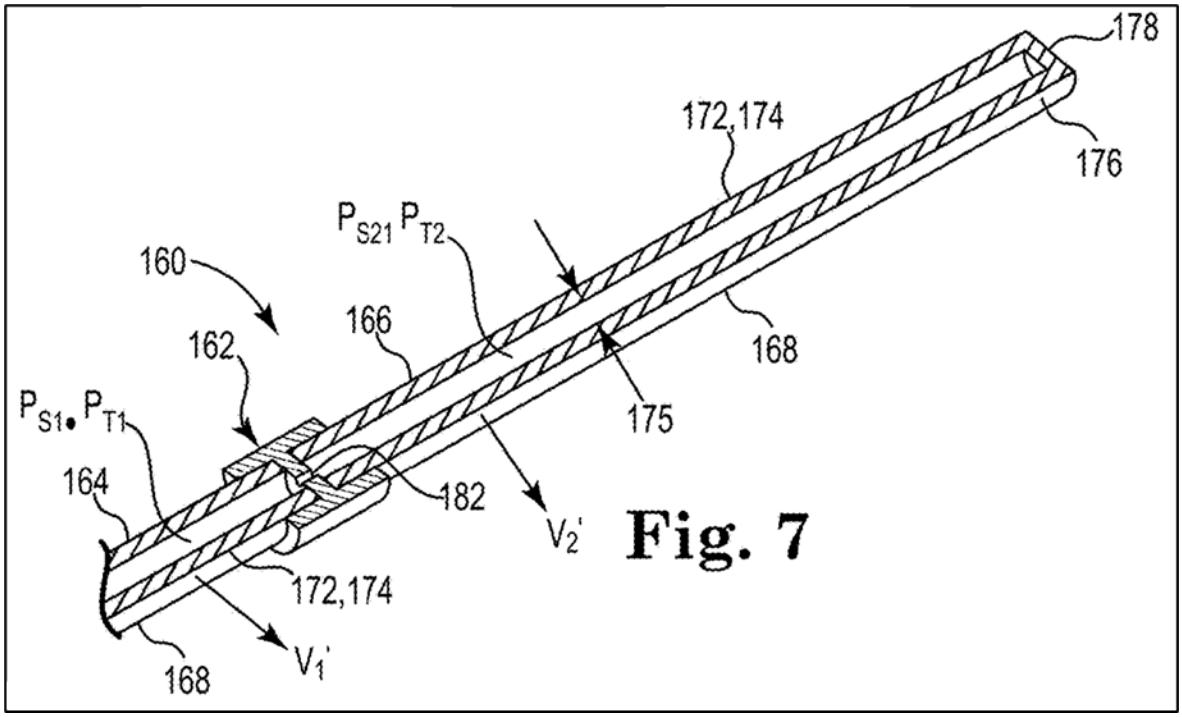


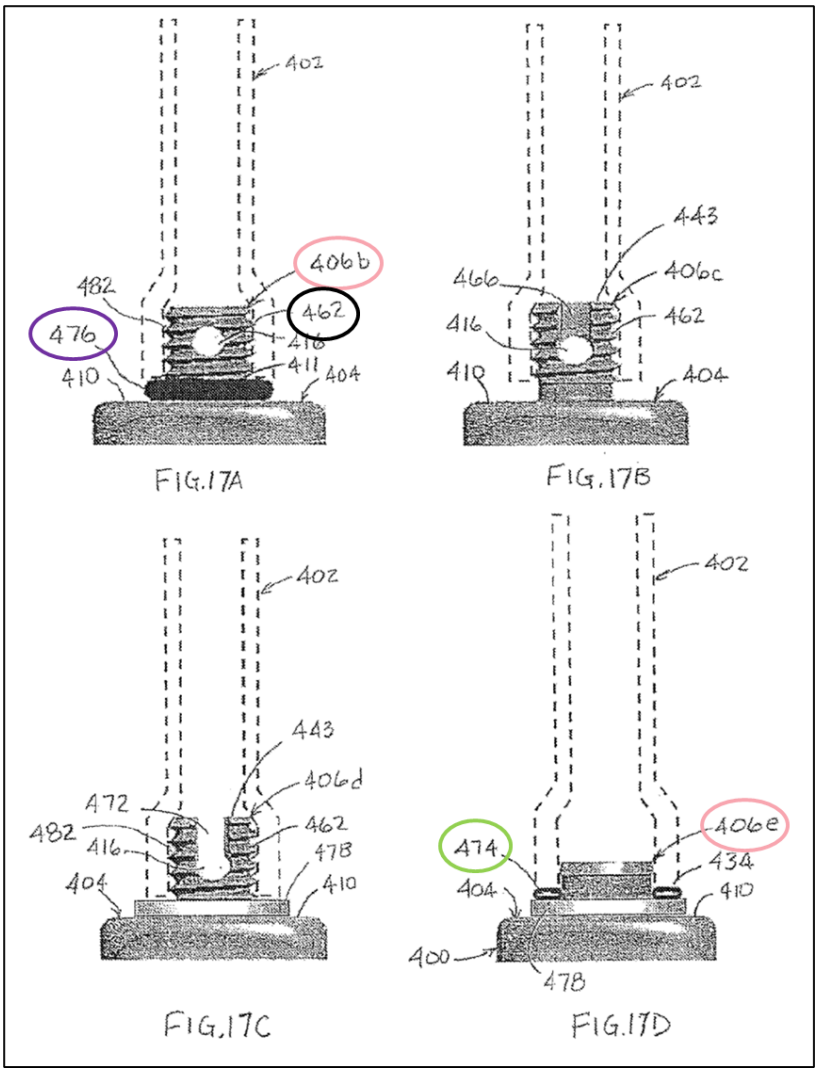
Fig. 7

Ex1011, Fig. 7; *see also id.,* figs. 5, 6, 9A, 9B, 11A-14C, 16B-19, and 21A-B.

e. Claim 6: The gas diffusion device according to claim 5, further comprising: a first collar, arranged in the open

end, the first collar located between the open end and the coupling structure.

231. The Combined Smith Distribution System discloses Claim 6. As shown in Figure 17A-D from Smith '517, it would have been obvious for the tubular diffuser to have *a first collar* [e.g., nipple 406b-e], *arranged in the open end* [e.g., open end of tubular diffusers], *the first collar* [e.g., nipple 406b-e] *located between the open end and the coupling structure* [e.g., coupling 522]. For example, as I described in §IX.C.1, the Combined Smith Distribution System includes coupling 522 from Smith '517's Figure 19, and it would have been obvious that this coupling structure can be implemented with a variety of known coupling mechanisms such as those depicted in Fig. 17A-17D (below). Ex1011, 15:7-31, Figs. 17A-17D. The coupling mechanism in Figs. 17A and 17D include nipple 406b-406e, which is *in the open end* of the tubular diffuser and would be *located between the open end and the coupling structure*—i.e., the portion of coupling 522 connecting to intake valve 518. *See* Ex1011, Fig. 19; §IX.C.1. A POSITA would have understand from the specification that being arranged both in the open end and between the open end and the coupling structure would imply that the first collar is both internal to the tubular diffuser and on the face of the diffuser.



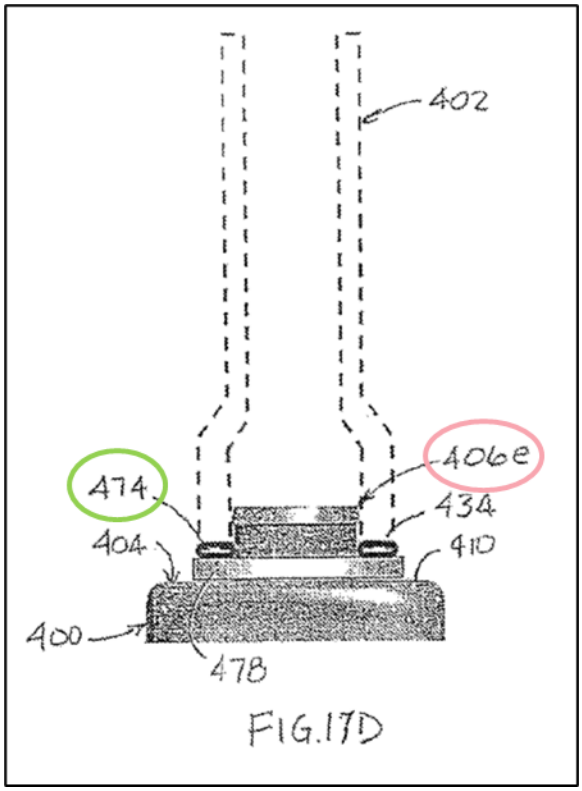
Ex1011, Fig. 17A-D (annotated).

f. Claim 7: The gas diffusion device according to claim 6, further comprising: a second collar, located between the first collar and the coupling structure when the second collar is disposed on the coupling structure so as to reinforce airtightness.

232. The Combined Smith Distribution System discloses Claim 7.

Specifically, as I described in §IX.C.1 and for claim 6, it would have been obvious for the Combined Smith Distribution System to have a *second collar* [e.g., weld

joint 474 (light green)], *located between the first collar* [e.g., nipple 406e (pink)] *and the coupling structure* [e.g., coupling 522] *when the second collar is disposed on the coupling structure so as to reinforce airtightness*.



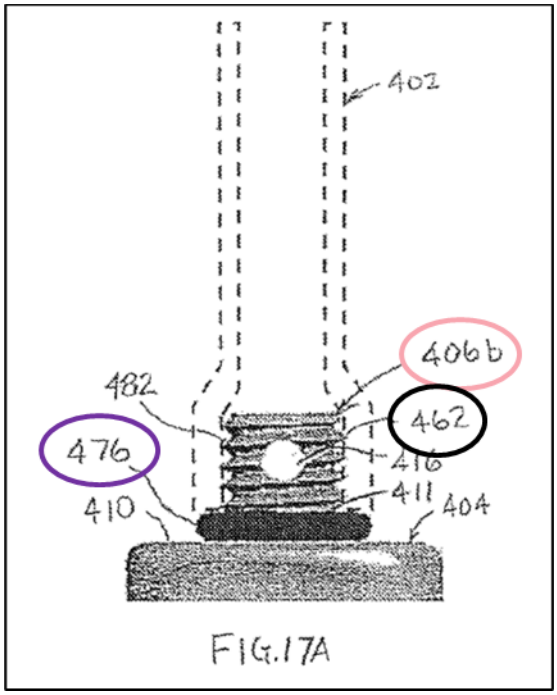
Ex1011, Fig. 17D (annotated).

233. As I described in §IX.C.1 and for claim 6, it would have been obvious for the Combined Smith Distribution System to implement the coupling structure in Fig. 17D. Figure 17D further discloses a "weld joint 474 [e.g., *second collar*] disposed between the proximal end 434 [e.g., *open end*]" of *the porous tube*, nipple 406e (pink), and the remainder of the *coupling structure*—i.e., the portion of coupling 522 connecting to intake valve 518. Ex1011, 15:29-31, Fig. 17D. A

POSITA would have understood that the welding structure reinforces *airtightness* and security of the coupling.

g. Claim 8: The gas diffusion device according to claim 6, wherein a material of the first collar is softer than a material of the porous tube to prevent breaking of the open end.

234. The Combined Smith Distribution System discloses Claim 8. Specifically, as I described in §IX.C.1 and for claim 6, it would have been obvious for the Combined Smith Distribution System to have *a material* [e.g., O-ring 476 (purple)] *of the first collar* [e.g., nipple 406b (pink)] that *is softer than a material of the porous tube to prevent breaking of the open end*.



Ex1011, Fig. 17A (annotated).

235. As I described in §IX.C.1 and for claim 6, it would have been obvious

for the Combined Smith Distribution System to implement the coupling structure in Fig. 17A. For example, it would have been obvious to a POSITA that the connection would include "O-ring 476 mounted at the base of the nipple 406b" [e.g., *first collar*]. Ex1011, 16:16-18. This may be required in situations where the porous diffuser lacks the matching external threads and has internal threads instead.

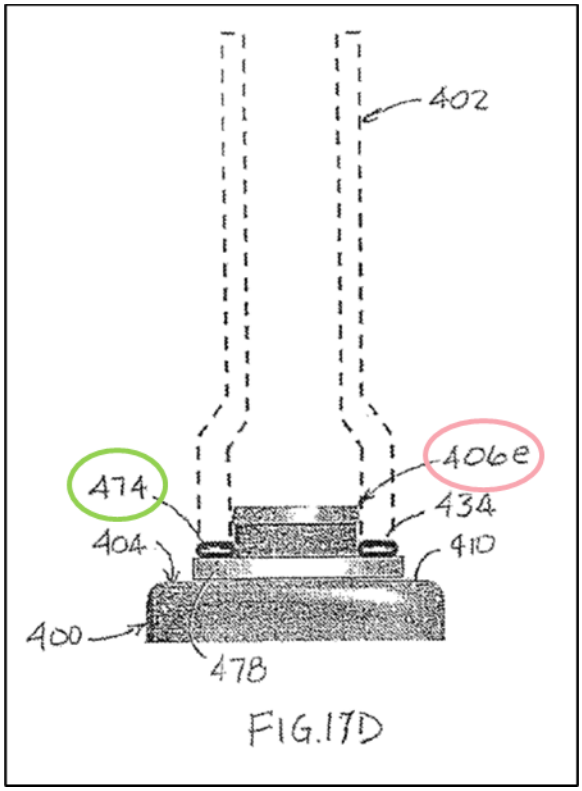
236. Additionally, it would also have been obvious to a POSITA based on the disclosures of Smith '517 that an O-ring is made of a softer material than the material used for the *porous tube*. Indeed, Smith '517 explains that "O-ring 476 can also be compressed between the proximal end 434" of *the porous tubes* and *the coupling structure*. Ex1011, 16:18-24. A POSITA would have understood that compressibility indicates that the compressed material (e.g., the O-ring) is softer than the material doing the compressing (e.g., the porous tube and coupling structure). Further, a POSITA would have known that a softer material such as bronze, or even an O-ring are typically used at one end of a fitting to ensure a better seal.

237. Additionally, slot 472 in Figure 17C would indicate that the nipple structure is more flexible, and thus, effectively softer, than the surrounding material. Ex1011, 15:24-26. A POSITA would have understood that, although the material itself might not be softer, the effect of adding the slot achieves the same

effect.

h. Claim 9: The gas diffusion device according to claim 7, wherein the second collar and the porous tube are sintered or bonded into an integral structure to prevent breaking of the open end.

238. The Combined Smith Distribution System discloses Claim 9. Specifically, as I described in §IX.C.1 and for claim 7, it would have been obvious for the Combined Smith Distribution System to have *a second collar* [e.g., weld joint 474] that bonds to *the open end of the porous tube*. Ex1011, 15:29-31, Fig. 17D. Item 474 is described as being bonded to the porous tube. *See* Ex1011, 16:6-16.



Ex1011, Fig. 17D.

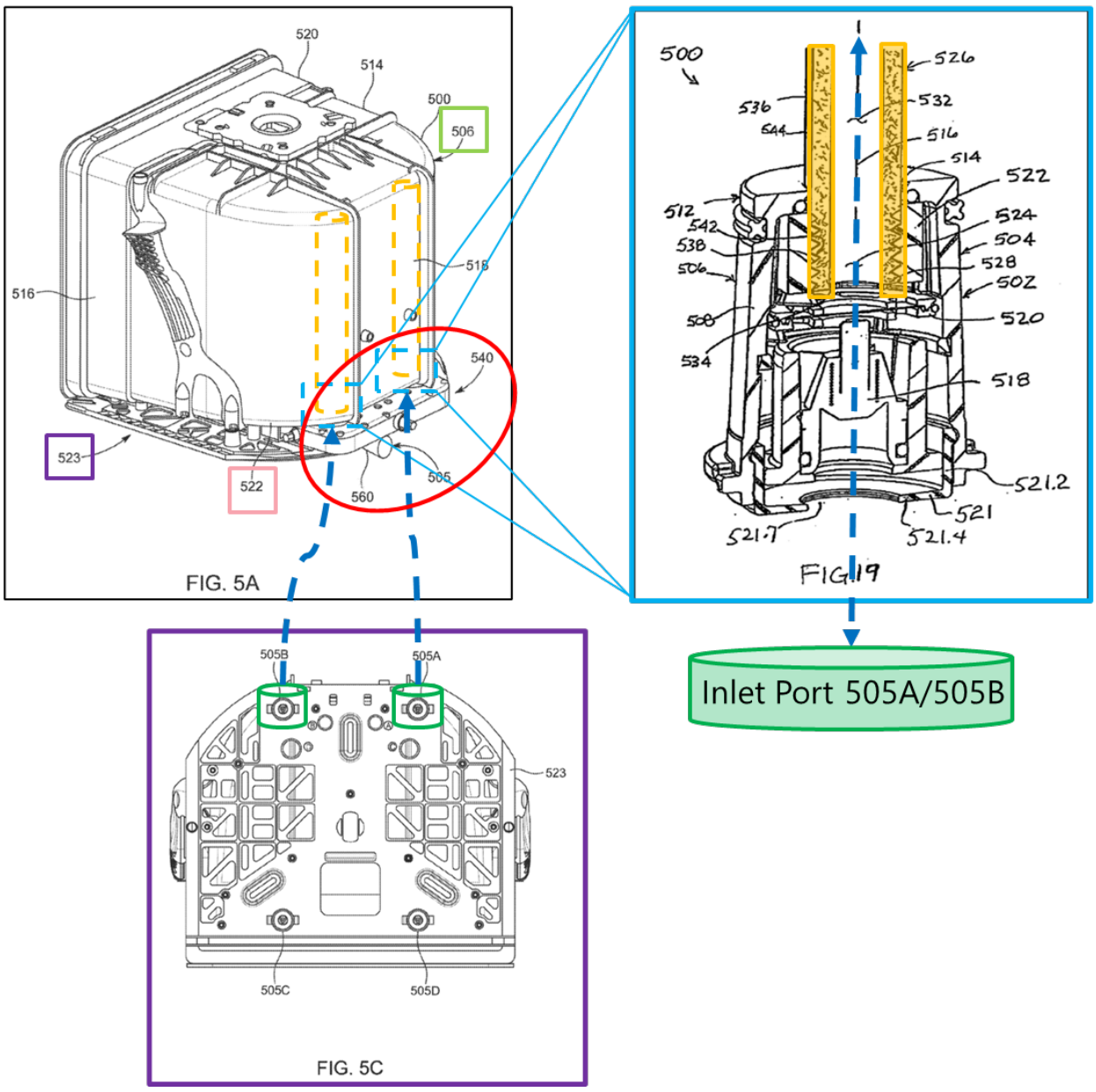
i. Claim 12: The gas diffusion device according to claim 1, further comprising: at least one gas intake module, communicatively coupled to the buffering gas chamber, the gas intake module having the gas intake center axis, supplying the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber.

239. The Combined Smith Distribution System discloses Claim 12. Specifically, as I described in §IX.C.1 and for claim 1, the Combined Smith Distribution System has:

- *at least one gas intake channel* [e.g., inlet supply ports 505A or 505B (green)] *communicatively coupled to the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red)] as I described for limitation 1[a][3];
- *the gas intake module* [e.g., inlet supply ports 505A or 505B, green] *having the gas intake center axis* [e.g., concentric with the central axis 516 (blue dashed line on right, below)] as I described for limitation 1[b][2];
- The gas intake *suppl[ies] the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber*. For example, Smith '154 describes the gas intake channels as "inlet" ports connected to the purge flow distribution system 540. Ex1008 ¶ 53. Based on the configuration of inlet supply ports 505A/B (green), a POSITA would have understood that the most efficient means of supplying gas from *the gas*

intake module would be to pass *through the gas intake channel and enter the buffering gas chamber* in *one single air intake direction* because it entails using the same structure disclosed by Smith ’154 without the need for additional piping or other connections between the gas intake module and the buffering gas chamber. §IX.A.1.c; Ex1008 ¶53

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated); *see also* Ex1008 Fig. 3B.

1. **<u>Independent Claim 13</u>**

a. 13[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas

diffusion device comprising:

240. To the extent the preamble is limiting, the Combined Smith Distribution System renders limitation 13[pre] obvious for the same reasons discussed with respect to limitation 1[pre]. *Supra* §IX.C.2.a.

b. 13[a][1]: a gas cartridge, configured at a bottom portion of the wafer container to define a buffering gas chamber,

13[a][2]: the bottom portion provided with at least two coupling structures, each of the coupling structures defining a through channel having a center axis,

13[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and

241. The Combined Smith Distribution System discloses limitations 13[a][1]-[3]. Limitations 13[a][1]-[3] are nearly identical to limitations 1[a][1]-[3], with the exceptions of the term "a gas cartridge" and the disclosure of a second coupling structure. As discussed previously, it is my opinion that the Combined Smith Distribution System discloses limitation 1[a][1]-[3] as well as a second coupling structure. *Supra* §§IX.C.2.b-IX.C.2.d. Moreover, as discussed for Grounds 1-2, it is my opinion that the purge flow distribution system 540 in Smith '154 is a "gas cartridge."

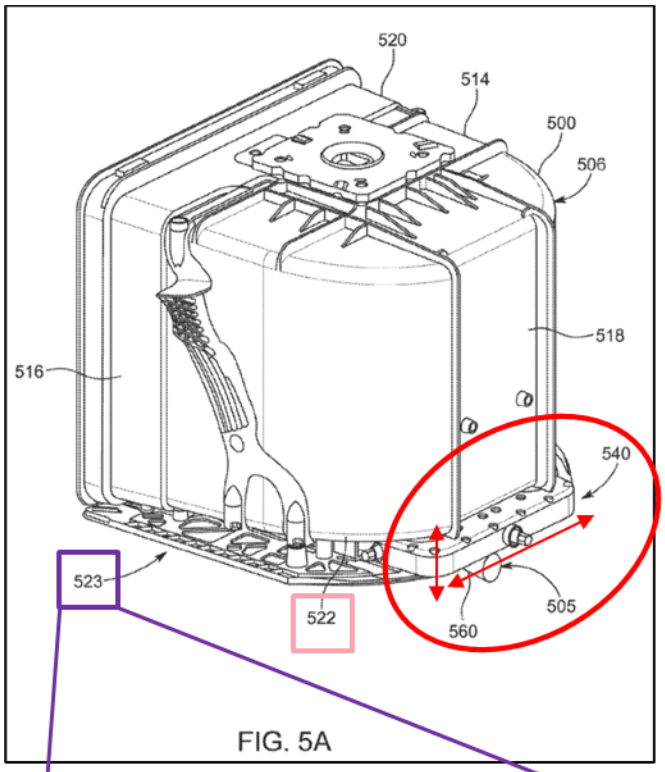


FIG. 5A

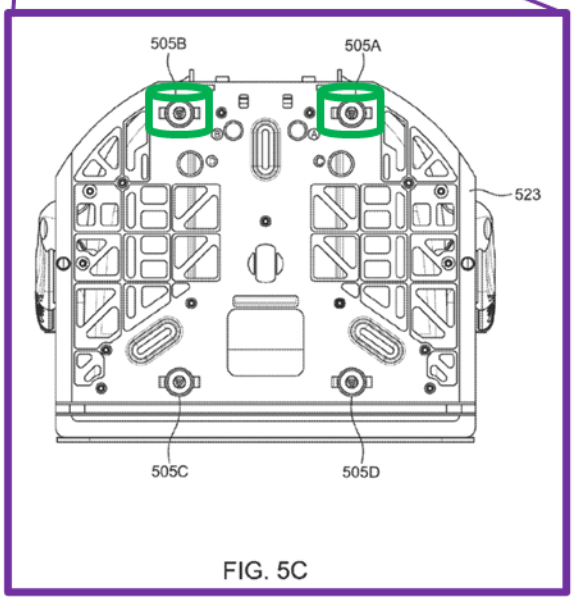


FIG. 5C

Ex1008, Figs. 5A, 5C (annotated).

242. The purge flow distribution system is a gas cartridge. It is a buffering gas chamber, as described in claim 23, with a structure having a sidewall between a bottom portion of shell 522 and bottom portion of buffering gas chamber 540, as

depicted in Fig. 5A. This is consistent with the description of a "gas cartridge" in the '711 Patent. *See* Ex1001, 13:49-52 ("The gas cartridge (90) consists of a bottom portion (91), a sidewall 50 (92) extending from the bottom portion (91) and the bottom portion (201) of the shell (21)."). Moreover, the bottom portion of the purge flow distribution system 540 has gas intake channels formed thereon: "The purge flow distribution system 540 is connected to at least one inlet port 505 that is connected to a purge gas supply system for supplying the purge gas to the network of separate gas distributing devices." Ex1008 ¶ 49. For example, as shown in Fig. 5C above, gas intake channels supply purge gas to the manifold 560 of the gas cartridge 540. Ex1008 ¶ 53.

243. I note that the gas cartridge in the '711 Patent is detachable. To the extent Patent Owner argues that a gas cartridge must be detachable, that would have been obvious. The Combined Smith Distribution System is intended to be implemented as a retrofitting kit. *Supra* § IX.C.1. As such, the retrofitted gas cartridge would be easy to install in a detachable manner as it could not, by definition, be a molded portion of the container.

244. Further, a POSITA would have constructed separate structures attached to a wafer container, such as purge flow distribution system 540, as detachable elements for maintenance, replacement, and cleaning. The benefits and implementation of detachable elements were well known in the art by 2021. For

example, Eggum, which also describes a wafer container and is analogous art to the ’711 Patent and Smith ’154, specifically discloses a detachable base: “[p]urge connectors and modules for a substrate container” “including a plate, a shell, a connector and a seal, where the connector is threaded and secured via a nut.” Ex1013, (54); Abstract. Eggum discloses that this connectivity enables a “removable purge module.” *Id.* A POSITA would have been motivated to use the same teachings and connectors with the purge flow distribution system of Smith ’154, with a reasonable expectation of success, using the same threaded connector mechanism.

c. 13[b]: at least two porous tubes, each of the porous tubes having a longitudinal space, the at least two porous tubes respectively installed to corresponding coupling structures of the wafer container, the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the at least two porous tubes and enter the accommodating space.

245. The Combined Smith Distribution System discloses limitation 13[b] for the same reasons discussed with respect to limitation 1[b][1]. *Supra* §IX.C.2.e.

2. <u>Dependent Claims 14-21</u>

a. Claim 14: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the

porous tubes, the center axis of the longitudinal space of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial.

246. The Combined Smith Distribution System discloses Claim 14 for the same reasons discussed with respect to Claims 2 and 13. *Supra* §IX.C.3.a. Claim 14 is similar to claim 2, except claim 14 requires multiple coupling structures with through channels, each of which is coaxial with the center axis of the open ends and the longitudinal space and the center axis of the gas intake. As described above, the Combined Smith Distribution System has multiple couplings with through channels, and each is coaxial with the claimed elements. §IX.C.3.a.

b. Claim 15: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial; the center axis of the longitudinal space of each of the porous tubes is offset from the center axis of the through channel, the center axis of the open end of the porous tube and the gas intake center axis.

247. The Combined Smith Distribution System discloses Claim 15 for the same reasons discussed with respect to Claims 3 and 13. *Supra* §IX.C.3.b. Claim 15 is similar to claim 3, except claim 15 requires multiple coupling structures with through channels, each of which is coaxial with the center axis of the open ends and the center axis of the gas intake, but offset from the longitudinal space. As

described above, the Combined Smith Distribution System has multiple couplings with through channels, and it would have been obvious to further modify it to have the configuration of claim 15. §IX.C.3.b.

c. Claim 16: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tube has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, and the center axis of the longitudinal space of each of the porous tubes are coaxial; a position of a gas intake center axis along which the gas passes is offset from the center axis of the through channel, the center axis of the open end and the center axis of the longitudinal space that are coaxial.

248. The Combined Smith Distribution System renders obvious Claim 16. Specifically, the Combined Smith Distribution System has:

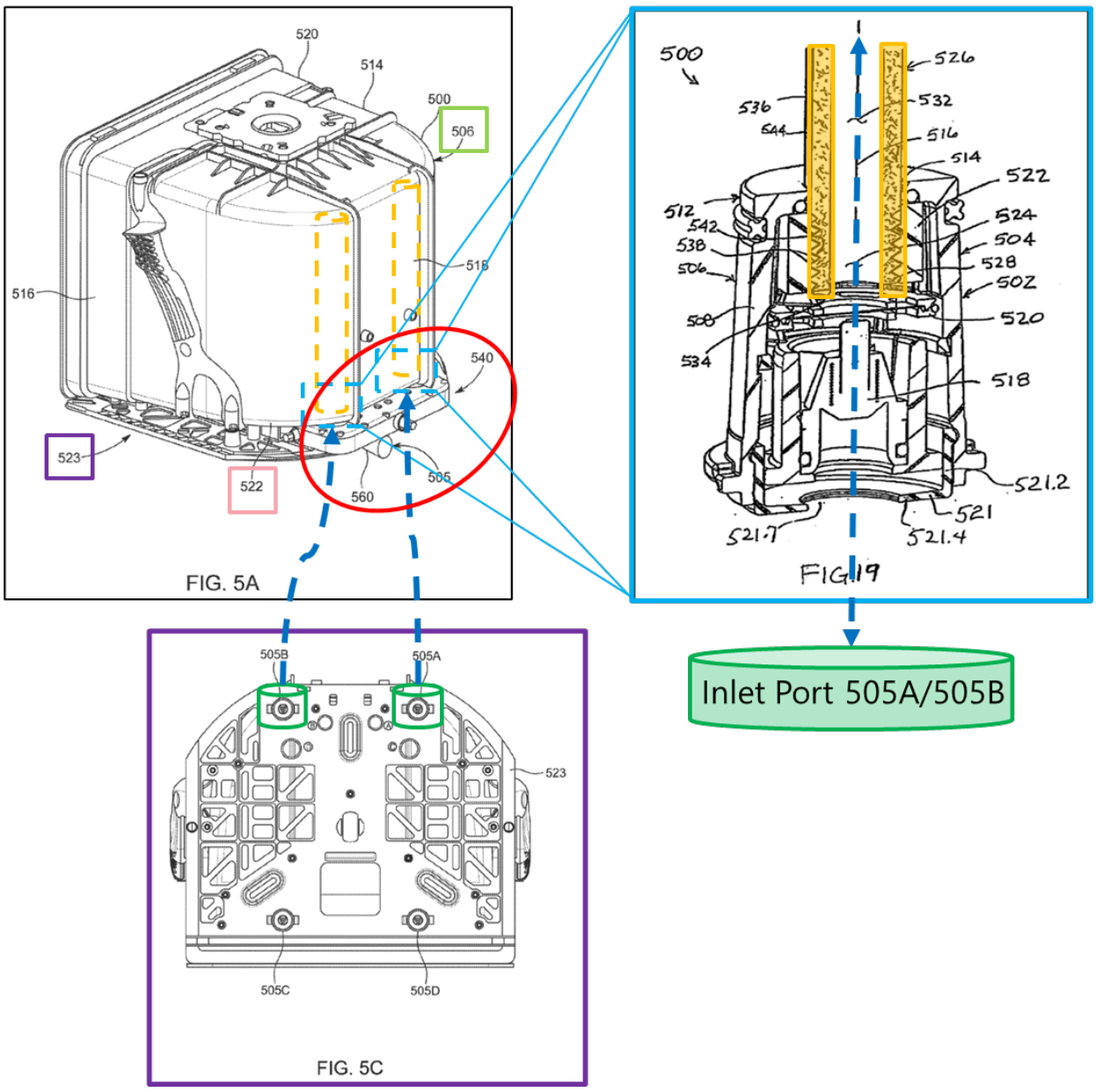
- *at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tube has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, and the center axis of the longitudinal space of each of the porous tubes are coaxial*, for the reasons I described for claim 14; (§IX.C.2.a)

249. Regarding the requirement of claim 16 that a position of a gas intake

center axis along which the gas passes is offset from the center axis of the through channel, the center axis of the open end and the center axis of the longitudinal space that are coaxial, the Combined Smith Distribution System does not expressly disclose a configuration in which the gas intake center axis is offset from the center axis of the through channel and open space/longitudinal space of the diffuser. But that configuration would have been obvious to a POSITA.

250. The claimed configuration would be met by the Combined Smith Distribution System if elements 505A and 505B (below green) were radially offset slightly from their locations shown below in any direction.

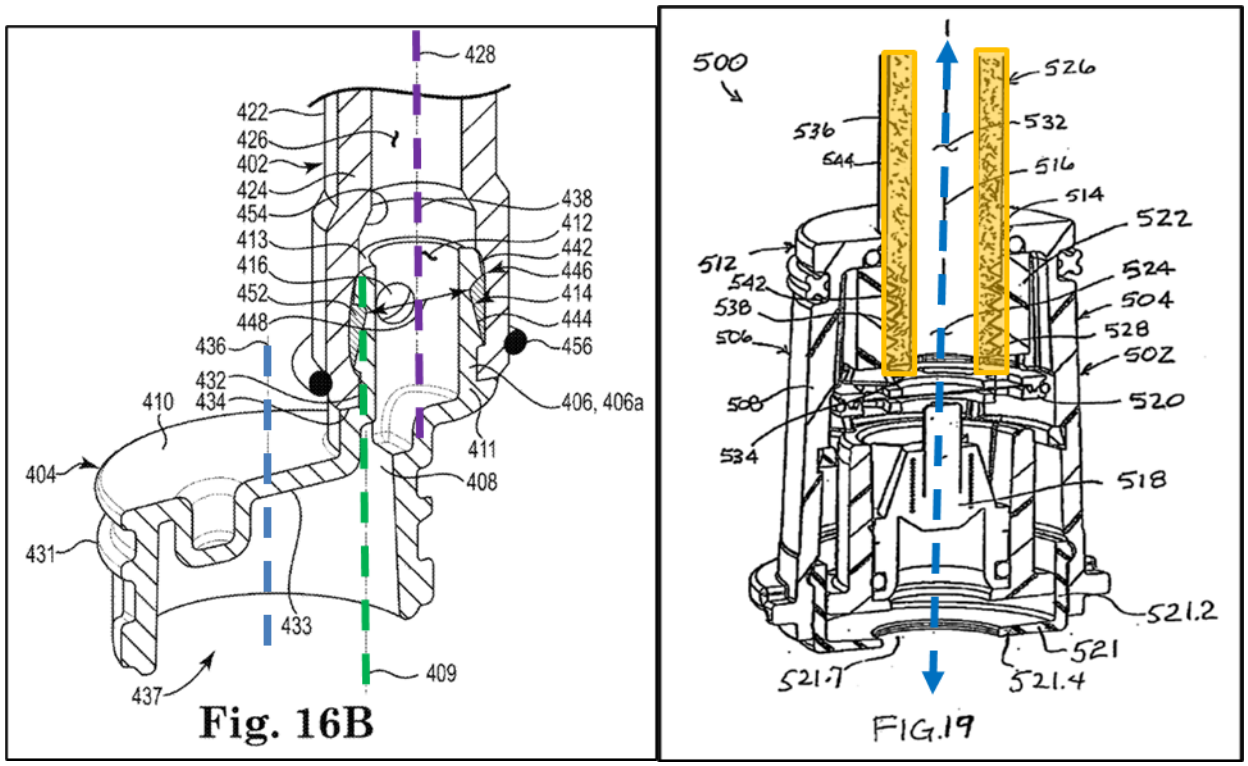
Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

251. A POSITA would have been motivated to implement such an offset when retrofitting a wafer container to add a purge flow distribution system, as described in this Ground. As I described, for example, the alignment of elements in

a wafer container is largely motivated by the existing position of inlet ports in an existing container that must be retrofit to accommodate the purge flow distribution system. *See* §IX.C.1. If the base plate in the existing wafer contained inlet ports slightly offset from tubular diffusers, then the retrofit system would include the same offset. A POSITA would have understood that such offset alignments were well known. Smith '517 for example discloses that a tubular diffuser (purple dashed line) can be radially offset from an inlet port (blue dashed line).



Ex1011, Figs. 16B (annotated) and 19 (annotated).

252. In view of these disclosures, a POSITA would have recognized, with a reasonable expectation of success, that the Combined Smith Distribution System would have accommodated an input port (505A/B) offset from the coupling and

tubular diffuser. Indeed, a main point of Smith ’517 is that the existing mechanical configuration in a wafer container can be retrofitted in a variety of ways using the flexible couplings disclosed in that patent.

d. Claim 17: The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels and the center axis of the open end of each of the porous tubes are coaxial; a gas intake center axis along which the gas passes and the center axis of the longitudinal space are both offset from the center axis of the through channel and the center axis of the open end that are coaxial.

253. The Combined Smith Distribution System renders obvious Claim 17. For example, the Combined Smith Distribution System has:

- *at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels and the center axis of the open end of each of the porous tubes are coaxial*, for the reasons described for claim 14. *Supra* §IX.C.2.a.

254. Moreover the Combined Smith Distribution System renders obvious:

- *a gas intake center axis along which the gas passes is offset from the center axis of the through channel and the center axis of the open end that are*

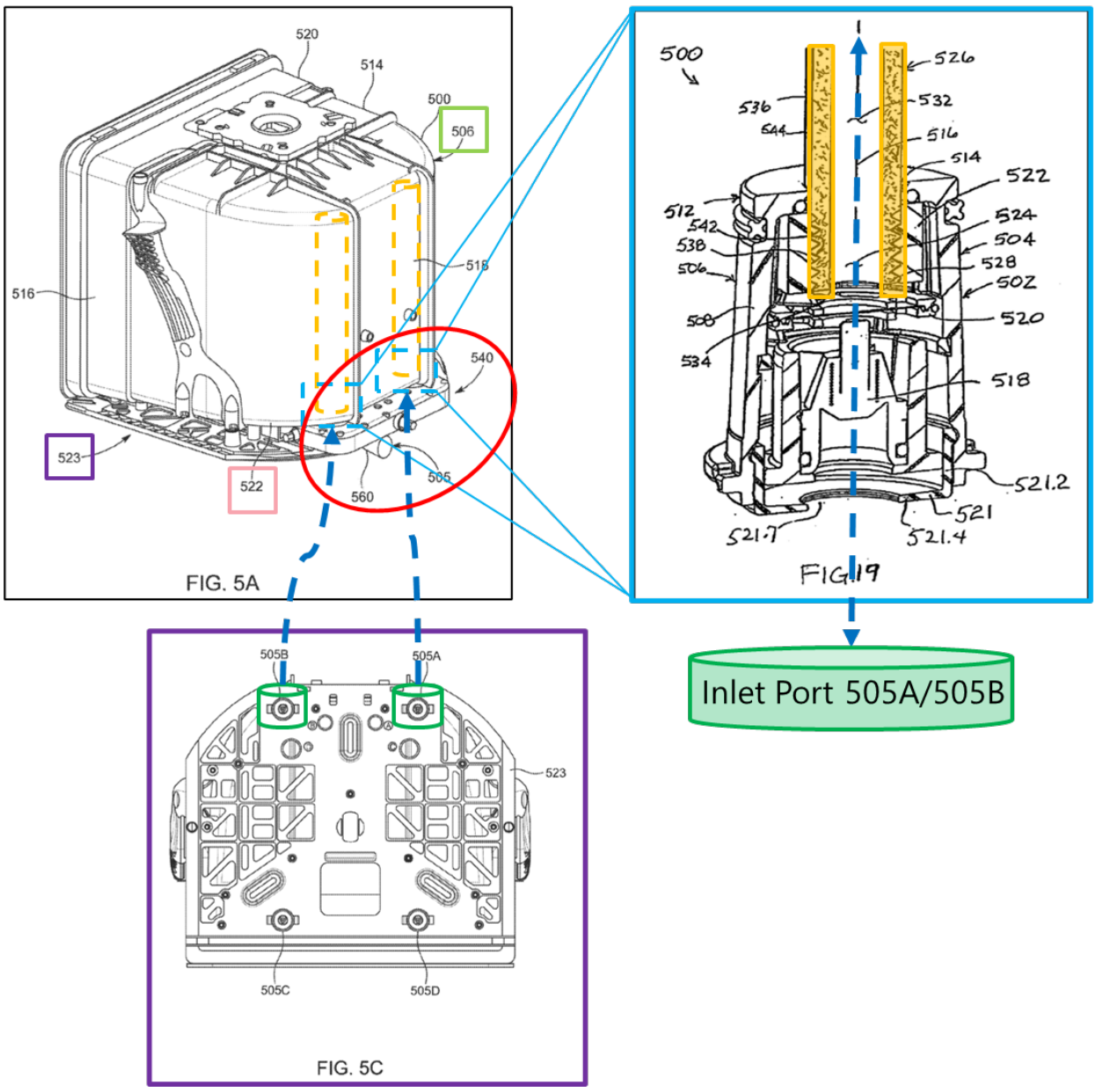
coaxial, for the reasons described for Claim 16; (*supra* §IX.C.2.c) and

- *the center axis of the longitudinal space is offset from the center axis of the through channel and the center axis of the open end that are coaxial*, for the reasons described for Claim 15. *Supra* §IX.C.3.b.

e. Claim 18: The gas diffusion device according to claim 13, wherein the gas cartridge has a bottom portion and a sidewall extending from the bottom portion, and the gas intake channel is formed at the bottom portion of the gas cartridge.

255. The Combined Smith Distribution System discloses claim 18. The *gas cartridge has a bottom portion and a sidewall extending from the bottom portion,* [*e.g.*, bottom portion and sidewall of purge flow distribution system 540 with manifold base 560 (red)], *and the gas intake channel is formed at the bottom portion of the gas cartridge* [e.g., bottom portion of purge flow distribution system 540 has inlet ports, e.g., 505A-D (green below)], for the same reasons described for Grounds 1-2, claim 18. *Supra* §IX.A.4.a.

Combined Smith Distribution System



Ex1008, Figs. 5A, 5C (annotated); Ex1011, Fig. 19 (annotated).

f. Claim 19: The gas diffusion device according to claim 13, wherein the gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber.

256. The Combined Smith Distribution System discloses Claim 19. The *gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold 560 installed at the bottom portion 522/422 of shell 506/406 to define the buffering chamber], for the same reasons described above and for Grounds 1-2, claims 18-19. *Supra* §IX.C.2.e and §§IX.A.4.a-IX.A.4.b.

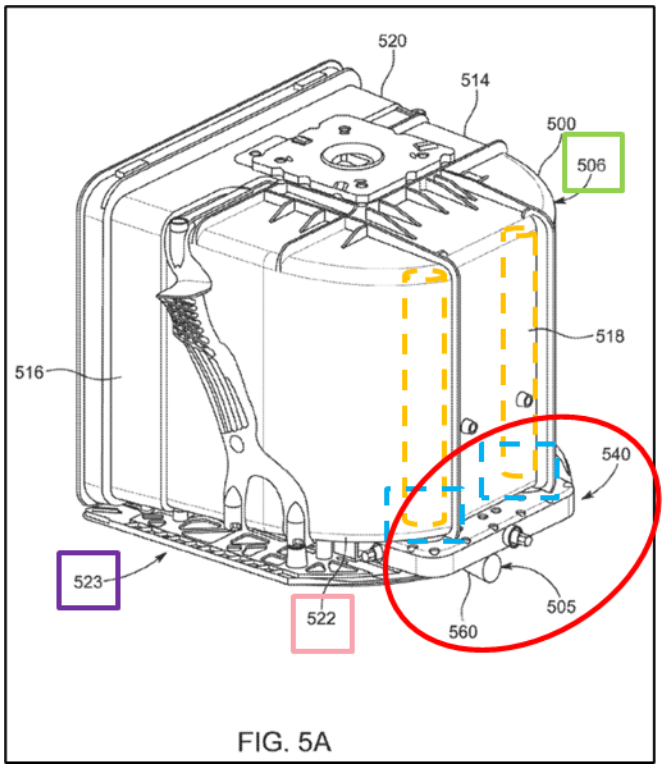
g. Claim 20: The gas diffusion device according to claim 13, wherein a plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber.

257. The Combined Smith Distribution System discloses Claim 20. First, the Combined Smith Distribution System renders obvious *plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis*, for the same reason described regarding the gas cartridge in Ground 1, claim 28. §IX.A.2.d. Second, *the gas intake module has the gas intake center axis; the*

installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber, for the same reasons described for claim 12. §IX.C.3.i.

h. Claim 21: The gas diffusion device according to claim 13, wherein the wafer container comprises a base plate installed at the bottom portion of the wafer container, and the buffer gas chamber is between the bottom portion and the base plate of the wafer container.

258. The Combined Smith Distribution System discloses Claim 21. Specifically, as I described in §IX.C.1, the Combined Smith Distribution System, as shown in Figure 5A, has *a base plate* [e.g., carrier plate 523 (purple square)], *connected below the shell to support the shell* [e.g., shell 506/406]*; wherein the buffering gas chamber* [e.g., purge flow distribution system 540 with manifold base 560 (red) from Smith '154] *is between the bottom portion* [e.g., bottom wall 522/422 (pink square)] *and the base plate of the shell* [e.g., carrier plate 523 (purple square)].



Ex1008, Fig. 5A (annotated).

3. Independent Claim 23

a. 23[pre]: A wafer container, comprising:

259. To the extent the preamble is limiting, it is my opinion that the Combined Smith Distribution discloses 23[pre]. Specifically, as I described in §IX.C.1 and for limitation 1[pre], the Combined Smith Distribution System includes *a wafer container* [e.g., substrate container with shell 506/406].

b. 23[a]: a shell, comprising a bottom portion, the bottom portion configured with a plurality of coupling structures, the coupling structures defining a plurality of through channels;

260. The Combined Smith Distribution System discloses limitation 23[a]. Specifically, as I described for §IX.C.1 and for limitation 1[a][2], the Combined

Smith Distribution System includes *a shell* [e.g., shell 506/406], *comprising a bottom portion* [e.g., bottom wall 522/422], *the bottom portion configured with a plurality of coupling structures* [e.g., couplings 522 from Smith '517], *the coupling structures defining a plurality of through channels* [e.g., flow paths along center axis 516 (blue dashed line) for each coupling structure]. *Supra* §IX.C.2.c.

c. 23[b]: a buffering gas chamber, formed below the bottom portion, the buffering gas chamber having a plurality of gas intake channels, the gas intake channels communicating with the corresponding through channels; and

261. The Combined Smith Distribution System discloses limitation 23[b]. Specifically, as I described in §IX.C.1 and for limitations 1[a][1] and 1[a][3], the Combined Smith Distribution System has *a buffering gas chamber* [e.g., purge flow distribution system 540, with manifold base 560 from Smith '154], *formed below the bottom portion* [e.g., bottom wall 522/422 from Smith '154], *the buffering gas chamber having a plurality of gas intake channels* [e.g., inlet supply ports 505A and B], *the gas intake channels communicating with the corresponding through channels* [e.g., communicating flow paths along center axis 516 in Smith '517]. *Supra* §§IX.C.2.b, IX.C.2.d.

d. 23[c]: a plurality of porous tubes, each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the porous tubes and enter an

accommodating space of the shell.

262. The Combined Smith Distribution System discloses limitation 23[c]. Specifically, as I described in §IX.C.1 and for limitation 1[b][1] and claim 2, the Combined Smith Distribution System has *a plurality of porous tubes* [e.g., tubular diffusers 450A/450B or 550A/550B], *each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion* [e.g., tubular diffusers 450A/450B or 550A/550B have open ends connected to couplings 522] *and communicating with the buffering gas chamber* [e.g., purge flow distribution system 540, with manifold base 560] *via the corresponding through channel* [e.g., corresponding flow path along each center axis 516], *allowing a gas to pass through the porous tubes and enter an accommodating space of the shell* [e.g., interior of the container shell 506/406]. *Supra* §§IX.C.2.e, IX.C.3.a. Whether the claim term "correspondingly connecting" means fluidly connected or directly or physically connected, the open end of each of the tubular diffusers 450A/450B or 550A/550B are correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the tubular diffusers and enter an accommodating space of the shell. Ex1008 ¶¶ 48-53, Figs 5A-5C.

4. <u>Dependent Claims 24-28, and 30</u>

a. Claim 24: The wafer container according to claim 23, wherein the porous tube has a longitudinal space, the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber is capable of passing through the open end to enter the longitudinal space.

263. The Combined Smith Distribution System discloses Claim 24. Specifically, as I described in §IX.C.1 and for claim 4, in the Combined Smith Distribution System, *the porous tube* [e.g., tubular diffusers 450A/450B or 550A/550B (orange)] *has a longitudinal space* [e.g., internal space (shaded)], *the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber* [e.g., purge flow distribution system 540, with manifold base 560 from Smith '154] *is capable of passing through* [e.g., via flow path along center axis 516 in Smith '517] *the open end to enter the longitudinal space* [e.g., internal space (shaded)].

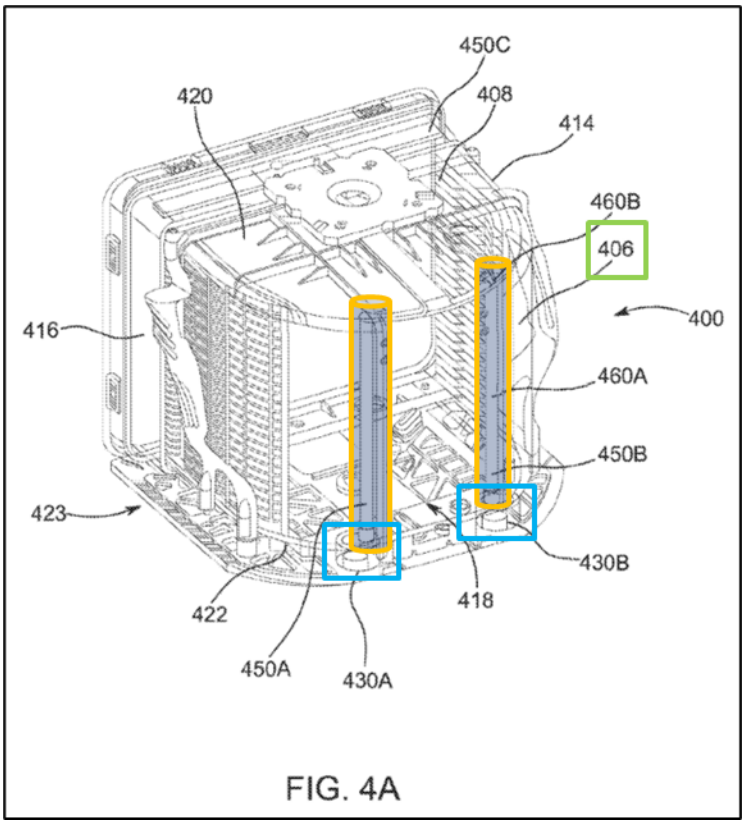


FIG. 4A

Ex1008, Fig. 4A (annotated).

b. Claim 25: The wafer container according to claim 23, further comprising: a collar, arranged between the open end and the coupling structure, a material of the collar being softer than a material of the porous tube to prevent breaking of the open end.

264. The Combined Smith Distribution System discloses Claim 25. Specifically, as I described in §IX.C.1 and for claims 6 and 8, the Combined Smith Distribution System has *a collar* [e.g., nipple 406b-e], *arranged between the open end and the coupling structure* [e.g., coupling 522] *a material* [e.g., O-ring 476] *of the collar* [e.g., nipple 406b-e] *being softer than a material of the porous tube* [e.g., tubular diffusers 450A/450B or 550A/550B] *to prevent breaking of the open*

end. *Supra* §§IX.C.3.e, IX.C.3.g.

c. Claim 26: The wafer container according to claim 23, further comprising: a gas cartridge, having a bottom portion and a sidewall extending from the bottom portion, the bottom portion of the gas cartridge having the gas intake channels formed thereon.

265. The Combined Smith Distribution System discloses Claim 26 for the same reasons discussed with respect to Claims 13, 18 and 23. *Supra* §§IX.C.1, IX.C.2.e, and IX.C.3.

d. Claim 27: The wafer container according to claim 26, wherein the gas cartridge is installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber.

266. The Combined Smith Distribution System discloses Claim 27 for the same reasons discussed with respect to Claims 19 and 26. *Supra* §§IX.C.2.f, IX.C.4.c.

e. Claim 28: The wafer container according to claim 26, wherein a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module.

267. The Combined Smith Distribution System discloses Claim 28 for the same reasons discussed with respect to Claims 20 and 26. *Supra* §§IX.C.2.g, IX.C.4.c.

f. Claim 30: The wafer container according to claim 23, further comprising: a base plate, connected below the shell

to support the shell; wherein the buffering gas chamber is between the bottom portion and the base plate of the shell.

268. The Combined Smith Distribution System discloses Claim 30 for the same reasons as Claim 21. *Supra* §IX.C.2.h.

D. Ground 5: Obviousness of Claims 1-31 in View of Ground 4 in further view of Ogawa

269. Ground 4 demonstrated that Smith ’517 and Smith ’154 render obvious claims 1-9, 12, 13-21, 23-28, and 30. Dependent claims 10-11, 22, 29, and 31, are further rendered obvious with Ogawa.

1. Motivation to Combine Ground 4 with Ogawa

270. A POSITA would be motivated to combine Ground 4 with Ogawa for the same reasons discussed with respect to Ground 2 in view of Ogawa combination and would have the same reasonable expectation of success. *Supra* §IX.B.1. Nothing about the Ground 4 system combination changes the relevant teachings or POSITA understandings from Ground 2 or from Ogawa.

2. Claim 10: The gas diffusion device according to claim 8, wherein the coupling structure, the porous tube, the first collar and/or the second collar are/is made of a thermal resistant material which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.

271. As discussed previously, the Combined Smith Distribution System renders Claim 1 obvious. *Supra* §IX.C.2. In addition, for the same reasons discussed with respect to Ground 3, claim 29, and Ground 4, claim 2, the

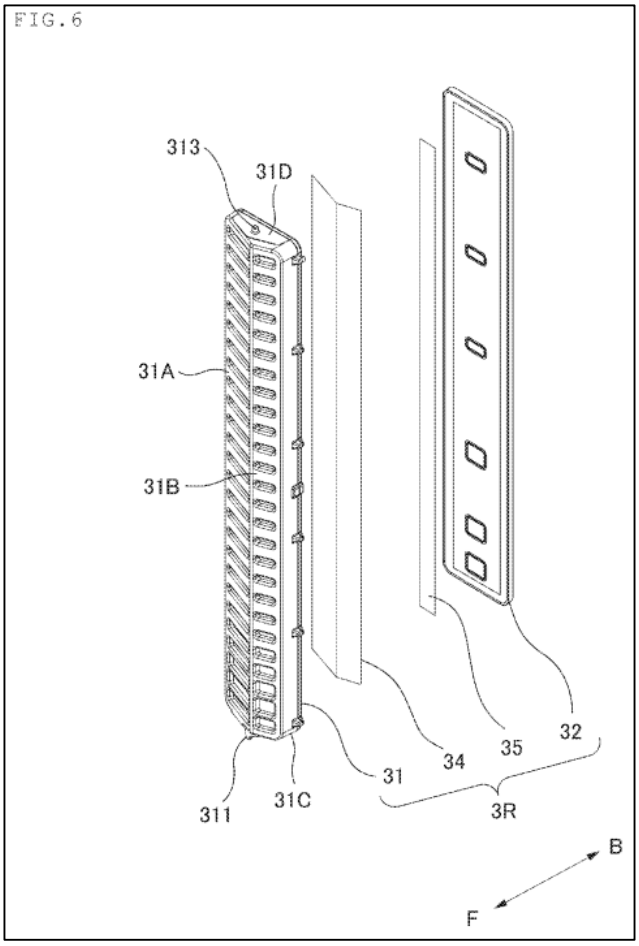
Combined Smith Distribution System in view of Ogawa renders obvious Claim 10. *Supra* §§IX.B.2, IX.C.3.a. For example, when *the coupling structure is formed as extending from the bottom portion of the wafer container* as discussed for Ground 4, Claim 2, a POSITA would understand that the same material used for the wafer container (e.g., PEEK) would also be used to form the coupling structure. §§IX.B.2, IX.C.3.a.

3. Claim 11: The gas diffusion device according to claim 1, further comprising: an airflow guiding member, arranged adjacent to one side of the porous tube, the airflow guiding member configured to adjust an airflow direction of the gas entering the accommodating space.

272. As discussed previously, the Combined Smith Distribution System renders Claim 1 obvious. *Supra* §IX.C.2. In addition, the Combined Smith Distribution System in view of Ogawa discloses *an airflow guiding member* [e.g., housing member 31 and cover member 32 from Ogawa], *arranged adjacent to one side of the porous tube* [e.g., tubular diffusers 450A/450B or 550A/550B from Smith '154], *the airflow guiding member* [e.g., housing member 31 and cover member 32 from Ogawa] *configured to adjust an airflow direction of the gas entering the accommodating space* [e.g., interior of the container shell 506/406 from Smith '154].

273. For example, as shown in Figure 6, Ogawa discloses that "gas G passes through the filter members 34, 35, and is blown out from the first group

blowout holes 31a-z, [and] the second group blowout holes 32a–f . . . into the internal space of the container body 2." Ex1012, 9:15-20.



Ex1012, Fig. 6.

274. A POSITA would have understood that air permeable filter members 34/35 inside housing member 31 and cover member 32 taught by Ogawa are functional equivalents to the tubular diffusers 450A/450B or 550A/550B from Smith '154. *See* Ex1012, 9:8-20; Ex1008 ¶35. Additionally, Ogawa does not disclose the shape formed by the filter members. Thus, a POSITA would have understood that the use of tubular filter members would have been compatible with

Ogawa and could have been used as the air permeable filter members 34/35 in Ogawa. Therefore, combining housing member 31 and cover member 32 with tubular diffusers 450A/450B or 550A/550B would have had a reasonable likelihood of success.

275. In my opinion a POSITA would have been motivated to combine the teachings of Ogawa relating to the housing and cover member with the Combined Smith Distribution System with a reasonable expectation of success. A POSITA would have understood that using Ogawa's housing member 31 and cover member 32 to direct the gas entering the internal space of the substrate container of the Combined Smith Distribution System would have enabled efficient distribution of purge gas to the interior of the substrate container.

276. Indeed, Smith '517 provides the motivation and discusses the benefits of "direct[ing] the gaseous working fluid toward the opening 48" of the shell, but it does not explicitly disclose a method for ensuring the gas is consistently adjusted to accomplish this goal. Thus, a POSITA would be motivated to look to Ogawa when constructing the disclosed tubular diffusers to improve the effectiveness of the system by directing the gaseous working fluid toward the opening of the shell as taught by Smith '517.

277. It is my opinion that such a combination would have been well within the level of skill of a POSITA. Smith '517, Smith '154, and Ogawa are analogous

art to the '711 Patent. *Supra* §§IX.B.1, IX.C.1. A POSITA would have understood that Ogawa's techniques would be entirely complementary with the Combined Smith Distribution System. Thus, a POSITA would have had a reasonable expectation of success in combining the tubular diffusers of Ground 4 with Ogawa's housing member 31 and cover member 32. The straightforward combinations simply uses a known technique (e.g., Ogawa's housing member 31 and cover member 32) to improve a similar device (e.g., tubular diffusers of the Combined Smith Distribution System) in the same way, while providing predictable results.

4. Claim 22: The gas diffusion device according to claim 21, wherein the base plate is made of a material comprising a self-lubricating material.

278. As discussed previously, the Combined Smith Distribution System renders Claim 21 obvious. *Supra* §IX.A.4.d. The Combined Smith Distribution System in view of Ogawa renders obvious Claim 22 for the reasons discussed for Ground 3. *See* §IX.B.4.

5. Claim 29: The wafer container according to claim 23, wherein the wafer container further comprises a door detachably combined with the shell, and a pair of support portions configured on an inner side of the shell, and the wafer container is made of a thermal resistance material, which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.

279. As discussed previously, the Combined Smith Distribution System renders Claim 23 obvious. *Supra* §IX.C.3. The Combined Smith Distribution System includes a detachable door combined with the shell, and a pair of support portions configured on an inner side of the shell, §§IX.C.1, IX.C.3.a, and in further view of Ogawa also renders obvious Claim 29, for the reasons discussed for Ground 3. *Supra* §IX.B.2.

6. Claim 31: The wafer container according to claim 30, wherein the base plate is made of a material comprising a self-lubricating material.

280. As discussed previously, the Combined Smith Distribution System renders Claim 30 obvious and includes a base plate 523. *Supra* §IX.C.4.f. The Combined Smith Distribution System in view of Ogawa also renders obvious Claim 31, for the reasons discussed for Ground 3. *Supra* §IX.B.3.

E. Ground 6: Claims 1, 2-9 and 12 are Obvious in View of Smith '517

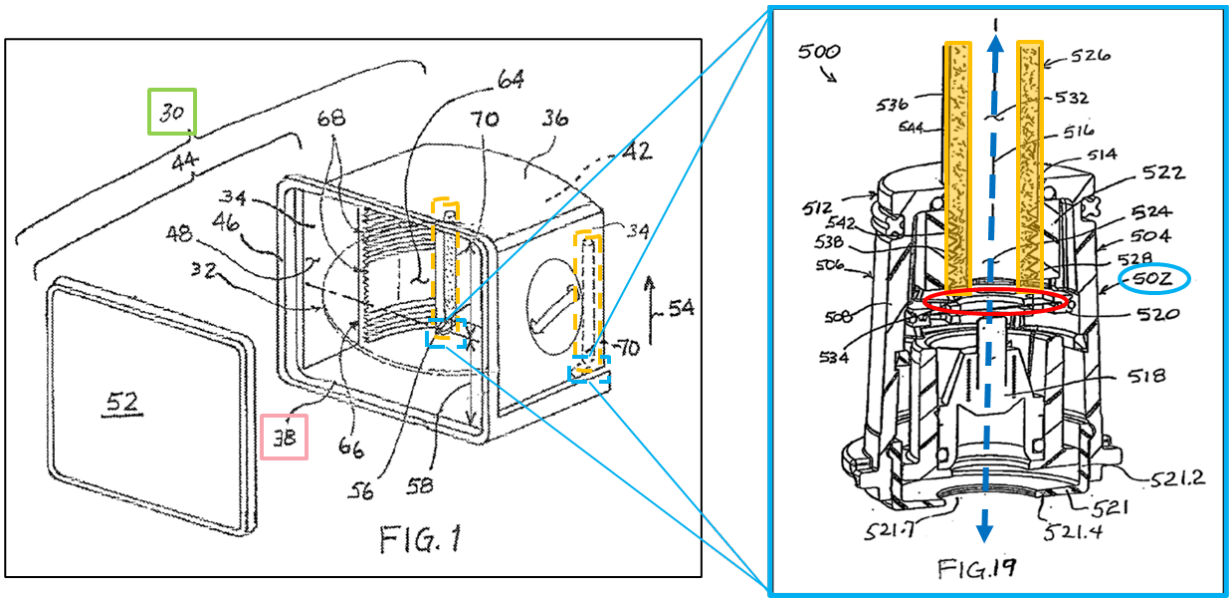
281. While I disagree with the potential construction of buffering gas chamber discussed previously (§VI), even assuming that claims 1-10, and 12 of the '711 Patent have a priority date of August 2021 based on the disputed potential construction, the claims would still have been rendered obvious by Smith '517, as I explain below in Grounds 6 and 7.

1. Independent Claim 1

a. 1[pre]: A gas diffusion device, installed in a wafer container having an accommodating space, the gas

diffusion device comprising:

282. To the extent the preamble is limiting, Smith '517 discloses *a gas diffusion device* [e.g., porous tower diffuser assembly 70 or 500], *installed in a wafer container* [e.g., substrate container 30] *having an accommodating space* [e.g., microenvironment 64]. Smith '517 is directed towards a "diffuser assemblies 70 []" that "direct the gaseous working fluid . . . to purge the substrate container 30." Ex1011, 5:57-60. Further, Smith '517 explains that a substrate container is "suitable for use in storing or transporting objects such as semiconductor wafers in a clean environment." Ex1011, 1:16-21.



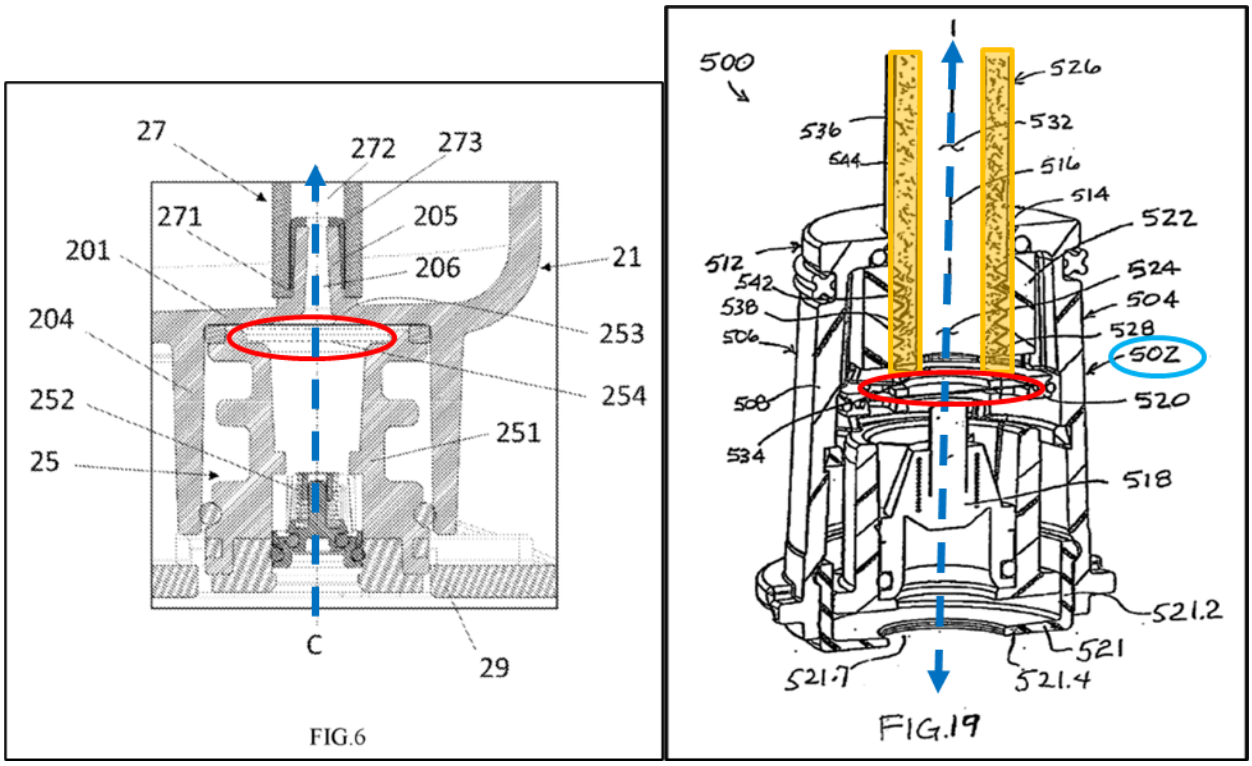
Ex1011, Figs. 1 and 19 (annotated).

283. It is my understanding that Figure 1 and the coupling in Figure 19 describe the same embodiment. Ex1011, 16:34-37 (describing coupling of Figure 19 implemented in wafer container 30 of Figure 1).

b. 1[a][1]: a buffering gas chamber, configured at a bottom portion of the wafer container,

284. In my opinion, Smith '517 discloses limitation 1[a][1]. For example, under Patent Owner's potential incorrect interpretation of "buffering gas chamber," Smith '517 discloses *a buffering gas chamber* [e.g., increased diameter before filter assembly 520 (light blue)], *configured at a bottom portion* [e.g., bottom portion 38] *of the wafer container* [e.g., substrate container 30].

285. As previously discussed, the '711 Patent states, with regard to Figure 6, that when "elastic sleeve (251) has a larger diameter" than "filter membrane (253)" "a buffering gas chamber (254) [light blue] is formed between the gas intake channel and the filter membrane (253)." *Supra* §VI. To the extent this structure meets the "buffering gas chamber" of Claim 1 (which I disagree with), it is also disclosed in Smith '517. As shown in Figure 19, Smith '517 discloses the same increased diameter (e.g., *buffering gas chamber*) between the *gas intake channel* (e.g., check valve 518) and the filter assembly 520.

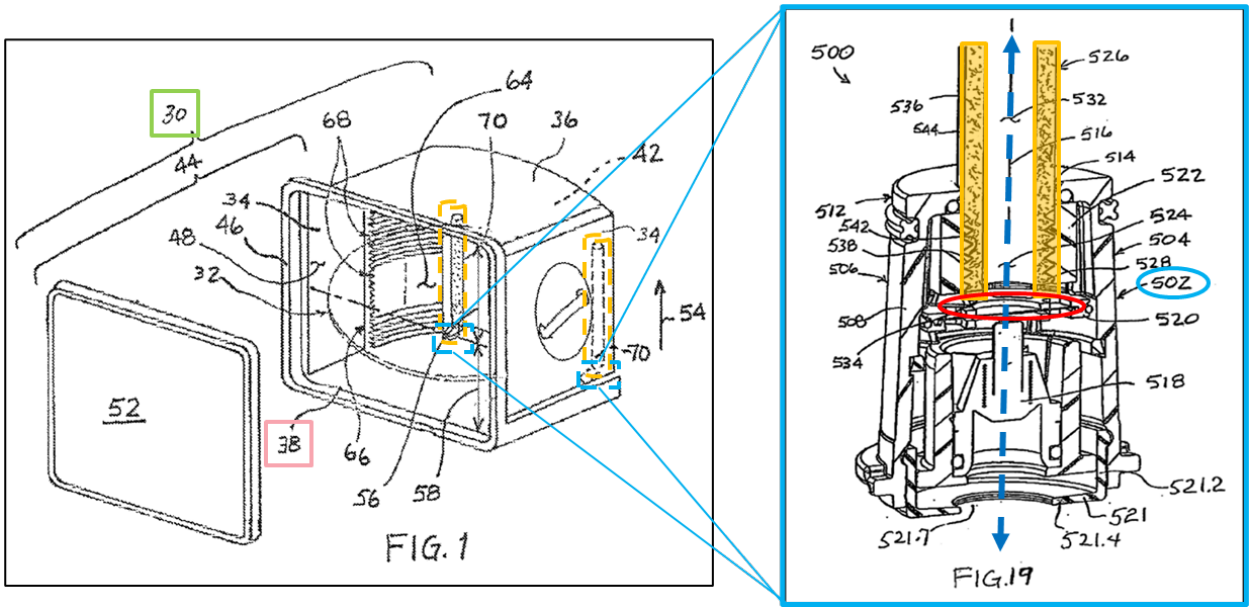


Ex1001, Fig. 6 (annotated); Ex1011, Fig. 19 (annotated).

c. 1[a][2]: the bottom portion provided with at least one coupling structure, the coupling structure defining a through channel having a center axis,

286. Smith ’517 discloses limitation 1[a][2]. For example, Smith ’517 discloses *the bottom portion* [e.g., bottom portion 38] *provided with at least one coupling structure* [e.g., coupling 522], *the coupling structure* [e.g., coupling 522] *defining a through channel having a center axis* [e.g., central axis 516 (blue dashed line)]. Figure 19 of Smith ’517 shows coupling 522 (e.g., *coupling structure*) that defines central axis 516 (blue dashed line) (e.g., *a through channel having a center axis*). Smith ’517 also discloses that the purge module 502 depicted in Figure 19, including coupling 522 (e.g., *coupling structure*), is “configured for installation in

the bottom portion 38 of the substrate container 30" (e.g., *bottom portion of the wafer container*). Ex1011, 16:34-36.

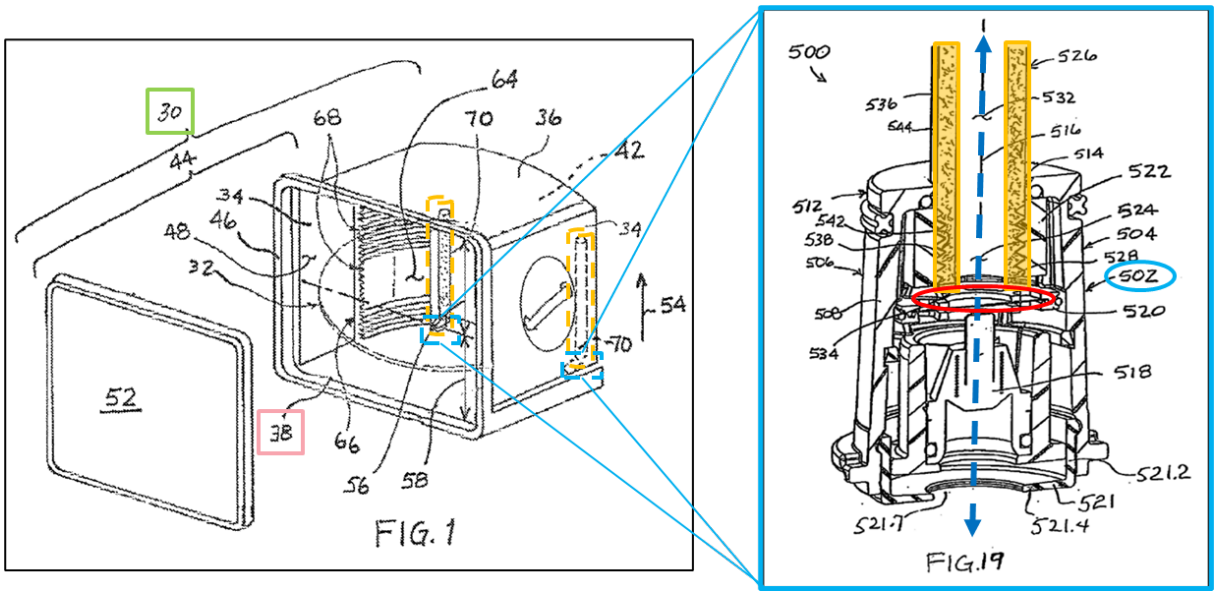


Ex1011, Figs. 1 and 19 (annotated).

d. 1[a][3]: the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and

287. Smith '517 discloses limitation 1[a][3]. For example, under Patent Owner's potential incorrect interpretation of "buffering gas chamber," Smith '517 discloses *the buffering gas chamber* [e.g., increased diameter before filter assembly 520 (light blue)] *having at least one gas intake channel* [e.g., check valve 518], *the gas intake channel, the buffering gas chamber, the through channel* [e.g., central axis 516 (blue dashed line)] *and the accommodating space* [e.g., microenvironment 64] *communicating with one another*. Figure 19 of Smith '517 shows check valve

518 below the change in diameter and coaxial with the coupling through channel and all communicating with one another and microenvironment 64 (e.g., *accommodating space*), thereby enabling "flow to enter the substrate container 30." Ex1011, 16:60-43.

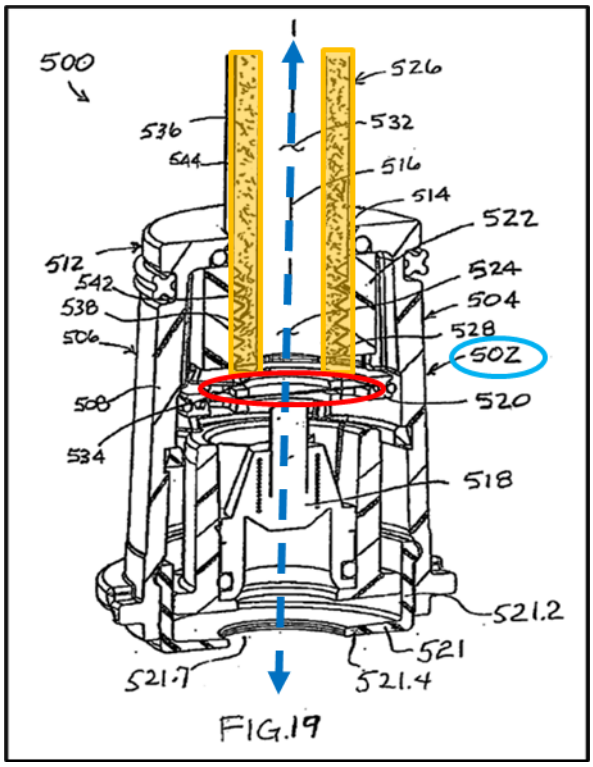


Ex1011, Figs. 1 and 19 (annotated).

e. 1[b][1]: at least one porous tube, having a longitudinal space, the porous tube installed to the coupling structure of the wafer container, the longitudinal space of the porous tube communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the porous tube and enter the accommodating space,

288. Smith '517 discloses limitation 1[b][1]. For example, under Patent Owner's potential incorrect interpretation of "buffering gas chamber," as shown in Figure 19, Smith '517 discloses *at least one porous tube* [e.g., porous media diffuser 526], *having a longitudinal space* [e.g., diffuser passageway 532], *the*

porous tube [e.g., porous media diffuser 526] *installed to the coupling structure* [e.g., coupling 522] *of the wafer container* [e.g., substrate container 30], *the longitudinal space of the porous tube communicating with the buffering gas chamber* [e.g., increased diameter before filter assembly 520 (light blue)], *the buffering gas chamber* [*providing a gas to pass through the porous tube and enter the accommodating space* [e.g., microenvironment 64].



Ex1011, Fig. 19 (annotated).

289. Smith ’517 teaches that “a porous tower diffuser assembly 500” includes “[a] porous media diffuser 526 [e.g., *porous tube*] . . . operatively coupled with the coupling 522 [e.g., *coupling structure*] . . . defining a diffuser passageway 532 [e.g., *longitudinal space*].” Ex1011, 16:59-64. As shown in Figure 19, diffuser

passageway 532 [e.g., *longitudinal space*] is in communication with the increased diameter before filter assembly 520 [e.g., *buffering gas chamber*]. For example, Figure 19 shows increased diameter before filter assembly 520 (e.g., *buffering gas chamber*) allowing gas to pass through and enter porous media diffuser 526 (e.g., *porous tube*) which will then be diffused into microenvironment 64 (e.g., *accommodating space*).

f. 1[b][2]: a gas intake center axis of the gas and a center axis of the coupling structure being coaxial.

290. In my opinion, Smith ’517 discloses limitation 1[b][2]. For example, as shown in Figure 19, Smith ’517 discloses *a gas intake* [e.g., check valve 518] *center axis of the gas and a center axis of the coupling structure* [e.g., coupling 522] *being coaxial* [e.g., concentric with the central axis 516]. Smith ’517 discloses “a check valve 518 that permits flow to enter the substrate container” [e.g., *a gas intake center axis of the gas*] and a “coupling 522” [e.g., *coupling structure*] that are “concentric with the central axis 516” [e.g., *coaxial*]. Ex1011, 16:28-58. Thereby Smith ’517 discloses enabling “flow to enter the substrate container 30.” Ex1011, 16:60-43.

2. <u>Dependent Claims 2-9, and 12</u>

a. Claim 2: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the

center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial.

291. Smith ’517 discloses Claim 2. For example, as I described for claim 1, Smith ’517 has:

- *the coupling structure formed as extending from the bottom portion of the wafer container* [e.g., a coupling 522 from Smith ’517, light blue box, extending from bottom portion 38], as I described for limitation 1[a][2];
- *an open end of the porous tube has a center axis and the longitudinal space of the porous tube has a center axis* [e.g., porous media diffuser 526 having diffuser passageway 532 and a center axis 516] (*see also* Ex1011, 16:64-66 (describing opening 534 at proximal end 528));
- *the center axis of the coupling structure the center axis of the open end of the porous tube and the gas intake* [e.g., check valve 518] *center axis are coaxial* [e.g., concentric about the central axis 516] (*see* §IX.E.1.f; Ex1011 Fig. 19).

292. To the extent that Patent Owner argues that *the coupling structure is formed as extending from the bottom portion of the wafer container* requires the a component of the coupling structure to be attached to or molded from the bottom portion, that would have been obvious. Figure 19 shows that coupling 522 is included in porous tower diffuser assembly 500. This assembly also includes top

portion 512, which is "substantially flush with the interior surface 40 of the bottom portion 38." In order for this assembly 500 to have a component that is flush with bottom portion 38 and to be securely installed in the container, there must be a component of the bottom portion that is formed in a way to enable assembly 500, and coupling 522 to securely attach to bottom portion 38. In my opinion, a POSITA would have understood this attachment formation to be part of *the coupling structure [] formed as extending from the bottom portion of the wafer container*.

b. Claim 3: The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial; the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis.

293. Smith '517 renders obvious Claim 3. For example, Smith '517 has:

- *the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis*, for the reasons described for claim 2;
- *the center axis of the coupling structure, the center axis of the open end of*

the porous tube and the gas intake center axis are coaxial, for the reasons described in claim 2;

294. Regarding the requirement of claim 3 that the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis, Smith ’517 does not expressly disclose a configuration in which the opening of the porous tube and coupling structure are coaxial but the longitudinal space of the porous tube is offset, but that configuration would have been obvious to a POSITA.

295. As described in the ’711 Patent, this configuration is met by an asymmetric tubular diffuser that extends radially in one direction more than the other. *See* Ex1001, 16:9-27, Fig. 21C. A POSITA would similarly have understood that this configuration would be achieved by including, for example, a porous tube with an elbow bend or an s-curve. Both of these options would necessitate that the axis of the open end be off-center of the longitudinal axis inside the tube.

296. A POSITA would have in fact been motivated by Smith ’517 to use such an asymmetric diffuser. A POSITA would have understood that there is a finite number of options for aligning how a pipe is shaped and coupled to a gas inlet. For example, would have been aware of the exclusion zone, or exclusion volume, inside the container that must be reserved for the wafers, *e.g.*, Ex1017, 1,

3, 9, 16; Ex1021, 3:3-12, which would have motivated a particular shape and alignment of porous tubes for a given container. A POSITA would have known that, when retrofitting components to an existing shell, as described in Smith '517, any known shape (such as a porous tube with an elbow-bend or s-curve) could be used to meet the specific constraints of the current project and thus would have been motivated to use the alignment that was most applicable to the current project.

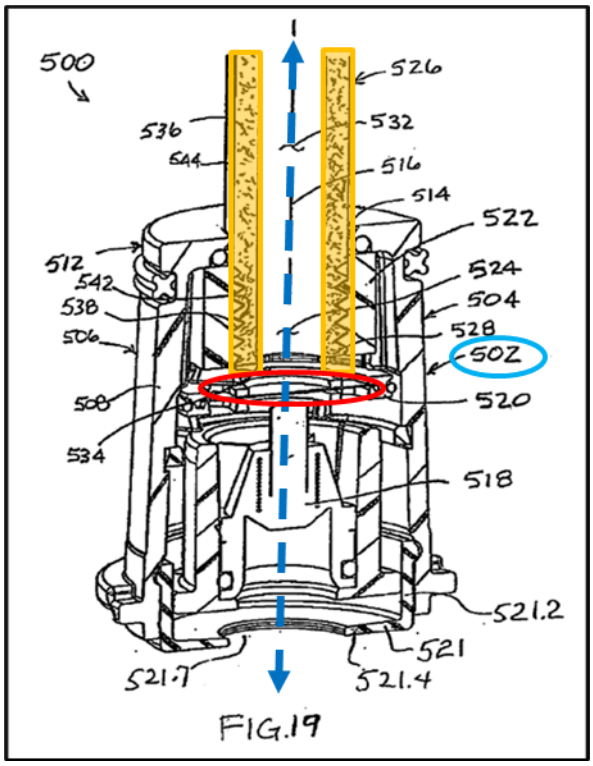
297. A POSITA would have specifically been motivated to use an asymmetric diffuser when retrofitting a wafer container to maximize the internal space inside the container and satisfy the structure and design needs of any particular wafer container, such as avoiding the exclusion zone. *See* Ex1017; Ex1021, 3:3-12. For example, a project may need a flow path to extend up a rear wall and bend across a top wall of a wafer container, to distribute gas at the front of the container, which would require a tubular diffuser with two axes. Ex1008 ¶46.

298. Moreover, Smith '517 already discloses that a tubular diffuser can be offset from a coupling and that the internal space of the porous media diffuser, termed the "central passageway" "can define a second axis [] that is substantially parallel to…[and] is radially offset from the first axis." Ex1011, 14:53-56. In this regard, Smith '517 discloses that a coupling and tubular diffuser has separate axes:

first axis 436, second axis 438, and aperture axis 409 defined by axial aperture 408 that is point at which gas enters the open end of the porous tube. Ex1011, 14:5-8, 14:49-54, Fig. 16B. In view of these disclosures, a POSITA would have been motivated to use and could have readily implemented Smith '517 with a tubular diffuser that had two axes—one at its opening and one offset and remote from the opening.

c. Claim 4: The gas diffusion device according to claim 1, wherein the longitudinal space of the porous tube has a closed end and an open end, and the open end receives the corresponding coupling structure, so that the gas enters the longitudinal space by passing through the buffering gas chamber and the open end.

299. Smith '517 discloses Claim 4. For example, under Patent Owner's potential incorrect interpretation of "buffering gas chamber," as shown in Figure 19, Smith '517 discloses *the longitudinal space* [e.g., diffuser passageway 532] *of the porous tube* [e.g., porous media diffuser 526] *has an open end* [e.g., opening 534 at proximal end 528 of the porous media diffuser 526], *and the open end receives the corresponding coupling structure* [e.g., coupling 522], *so that the gas enters the longitudinal space by passing through the buffering gas chamber* [e.g., increased diameter before filter assembly 520 (red)] *and the open end*, as shown in Figure 19.



Ex1011, Fig. 19 (annotated).

300. Regarding the requirement of claim 4 *that the longitudinal space of the porous tube has a closed end*, as shown in Figure 7, Smith '517 describes a "blind end 178" that can be "solid and impermeable," i.e., closed. Ex1011, 8:49-58. A POSITA would have been motivated to use such a tube with Figure 19, with a reasonable expectation of success.

d. Claim 5: The gas diffusion device according to claim 1, wherein a shape of a horizontal cross section of the porous tube is an ellipsoid or an elongated narrow shape having a long axis and a short axis, or a circle having a diameter.

301. For the same reasons discussed for Ground 4, Smith '517 discloses Claim 5. *Supra* §IX.C.3.d.

e. Claim 6: The gas diffusion device according to claim 5, further comprising: a first collar, arranged in the open end, the first collar located between the open end and the coupling structure.

302. For the same reasons discussed for Ground 4, Smith ’517 discloses Claim 6. *Supra* §IX.C.3.e.

f. Claim 7: The gas diffusion device according to claim 6, further comprising: a second collar, located between the first collar and the coupling structure when the second collar is disposed on the coupling structure so as to reinforce airtightness.

303. For the same reasons discussed for Ground 4, Smith ’517 discloses Claim 7. *Supra* §IX.C.3.f.

g. Claim 8: The gas diffusion device according to claim 6, wherein a material of the first collar is softer than a material of the porous tube to prevent breaking of the open end.

304. For the same reasons discussed for Ground 4, Smith ’517 discloses Claim 8. *Supra* §IX.C.3.g.

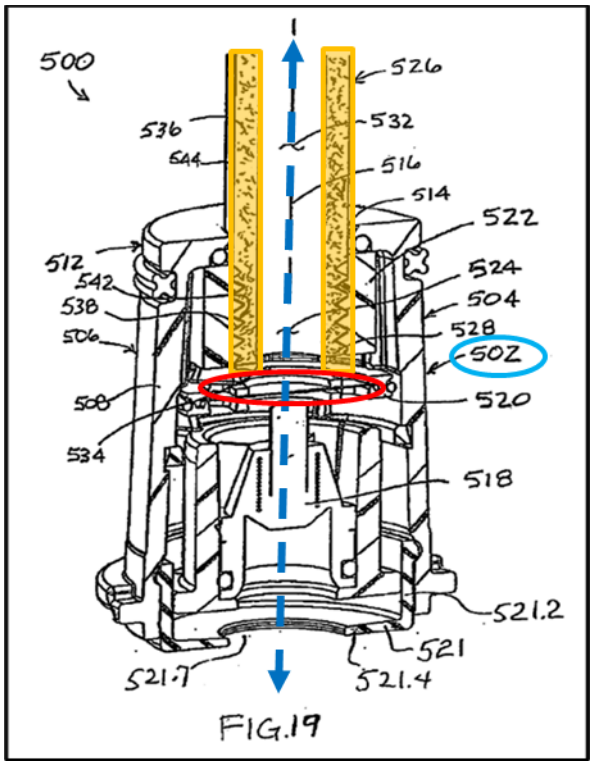
h. Claim 9: The gas diffusion device according to claim 7, wherein the second collar and the porous tube are sintered or bonded into an integral structure to prevent breaking of the open end.

305. For the same reasons discussed for Ground 4, Smith ’517 discloses Claim 9. *Supra* §IX.C.3.h.

i. Claim 12: The gas diffusion device according to claim 1, further comprising: at least one gas intake module, communicatively coupled to the buffering gas chamber, the gas intake module having the gas intake center axis,

supplying the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber.

306. Under Patent Owner's potential incorrect interpretation of "buffering gas chamber," Smith '517 discloses Claim 12. For example, as shown below in exemplary Figure 19, Smith '517 discloses *at least one gas intake module* [e.g., check valve 518], *communicatively coupled to the buffering gas chamber* [e.g., increased diameter before filter assembly 520 (red)], *the gas intake module* [e.g., check valve 518] *having the gas intake center axis, supplying the gas in one single gas intake direction* [e.g., an inlet] *to pass through the gas intake channel and enter the buffering gas chamber* [e.g., increased diameter before filter 520].



Ex1011, Fig. 19 (annotated).

307. For example, Smith ’517 teaches that “check valve 518 that permits flow to enter the substrate container” [e.g., *gas intake module*] via filter assembly 520 which necessitates the gas flowing through the increased diameter space between check valve 518 and filter assembly 520 [e.g., *buffering gas chamber*]. Ex1011, 16:28-58. Smith ’517 further discloses that each of these elements are “concentric with the central axis 516” [e.g., *gas intake center axis*] (blue dashed line). Check valve 518, as shown in Figure 19 and by nature of being a check valve, necessarily *supply[s] the gas in one single gas intake direction*.

F. Ground 7: Obviousness of Claims 1-12 in View of Smith ’517 in further view of Ogawa

308. Ground 6 demonstrated that Smith ’517 alone renders obvious claims 1-9, 12. Dependent claims 10-11 are further rendered obvious with Ogawa.

1. Motivation to Combine Ground 6 with Ogawa

309. A POSITA would be motivated to combine Smith ’517 with Ogawa for the same reasons discussed with respect to the Grounds 2 and 4 in view of Ogawa combination and would have the same reasonable expectation of success. *Supra* §§IX.B.1, IX.C.1. Nothing about Smith ’517 changes the relevant teachings or POSITA understandings from Grounds 2 or 4 or from Ogawa.

2. Claim 10: The gas diffusion device according to claim 8, wherein the coupling structure, the porous tube, the first collar and/or the second collar are/is made of a thermal resistant material which is one or a combination of at least two selected from a group consisting of PEEK, HTPC,

FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.

310. As discussed previously, Smith ’517 renders Claim 1 obvious. *Supra* §IX.E.1. In addition, for the same reasons discussed with respect to Grounds 3 and 5, claim 29, Smith ’517 in view of Ogawa renders obvious Claim 10. *Supra* §§IX.B.2, IX.D.5.

3. Claim 11: The gas diffusion device according to claim 1, further comprising: an airflow guiding member, arranged adjacent to one side of the porous tube, the airflow guiding member configured to adjust an airflow direction of the gas entering the accommodating space.

311. As discussed previously, Smith ’517 discloses Claim 1. *Supra* §IX.E.1. In addition, for the reasons described for Ground 5, Smith ’517 in view of Ogawa renders claim 11 obvious. *Supra* §IX.D.3.

G. Secondary Considerations

312. During prosecution of the ’711 Patent, the applicant did not identify any evidence of secondary considerations of non-obviousness tied to the claimed invention of the ’711 Patent. I am aware of no evidence of secondary considerations that would meaningfully rebut a finding of obviousness.

313. Accordingly, there is no objective evidence of non-obviousness that might warrant a finding that Claims 1-31 are patentable. To the extent Patent Owner at a later date cites or provides any other evidence regarding secondary considerations, including any expert opinions, I reserve the right to supplement my

analysis and opinions to address it.

X. GROUND 8: CLAIMS 1-12 ARE INVALID UNDER § 112

314. Claims 1-12 are invalid under § 112 for lack of written description and being indefinite.

A. Claim 1

315. Claim 1 includes the limitation "***a gas intake center axis of the gas*** and a center axis of the coupling structure being coaxial." Ex1001, 17:56-57 (emphasis added). In my opinion this limitation can be interpreted in at least two ways as shown in the drawings below: (1) as shown in Fig. 21A on the left below, the "gas intake center axis of the gas" (red) could be the center axis of the entire gas intake module (green), and the claim could require that that axis is coaxial with the center axis of the coupling structure (light blue)[3]; **or** (2) as shown in the modified Fig. 21A on the right below, the "gas intake center axis of the gas" (red) could be the center axis of the gas intake channel (i.e., the opening of the buffering channel receiving the gas from the gas intake channel) (orange), and the claim could require that that axis is coaxial with the center axis of the coupling structure (light blue). Given the different potential interpretations, a POSITA could not know if the claim is met by a gas intake module (green) offset from the coupling

[3] I note that I apply this first interpretation in assessing the prior art.

structure (light blue) with a path (purple) between the gas intake module (green) and gas intake channel (orange).

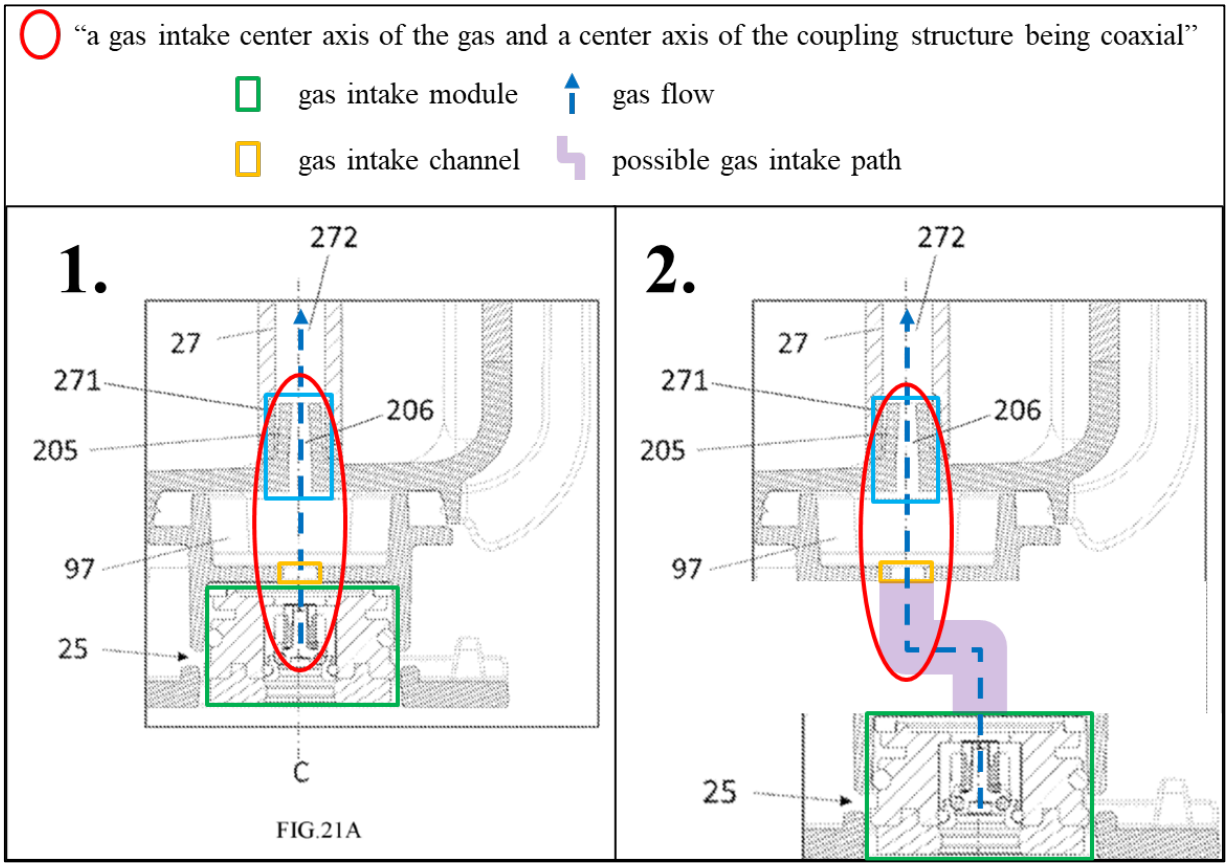


FIG.21A

Ex1001, Fig. 21A (modified and annotated).

316. A POSITA would not know with reasonable certainty if claim 1 covers both interpretations.

317. Nothing in the specification could resolve this ambiguity either. With regard to the first interpretation, that is also what is covered by claim 12. Specifically, claim 12 tracks Fig. 21A (left above) and recites that the "gas intake module" has "the gas intake center axis" and supplies "the gas in one single gas intake direction to pass through the gas intake channel." Accordingly, a POSITA

would not have believed claim 1 would be limited to this same interpretation because it would have rendered claim 12 superfluous. I note that I apply this first interpretation in assessing the prior art.

318. With regard to the second interpretation, a POSITA would also not have understood claim 1 to cover that interpretation at least because there is no written description support for it. Instead, the specification appears to teach away from such an embodiment. For example, the specification teaches that the prior art's "offset configuration of the gas intake module and the porous tube further suffer from drawbacks of being difficult to install" and that a "winding path" is susceptible to "breaking or damage . . . hence affecting the quality of airflow." Ex1001, 1:62-67. Further the specification advises that "there is a need for a person skilled in the art to develop an improved gas diffusion device, so as to solve the problems of inconsistent gas filling performance and hence poor airflow quality caused by such conventional non-straight-through structure." *Id.*, 2:23-30. Therefore, the second interpretation, while a plausible reading of the claims, directly contradicts the stated purpose of the patent.

319. Because the claim specifies only a "gas intake center axis of the gas," without more, a POSITA would not have known which interpretation (and which coaxial alignment) would satisfy the claim. Because there are two equally plausible interpretations of this limitation, in my opinion it is indefinite, and thus invalid

under § 112. Moreover, to the extent that claim 1 is construed to cover the second interpretation described above, claims 1-12 would be invalid for lack written description under § 112 and thus invalid.

320. Because independent claim 1 is invalid, dependent claims 2-12 would also have been indefinite or lacking written description for the same reasons.

B. Claims 2, 3, 12

321. In addition to the indefiniteness of claim 1, dependent claims 2, 3, and 12 also are indefinite for the additional reason that they lack the proper antecedent basis of the term "gas intake center axis." As discussed, claim 1 states: "a gas intake center axis of the gas;" however claims 2, 3 and 12 all discuss "the gas intake center axis," without reference to the "of the gas" qualifier. Given the different language used, a POSITA would not have understood the "gas intake center axis of the gas" to be the same as the different phrase "the gas intake center axis." Therefore, a POSITA would not have understood with reasonable certainty what "the gas intake center axis" refers to in claims 2, 3, and 12 for this additional reason.

* * *

I, Alexander Glew, do hereby declare and state, that all statements made herein of my own knowledge are true and that all statements made on information and belief

are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, under Section 1001 of Title 18 of the United States Code.

Executed on: March 31, 2026

Alexander D Glew

Dr. Alexander Glew

March 31, 2026

EXHIBIT LIST

Ex#	Description
1001	U.S. Patent No. 12,347,711
1002	File History of U.S. Patent No. 12,347,711 (Application No. 17/882,703)
1003	U.S. Provisional Application No. 63/233,878
1004	U.S. Provisional Application No. 63/284,105
1005	U.S. Provisional Application No. 63/316,391
1006	Declaration of Dr. Alexander Glew
1007	Curriculum Vitae of Dr. Alexander Glew
1008	U.S. Patent Pub. No. 2023/0128154 A1 ("**Smith '154**")
1009	File History of U.S. Patent Pub. No. 2023/0128154 A1 (Application No. 17/973,309)
1010	U.S. Provisional Application No. 63/272,282
1011	U.S. Patent No. 10,347,517 ("**Smith '517**")
1012	U.S. Patent No. 10,923,373 ("**Ogawa**")
1013	U.S. Patent No. 11,551,957 ("**Eggum**")
1014	Taiwanese Patent No. TW I606534
1015	Machine Translation of Taiwanese Patent No. TW I606534
1016	U.S. Patent Pub. No. 2004/0004079 A1
1017	*SEMI E47.1-1101, Provisional Mechanical Specification for Boxes and Pods Used to Transport and Store 300 mm Wafers*, Semi (2001)
1018	VICTREX, *VICTREX PEEK 150G/151G*, June 2009, *available at* < https://web.archive.org/web/20100331212618/http://www.victrex.com:80/docs/datasheets-docs/150G_151G.pdf >

Ex#	Description
1019	VICTREX, *Product Summary*, June 2009, *available at* <https://web.archive.org/web/20101122064448/http://www.victrex.com:80/docs/Product%20Summary_June09_UK.PDF >
1020	Entegris, *A300 FOUPs*, June 7, 2021, *available at* <https://www.entegris.com/shop/en/USD/products/wafer-handling/wafer-processing/300-mm-front-opening-unified-pods-(foups)/A300-FOUPs/p/A300FOUPs>
1021	U.S. Patent No. 8,783,463

CLAIM LISTING

Ref. #	Listing of Challenged Claims
1[pre]:	A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising:
1[a][1]:	a buffering gas chamber, configured at a bottom portion of the wafer container,
1[a][2]:	the bottom portion provided with at least one coupling structure, the coupling structure defining a through channel having a center axis,
1[a][3]:	the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and
1[b][1]:	at least one porous tube, having a longitudinal space, the porous tube installed to the coupling structure of the wafer container, the longitudinal space of the porous tube communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the porous tube and enter the accommodating space,
1[b][2]:	a gas intake center axis of the gas and a center axis of the coupling structure being coaxial.
2:	The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial.
3:	The gas diffusion device according to claim 1, wherein the coupling structure is formed as extending from the bottom portion of the wafer container, an open end of the porous tube has a center axis, and the longitudinal space of the porous tube has a center axis; the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis are coaxial; the center axis of the longitudinal space of the porous tube is offset from the center axis of the coupling structure, the center axis of the open end of the porous tube and the gas intake center axis.
4:	The gas diffusion device according to claim 1, wherein the longitudinal space of the porous tube has a closed end and an open end, and the open end receives the corresponding coupling structure, so that the gas enters the longitudinal space by passing through the buffering gas chamber and the open end.

Ref. #	Listing of Challenged Claims
5:	The gas diffusion device according to claim 1, wherein a shape of a horizontal cross section of the porous tube is an ellipsoid or an elongated narrow shape having a long axis and a short axis, or a circle having a diameter.
6:	The gas diffusion device according to claim 5, further comprising: a first collar, arranged in the open end, the first collar located between the open end and the coupling structure.
7:	The gas diffusion device according to claim 6, further comprising: a second collar, located between the first collar and the coupling structure when the second collar is disposed on the coupling structure so as to reinforce airtightness.
8:	The gas diffusion device according to claim 6, wherein a material of the first collar is softer than a material of the porous tube to prevent breaking of the open end.
9:	The gas diffusion device according to claim 7, wherein the second collar and the porous tube are sintered or bonded into an integral structure to prevent breaking of the open end.
10:	The gas diffusion device according to claim 8, wherein the coupling structure, the porous tube, the first collar and/or the second collar are/is made of a thermal resistant material which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.
11:	The gas diffusion device according to claim 1, further comprising: an airflow guiding member, arranged adjacent to one side of the porous tube, the airflow guiding member configured to adjust an airflow direction of the gas entering the accommodating space.
12:	The gas diffusion device according to claim 1, further comprising: at least one gas intake module, communicatively coupled to the buffering gas chamber, the gas intake module having the gas intake center axis, supplying the gas in one single gas intake direction to pass through the gas intake channel and enter the buffering gas chamber.
13[pre]:	A gas diffusion device, installed in a wafer container having an accommodating space, the gas diffusion device comprising:
13[a][1]:	a gas cartridge, configured at a bottom portion of the wafer container to define a buffering gas chamber,

Ref. #	Listing of Challenged Claims
13[a][2]:	the bottom portion provided with at least two coupling structures, each of the coupling structures defining a through channel having a center axis,
13[a][3]:	the buffering gas chamber having at least one gas intake channel, the gas intake channel, the buffering gas chamber, the through channel and the accommodating space communicating with one another; and
13[b]:	at least two porous tubes, each of the porous tubes having a longitudinal space, the at least two porous tubes respectively installed to corresponding coupling structures of the wafer container, the longitudinal spaces of the two porous tubes communicating with the buffering gas chamber, the buffering gas chamber providing a gas to pass through the at least two porous tubes and enter the accommodating space.
14:	The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, the center axis of the longitudinal space of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial.
15:	The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes and a gas intake center axis along which the gas passes are coaxial; the center axis of the longitudinal space of each of the porous tubes is offset from the center axis of the through channel, the center axis of the open end of the porous tube and the gas intake center axis.

Ref. #	Listing of Challenged Claims
16:	The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of the longitudinal space of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tube has a center axis; the center axis of each of the through channels, the center axis of the open end of each of the porous tubes, and the center axis of the longitudinal space of each of the porous tubes are coaxial; a position of a gas intake center axis along which the gas passes is offset from the center axis of the through channel, the center axis of the open end and the center axis of the longitudinal space that are coaxial.
17:	The gas diffusion device according to claim 13, wherein the at least two coupling structures are formed as extending from the bottom portion of the wafer container, an open end of each of the porous tubes has a center axis, and the longitudinal space of each of the porous tubes has a center axis; the center axis of each of the through channels and the center axis of the open end of each of the porous tubes are coaxial; a gas intake center axis along which the gas passes and the center axis of the longitudinal space are both offset from the center axis of the through channel and the center axis of the open end that are coaxial.
18:	The gas diffusion device according to claim 13, wherein the gas cartridge has a bottom portion and a sidewall extending from the bottom portion, and the gas intake channel is formed at the bottom portion of the gas cartridge.
19:	The gas diffusion device according to claim 13, wherein the gas cartridge is installed at the bottom portion of the wafer container, such that a bottom portion and a sidewall of the gas cartridge and the bottom portion of the wafer container define the buffering gas chamber.

Ref. #	Listing of Challenged Claims
20:	The gas diffusion device according to claim 13, wherein a plurality of annular sidewalls further extend from a lower surface of the bottom portion of the gas cartridge, each of the annular sidewalls defines an installation space for filling with a gas intake module, and the gas intake module has the gas intake center axis; the installation space, the gas intake channel at the bottom portion of the gas cartridge and the buffering gas chamber communicate with one another, such that the gas in one single air intake direction supplied by the gas intake module passes through the gas intake channel and enters the buffering gas chamber.
21:	The gas diffusion device according to claim 13, wherein the wafer container comprises a base plate installed at the bottom portion of the wafer container, and the buffer gas chamber is between the bottom portion and the base plate of the wafer container.
22:	The gas diffusion device according to claim 21, wherein the base plate is made of a material comprising a self-lubricating material.
23[pre]:	A wafer container, comprising:
23[a]:	a shell, comprising a bottom portion, the bottom portion configured with a plurality of coupling structures, the coupling structures defining a plurality of through channels;
23[b]:	a buffering gas chamber, formed below the bottom portion, the buffering gas chamber having a plurality of gas intake channels, the gas intake channels communicating with the corresponding through channels; and
23[c]:	a plurality of porous tubes, each of the porous tubes having an open end, the open end correspondingly connecting with the coupling structure at the bottom portion and communicating with the buffering gas chamber via the corresponding through channel, allowing a gas to pass through the porous tubes and enter an accommodating space of the shell.
24:	The wafer container according to claim 23, wherein the porous tube has a longitudinal space, the longitudinal space has a closed end and an open end, and the gas in the buffering gas chamber is capable of passing through the open end to enter the longitudinal space.

Ref. #	Listing of Challenged Claims
25:	The wafer container according to claim 23, further comprising: a collar, arranged between the open end and the coupling structure, a material of the collar being softer than a material of the porous tube to prevent breaking of the open end.
26:	The wafer container according to claim 23, further comprising: a gas cartridge, having a bottom portion and a sidewall extending from the bottom portion, the bottom portion of the gas cartridge having the gas intake channels formed thereon.
27:	The wafer container according to claim 26, wherein the gas cartridge is installed at the bottom portion of the shell, such that the gas cartridge and the bottom portion of the shell define the buffering gas chamber.
28:	The wafer container according to claim 26, wherein a plurality of annular sidewalls further extend from the bottom portion of the gas cartridge, and each of the annular sidewalls defines an installation space for filling with a gas intake module.
29:	The wafer container according to claim 23, wherein the wafer container further comprises a door detachably combined with the shell, and a pair of support portions configured on an inner side of the shell, and the wafer container is made of a thermal resistance material, which is one or a combination of at least two selected from a group consisting of PEEK, HTPC, FKM, PPS, PPO, chlorinated polyether, POB, TORLON, EP, PF, PEI, PI and LCP.
30:	The wafer container according to claim 23, further comprising: a base plate, connected below the shell to support the shell; wherein the buffering gas chamber is between the bottom portion and the base plate of the shell.
31:	The wafer container according to claim 30, wherein the base plate is made of a material comprising a self-lubricating material.